Carol Cleland's case of historical science—part 2: apologetic for historical science

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Philosopher of science Carol Cleland argues for the epistemic equality of historical and experimental science by making a positive case for historical science. She builds on the foundation of the Principle of Common Cause, using it to justify an asymmetry of overdetermination of historical evidence, and a method that chooses between multiple hypotheses by evidential 'smoking guns'. Although an improvement over crass positivist cases of the past century, her case falls short of its goal. A more robust view of science and history must begin with the rejection of positivism and uniformitarianism.

Secular intellectuals began arguing against biblical history in the 18th century, using deceptive or flawed premises.[1] For example, Lyell linked his uniformitarianism to Newton's uniformity, implying an unwarranted epistemic equality. The most effective Christian response to Lyell did not appear until the mid-20th century, with an emphasis on 'scientific creationism'.[2] Progress back to a Christian worldview has been slow. There is much to do, as naturalism permeates modernity, with multiple layers of distortion affecting even definitions, like 'science'.

Secular thinkers now face the revival of metaphysics in modern philosophy,[3] and 'friendly fire' from postmodernism, in their struggle to maintain a modernist view of science. New secular justifications for natural history are being made by philosophers of science—rather than geologists, paleontologists, and evolutionists. A leader in the field is Dr Carol Cleland. She advances both negative[4] and positive cases for the epistemic equality of historical science and experimental science (figures 1 and 4). After tarnishing the methodology of experimental science, she seeks to build a positive and solid foundation for historical science.

Cleland's positive case: rebuilding historical science

Having argued that the epistemic value of experimental science is less than that perceived by scientists and laymen,[4] Cleland attempts to explain why the value of historical science is greater. Building off *common cause explanation* (connecting disparate forensic effects to a single cause), she notes an *asymmetry of overdetermination* of past causes because the unidirectional causality from past to present implies excess evidence when looking from present to past. From this bounty, multiple hypotheses are resolved by *smoking guns* that provide 'capstone evidence'.

The key to her case is her unique definition of science, *linking hypotheses to evidence*. Though vague, it allows different 'sciences' to have distinct methods while maintaining the same high epistemic status as experimental science, which reduces uncertainty by repetitive, replicable testing. Should 'historical science', which does not employ repetitive replicable testing, enjoy the same level of confidence? Furthermore, are there really multiple 'sciences' in this loose sense? Is forensic natural history a 'science'? These are important questions for both Cleland and for anyone involved in studying natural history.

Basis for historical science: common cause explanation

Rational explanation relies on causality. Cleland builds her case for historical science on a corollary called 'common cause'. *Common cause* links disparate evidential traces to one cause, instead of many unrelated causes. Cleland references Reichenbach[5] as providing a basis for this assumption, although the nature of causality has been heavily discussed since Aristotle.

Common cause explanation in historical science is the *forensic* matching of effects to one cause, such as linking apparently unrelated oceanic trenches, mountain ranges, and compositions of basement rocks to the unifying cause of plate tectonics. But common cause explanation is not a scientific principle:

> "The principle of the common cause is not … a logical consequence of the mathematical theory of probability. It represents a metaphysical conjecture … and this is what makes it a metaphysical thesis, the universe might have been such that coincidences are the rule rather than the exception."[5]

If her 'coincidences' have been the rule rather than the exception, what metaphysical options might make Cleland's conjecture true? She doesn't say. However, she recognizes the dilemma presented by chance:

> "Attributing puzzling similarities and correlations among traces to a common cause has great explanatory power because it makes their joint occurrence credible. Attributing their concurrency to chance, on the other

hand, explains nothing; we are left with an intractable mystery."[6]

Cleland's avoidance of randomness cannot be grounded in materialism, which rests on randomness. Only a rational metaphysical grounding for such a conjecture (i.e. God) can ultimately avoid such complete randomness. But the God who alone can ground Cleland's conjecture is also a God who acts in history and recounts those acts in revelation. Why then does she limit her pool of explanations in natural history to materialistic ones, even in cases where materialistic explanations fail?

> "The best explanation for these remarkable similarities in molecular composition is not that they represent a fantastic coincidence but that all life on earth today inherited them from a last universal common ancestor."[7]

There is a better 'common cause' explanation Cleland doesn't mention: common design and common providence from one God. It explains "these remarkable similarities in molecular composition" as well as common ancestry, and explains other crucial facets of life that common ancestry cannot.[8–10]

Another problem is matching effects of the rock and fossil records with unobserved causes, a problem exacerbated by the paucity of these records relative to the old-earth view of history.[11–15] Cleland gets around these problems in an interesting way, using the linear nature of time to explain how causes and effects are more easily linked looking back in time, rather than forward:

> "The majority of localized cause-and-effect relations form many pronged forks opening in the direction from past to future; the principle of the common cause asserts that most events affect their environments in numerous and diverse ways, producing multiple lines of potential evidence (in the form of correlations and similarities) that persist into the future."[16]

Looking forward, we cannot see the multitude of effects generated by specific causes. But looking back, we see the branching lines of effects from past causes. She argues that even a small sample of the effects is enough to discern a common cause and allow historical scientists to justify hypotheses.[5]

However, a retrospective of Earth science shows that 'unwarranted speculation' forms the bulk of geological literature. Even Cleland seems to realize that her optimism is not always warranted, noting that common cause does not always apply to forensic data.[5] Since no one was present to observe those causal chains, how does one link historical traces to their causes? Cleland does not explain; instead, she diverts her focus to methods, comparing hers with other philosophers of science, Sober and Tucker.[6]

Note how she deftly inserts the critical importance of 'shared background beliefs':

> "Background beliefs play crucial roles at every stage of historiographic research, and this means that scientists do not begin by deciding between an unspecified common cause hypothesis and an unspecified separate cause hypothesis. On the contrary, they start with tentative conjectures about what might have produced the puzzling traces under investigation."[17]

These background beliefs are even more significant than she suggests. She is thinking of superficial ideas, like whether an evolutionary structure is homologous or analogous. In reality, these beliefs are better characterized as paradigms built on worldview commitments, like whether evolution occurred or whether uniformitarianism limits our options for deciphering the past. 'Background beliefs' is shorthand for differences between Christianity and naturalism, and drive interpretation far more than data. Even if we grant her definition and examine the method, questions remain.

In addition to the unquantified influence of background beliefs, the method is rife with uncertainty. Cleland tries to minimize this problem by an *ad hominem* appeal to the judgment of the scientists.[5] But the 'preference' of scientists hardly seems an objective basis on which to decide a hypothesis or build a science.

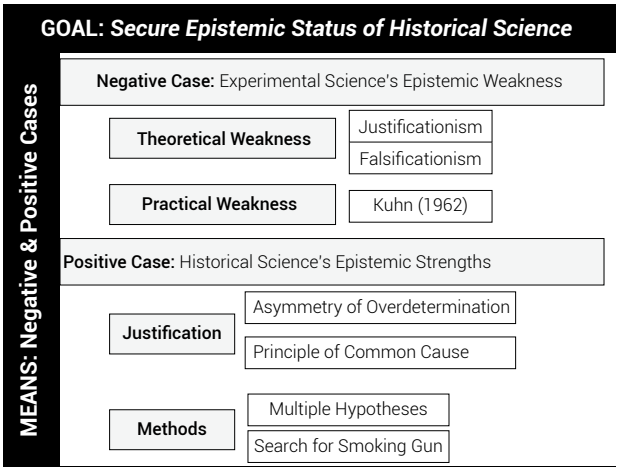

Figure 1. A map of Cleland's argument for epistemic equality of historical and experimental science. She uses both a negative critique of experimental science and a positive case for historical science.

Linking effects to common cause: the asymmetry of overdetermination

If common cause explanation is her forensic cornerstone of historical science, and if uncertainty attaches to discerning such causes, how can she achieve certainty? Experimental science at least reduces uncertainty using techniques unavailable to natural history. The scientific certainty of natural history was simply assumed, thanks to positivism

and uniformitarianism.[18] Cleland is to be congratulated for refocusing on these issues.

Common cause explanation focuses on the directional nature of causality from past to present. Cleland notes two resulting features: (1) causes precede effects in time, and (2) multiple effects flow from a single cause. This creates an expanding panorama of evidence through time. For example, a volcanic eruption produces ash, a peak, and lava flows. Any of these preserved in the rock record tell us that an eruption occurred. To overcome the paucity of the rock record, she proposes that these principles produce *excess* evidence compared to the future. This is called the *asymmetry of overdetermination*, a corollary that evidence for historical causes is excess to forensic need. Effects multiply, impact the environment, and leave a broad trail in the historical record.[16]

In an interesting twist, she uses this asymmetry to favourably contrast historical science to experimental science:

> "Put provocatively, the present does not contain traces (records) of future events as it does of past events. Viewed from this perspective the historical sciences have an advantage over classical empirical science."[16]

At any rate, this principle justifies her basis for historical science in using common cause explanation.[6]

Methods of historical science

If historical science rests on the principle of common cause, and we expect excess evidence, then what are its methods? Cleland presents a forensic method based on the principle of multiple working hypotheses and the means for discriminating the best hypothesis from those options.

Method 1: Multiple hypotheses

Cleland next advocates a two-step method: (1) develop multiple hypotheses, and (2) choose the best one using 'capstone' pieces of evidence. The first is not new; it was advocated by Chamberlain.[19] Unfortunately, it now receives mostly lip service. Multiple hypotheses are allowed as long as they remain firmly within the rigid limits of geological orthodoxy. Alternatives to absolute dates, uniformitarianism, the geological timescale, or plate tectonics are seldom allowed. Multiple hypotheses help, but may not be enough. She notes:

> "The predictions of historical scientists are too vague to specify precise conditions for testing and evaluating hypotheses. They function more as educated guesses … about where additional evidence (ideally a smoking gun) *might* be found and perhaps even what form it *might* take."[20]

This is not a strong case for epistemic equality with experimental science. Experimental testing usually provides greater confidence and less subjectivity than 'educated guesses'. Can the second part of her method—the smoking gun—remedy that weakness, especially in light of the fundamental precept of empiricism that the 'right' answer may be the one yet to be discovered?

Method 2: The search for the 'smoking gun'

A staple of television mysteries is a long, fruitless trek through red herrings, followed by a short climax, where a brilliant detective finds the one piece of evidence that solves everything. This is Cleland's view of historical science:

> "… scientists investigating long past events and processes exhibit a distinctive pattern of evidential reasoning characterized by two interrelated stages: (1) the proliferation of rival hypotheses to explain a puzzling body of traces … discovered in the field, and (2) a search for a 'smoking gun' to discriminate among these hypotheses … by showing that one or more provides a better *explanation* for the total body of evidence (traces) available than the others."[21]

How are geologists to discern smoking guns from less important data? She believes that the context of competing hypotheses defines such evidence:

> "Rival hypotheses are formulated on the basis of a body of traces that doesn't include a smoking gun. The discovery of a smoking gun changes the evidential situation by revealing that one or more of these hypotheses provide a better explanation for the total body of evidence now available. Considered in isolation, independently of the other lines of evidence, few traces would unambiguously count as a smoking gun for a hypothesis. A smoking gun for a hypothesis is a capstone piece of evidence; it can only be judged as a smoking gun when combined with the rest of the evidence available."[21]

Is this circular? Cleland deflects that question with a pragmatic justification:

> "The point is regardless of the circumstance in which it is acquired, whether a result of 'prediction' or serendipity, evidence functions as a smoking gun if it establishes that one hypothesis provides a better explanation than its rivals."[20]

Discussion

Cleland bases historical science on her idea that 'science' is nothing more than linking hypotheses to evidence. The investigation of historical traces rests on *common cause* and the *asymmetry of overdetermination*. Uncertainty is reduced by multiple working hypotheses, and the use of *smoking guns*. As a result, Cleland's historical science, despite different methods and objects of inquiry, performs

the same fundamental task as experimental science (figure 2). Doing so makes them epistemic equals.

There are positive aspects of Cleland's work. She recognizes the positivist arrogance of modern science. She has also attempted a unifying vision that would justify modern confidence in geohistory and biohistory. The logical links between her definition of 'science', her foundation of common cause, evidential implications of the asymmetry of overdetermination, and her method is a noteworthy accomplishment, far superior to simplistic views of men like Lyell. However, Christians should approach her work cautiously.

Critique 1: No escaping positivism

Many of Cleland's problems stem from her ambivalence about positivism. On one hand, she rejects an outmoded scientism, but she wants the same certainty for natural history.[22,23] The idea that forensic history is not science cannot be contemplated. This shows in her uncritical acceptance of evolution and theories like an end-Cretaceous extinction impact. Though disappointing, her inability to step outside her worldview is understandable. Christians must also beware this trap. Many fall into serious error seeking to accommodate naturalism. On one end are those who think science invalidates the factual content of the Bible; on the other are those unconsciously imbibing the assumptions of naturalism. Even creationists have displayed an echo of positivism in the 'origin/operation' science model.[22]

Critique 2: Conflating 'science' with 'empirical'

When science became the arbiter of truth, there was a stampede to label all disciplines 'sciences' so that they could enjoy the same status. Drawing disciplinary boundaries in the traditional way—by methods, questions, and objects of inquiry—became confused. It is a category error to make 'science' and 'empirical' identical in meaning and scope. Cleland does not escape it, as is evident in her definition of science. Correcting this problem requires recognizing that there are empirical disciplines that are not 'science', like history and philosophy. Adler[24] describes a better method for classifying disciplines (figures 3 and 5).

Critique 3: Reducing history to common cause

Aristotle entertained a much wider understanding of cause than many of today's scientists. His material, formal, efficient, and final causes have been restricted in modern science to the material and efficient. That worked well as long as people understood that *purpose* was still there, but described by theology and philosophy. Cleland's basing historical science on common cause explanation is certainly a *part* of forensic natural history. But it is not the totality:

> "One limitation of Cleland's characterization of prototypical historical science is that there is quite a lot of broadly historical natural science that does not fit her description very well."[25]

Turner specifically mentions looking for statistical patterns in large data sets and the role of modelling in natural history. Thus, Cleland's reliance on common cause explanation is reductionist, both in its understanding of natural history and causality.

Critique 4: Common cause vs random materialism

Cleland assumes a rationality in both nature and history at odds with the random reality of modern materialism.[26,27] It persists because Enlightenment rationalists unconsciously maintain a Christian worldview by assuming a rationally ordered cosmos. But postmodern nihilism has forced naturalism towards irrationality. Only the Christian worldview offers a rational justification for science. Cleland affirms evolution and the routine secular narratives of natural history, and in part recognizes her problem:

> "Attributing puzzling similarities and correlations among traces to a common cause has great explanatory power because it makes their joint occurrence credible. Attributing their concurrency to chance, on the other hand, explains nothing; we are left with an intractable mystery."[16]

But 'chance' is only unlikely and undesirable if the cosmos is uniformly ordered such that improbable associations typically do have common causes, and the only rational explanation of universal, uniform order is the Christian God who grounded the rise of science and natural history in the first place. Yet even with her insistence on multiple hypotheses, she never explores that

	Experimental Science	Historical Science
Objects of Inquiry	Hypotheses address regularities or types	Hypotheses address specific events in past
Method	Hypotheses tested in controlled lab	Smoking gun chooses best hypothesis
Justification	Inductive or falsificationist	Principle of common cause rests on overdetermination

Figure 2. Cleland contrasts experimental science and historical science based on their distinct foundations and derivative methods.

reasonable and compelling explanation as a potential solution to her 'intractable mystery'.

Critique 5: Assumption of linear time

The asymmetry of overdetermination of historical evidence rests on the metaphysical assumption of linear time. Cleland does not justify this assumption, much less note it. She is not alone; almost all adherents of secular natural history assume it without question.[28] That view of time is justified by biblical theology alone.[29] It remains an irony of modern science that it was the foundation (in uniformitarianism) of those fighting the Bible. Hutton was one of the few to posit a different view of time, but his squishy eternalism was quickly squelched by Playfair and Lyell.[30] Gould's interesting discussion of the interplay between linear and cyclical history shows that linear time is not self-evidently true.[31] Cyclical views have existed before and persist today. Linear time came from the Bible, as did uniformity and the progressive unrolling of history.

Critique 6: Prediction vs retrodiction: a false analogy

When Cleland uses the asymmetry of overdetermination to argue that historical science is superior to experimental science, she sets up the false analogy of comparing evidence of past events to evidence of future events:

> "The asymmetry of overdetermination holds that most localized events epistemically *over*determine their past causes … and underdetermine their future effects … . The overdetermination of the localized past by the localized present explains how geologists can confidently infer the occurrence of individual volcanic eruptions that occurred tens of millions of years ago. The underdetermination of the localized future by the localized present explains why it is so much more difficult for geologists to predict the occurrence of even imminent future eruptions."[32]

When Cleland claims that our knowledge of past events is greater than our knowledge of future events, she fails to note one of the key differences between science and history. Science investigates *timeless general principles* of nature, which help us understand past, present, and future. However, that knowledge does not guarantee knowledge of *specific* future events. The issue between experimental and historical science is not knowledge, but the confidence that comes with that knowledge. This dilemma is better resolved by seeing science and history as distinct disciplines, rather than competitors for the title of 'most scientific'.

A related error is her contrast of past vs future knowledge, rather than past vs *present* knowledge:

> "… the present does not contain traces (records) of future events as it does of past events. Viewed from this perspective the historical sciences have an advantage over classical empirical science."[16]

Science increases our knowledge of our *present* environment. This enables future prediction, but that prediction can only be specific if it is directly related to these general principles. For example, we can predict that volcanic lapilli will fall with the same acceleration of gravity at any time, even if physics cannot predict the eruption ahead of time. And our knowledge of the present is much greater than that of the unobserved past.

Critique 7: Blanks smoke too

Perhaps one of the most innovative features of Cleland's justification for the epistemic equality of 'historical science' with 'experimental science' is her hierarchy of evidence, with 'smoking guns' at the top. But rival hypotheses are seldom weighed objectively.[33] In reality, ruling paradigms and bandwagons drive historical science more than 'smoking guns'. How many 'smoking guns' did it take for geologists to accept the Lake Missoula Flood? Vine and Matthews[34]

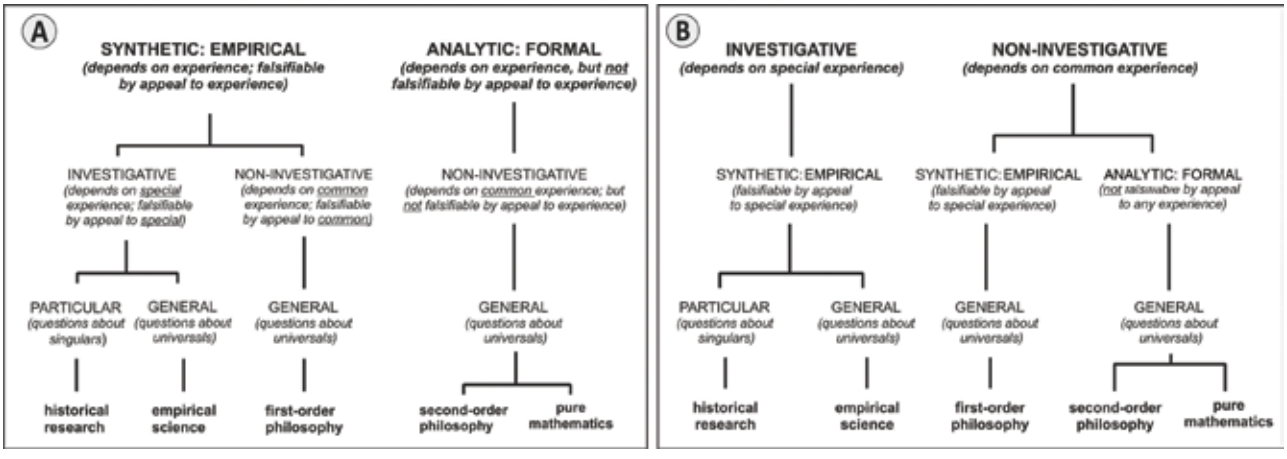

Figure 3. Adler's classification of disciplines based on the dual dichotomies of empirical vs formal and investigative vs non-investigative.[24] Science cannot be defined simply as 'empirical' but is distinguished by its object of inquiry, questions about universal principles of nature.

characterized anomalies near Iceland's mid-Atlantic ridge as 'proof' that sea-floor spreading has occurred in the past, yet further study has shown that their understanding of the evidence was less than clear.[35] Cleland's *purpose* for smoking guns is also questionable. She states that they clarify hypotheses that are "better explanation[s] for the total body of evidence". It is ironic that, having disparaged experimental science for problems of data completeness, objectivity, and unknown variables, the same issues are fixed in historical science by 'smoking guns':

> "Finally, it is important to keep in mind that the findings of historical scientists are just as tentative and subject to revision as those of experimental scientists".[21]

Thus, a 'smoking gun' is the important data (or interpretation) *at the time*, based on the shifting context of the scientists' belief system and experience. This can be avoided by Christians by defending the Bible as a source of absolute truth, recognizing that science and history are different disciplines, and seeing geohistory and biohistory as mixed questions, which require equally valid input from theology, philosophy, science, and history.[23]

Figure 4. Dr Carol Cleland is a philosopher at the University of Colorado, Boulder, specializing in understanding the logic and philosophy of science. Her interest in historical science seems driven by a desire for epistemological equality as defined by method, and results in the assimilation of historical inquiry into a broader scientific method.

Critique 8: Is the rock record complete?

Cleland does not describe how the overdetermination of past evidence can overcome the fundamental paucity of the rock and fossil records relative to her long-age understanding of Earth's history.[36] Her view that there is excess evidence is at odds with geologists, who worry about its incompleteness and the implications of preservation potential for stratigraphy and paleontology. Ager[37] said that there was 'more gap than record' and that the record consisted of a series of 'frozen accidents'. Van Andel warned:

> "… invariably we find that the rock record requires only a small fraction, usually 1 to 10 percent, of the available time, even if we take account of all the possible breaks in the sequence. Evidently deposition, unlike work in Murphy's Law, does not expand to fill the time available. This might in principle be expected but the universality and especially the magnitude of the shortfall are startling."[38]

Similar concerns have been expressed by Sadler,[12,13] Torrens,[14] and Bailey and Smith, who note that "it should always be borne in mind that the record may not be representative of this history".[39] It is not enough that we have evidence of the past and that properties of causality may supply redundant evidence. A high confidence in the translation of a paragraph means little when it is all that remains of a book.

Critique 9: Historical science in practice

Cleland pointed out failings of practice in experimental science. Yet the same problems are true of historical science, where the same mechanisms for reducing subjectivity are not available. Kuhn[40] criticized the control of experimental science by paradigms, yet the role of beliefs in historical science is much greater, as illustrated by evolution—a theory that cannot be falsified, despite abundant negative evidence. Moreover, Rudwick[41] noted that researchers were confident in deep time *a priori*.

Geologists cannot even describe their own history in a reliable manner. Gould[31] called the standard account of the history of geology a 'cardboard empiricist myth'. The heroic sagas of Hutton, Playfair, and Lyell devolve into much more complex stories as new studies delve into the interacting personalities with competing agendas, oversized egos, and a desire for fame and fortune.[41] They were united only by a common animosity to biblical history. That bias remains, and may be the dominant theme of geohistory and biohistory since the 18th century.

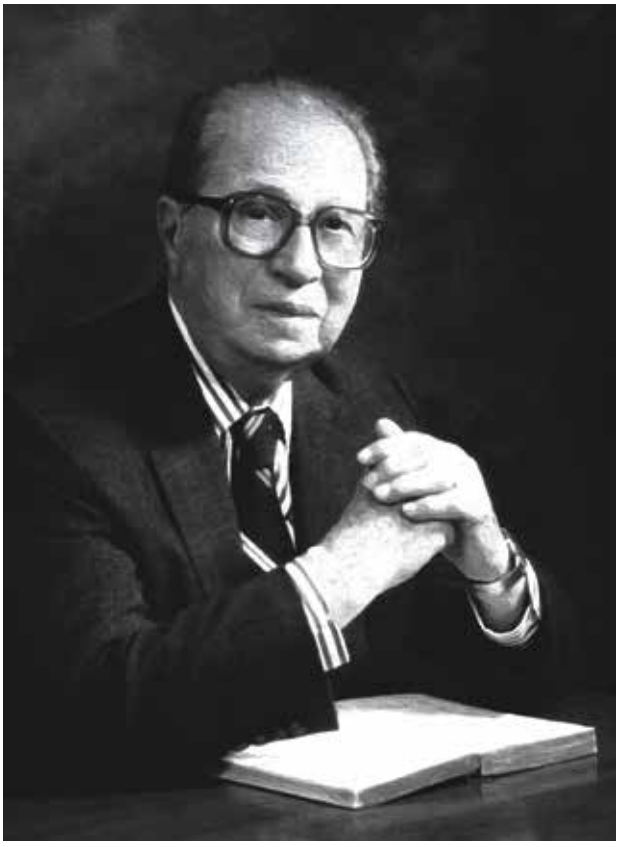

Figure 5. Dr Mortimer J. Adler (1902–2001) was an American philosopher, educator, and writer. He was involved in the *Great Books* program, was an editor of the *Encyclopedia Britannica*, and helped found the Aspen Institute. He pursued truth through philosophy, saw a distinction between the disciplines of science and history, and advocated a cross-disciplinary approach to questions that spanned those boundaries.

Critique 10: Best in field fallacy

Cleland does not account for the best-in-field fallacy.[42] This occurs when problems surface with models, and proponents do not answer the objections, but only respond that their model is better than competing hypotheses. As MacBeth noted, this approach measures truth by an appeal to the power of explanation, not by logic or evidence:

> "It seems that the standards of the evolutionary theorists are relative or comparative rather than absolute. If such a theorist makes a suggestion that is better than other suggestions, or better than nothing, he feels that he has accomplished something even if his suggestion will obviously not hold water. He does not believe he must meet any objective standards of logic, reason, or probability."[43]

In falling into this trap, Cleland stated:

> "The point is most historical hypotheses are not rejected on the basis of failed predictions but rather because another hypothesis does a better job of explaining the total body of evidence available."[20]

While a hypothesis may do 'a better job' of explaining data, that is not the measure of truth.[44] Cleland is caught in a trap of her own devising. If natural history is a subset of history, with the inherent uncertainty of history, then tentative models explaining limited data are acceptable. But if one insists that natural history has scientific certainty, the standard of proof is much higher. Simply having the best story is not enough.

Critique 11: Role of belief systems

Natural history has seen a clash of belief systems. Cleland is on firm ground in her understanding that background beliefs play a role in historical science. Unfortunately, she does not grasp her own biases. Naturalism is not an inherently scientific mindset, as its devolution into postmodern relativism is demonstrating. Christianity, and only Christianity, gave rise to science.[45] It did so with a unique collection of background beliefs that provided a cultural environment that fostered its purposes, strategies, and methods. Lyell and his intellectual children enjoyed the fruits while rejecting the tree. They caught the coat-tails of Newtonian physics, thinking natural history could be equally scientific. Cleland seeks the same goal by a different road. Her 'multiple hypotheses' excludes those of creationists, even when evidence strongly supports their ideas. Few secular geologists are willing to admit that uniformitarianism is not able to explain the rock record, and no secular geologist will face the implications of geology having been built on that false principle. Secular geologists and biologists are ill-equipped to address their worldview and retain large blind spots for that reason. It is understandable that scientists, given the inculcation of naturalism in education at every level, would fall prey to such problems. But philosophers of science are supposed to address those problems.

Conclusion

While Cleland's positive case for historical science is an improvement on Lyell's, her case falls far short of demonstrating an epistemic equality between natural history and experimental science, primarily because she is asking the wrong question. In conflating 'science' with 'empiricism', she requires that history become science. This should be a warning, since this error is at the root of the Christian redefinition of 'origins/operation/historical/supernormal science'.

Cleland makes an interesting case with a consistent foundation and method. However, it depends on suspicious assumptions and does not account for the scope of historical science. Until a better case is made, we cannot agree that

historical science is the epistemic equal of experimental science in the sense of having equal confidence in their conclusions because the experimental method allows a reduction in subjective elements that forensic history does not. Thus, we[23] continue to assert that Adler[24] provided a superior basis for natural history as a mixed question, incorporating truth from science, history, philosophy, and theology.

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