



Creation Matters

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Herbivores and Plant Volatiles: Part 1 – Tobacco and Tomato Plants

by E.L. Williams, Ph.D. and G.F. Howe, Ph.D.

Many people in our country enjoy raising vegetables in home gardens. One of the favorite crops is tomatoes, with their rich green leaves and fruitful harvest. In mid-to-late summer, however, you may find your plants stripped of many leaves and some of the fruit may be partially eaten, almost overnight. Droppings on the plants and on the ground are evidence of a fast-eating herbivore at work.



Figure 1. Tobacco hornworm larva (Insecta > Lepidoptera > Sphingidae), *Manduca sexta*. Image number UGA 1748030.

Photographer, Robert L. Anderson, USDA Forest Service.

Hornworms

It is difficult to locate the offending culprit since it is so well camouflaged. After an often-frustrating search, an ugly, large, green caterpillar called a

“hornworm” is found. The hornworm is three to four inches in length. It could be

either a tomato hornworm, which is the larva of *Manduca quinquemaculata* (Haworth), or a tobacco hornworm, the larva of *Manduca sexta* (Linnaeus). Both will attack tomato and tobacco plants, as well as eggplant, potato, pepper, horsetail, jimson weed, nightshade, and other members of the plant family Solanaceae.

The two larvae can be distinguished from each other because the tomato hornworm has eight V-shaped markings along each side, whereas the tobacco hornworm has seven diagonal slashes (Figure 1). The name “hornworm” comes

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The Future of Creationism

by John K. Reed, Ph.D.

Editor's note: This material summarizes the CRSQ article, Beyond Scientific Creationism, (Volume 41, p. 216) which was coauthored by Peter Klevberg, Chris Bennett, Jerry Akridge, Carl Froede, and Thomas Lott, and can be read at:

www.creationresearch.org/crsq/articles/41/41_3/beyond_sci_cre.htm

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People generally associate the term “Scientific Creationism” with a movement, when in fact it represents a methodology — using science to rebut evolution and uniformitarianism. This approach was effective primarily because its empirical arguments (e.g., gaps in the fossil record, thermodynamics, information theory) came as a shock to an academic elite and a public who believed the propaganda that the evolution vs. creation argument was really one of enlightened science vs. outmoded religion. But as we move ahead in the 21st century, we must examine whether or not the methodology of scientific creationism is the most effective strategy for completing the task. And that question can only be answered by a better understanding

of just what needs to be accomplished.

Although the emphasis on a *scientific* rebuttal of evolution and uniformitarianism attracted widespread attention and negated the “religion vs. science” claim, it also caused several problems. The most significant was friction between creation scientists and some professional theologians. The theologians were often biased against the conservative doctrinal stance of the creationists (and perhaps their usurpation of the theologians’ territory) and uneasy over associations with those the secular academic establishment had labeled “anti-intellectual” at a time when theologians were trying to keep their seat at that table.

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The Future of Creationism

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Also, many theologians remain indifferent to evolution and the age of the Earth because they believe that they can be made compatible with Christianity – unaware of the real challenges to biblical authority or still spooked by secular spin on Galileo's trial.

But the scientific emphasis presents other problems for creationists. The emphasis on empirical apologetics often moves the defense of biblical truth into areas that only a few experts are qualified to address. It reinforces one of the foundations of evolution and uniformitarianism — the belief that science is the gatekeeper of truth and that history is defined by scientific investigation. Finally, it ignores longstanding strengths of Christianity in theology and philosophy. As we evaluate the future of creationism, we need to find solutions to all of these problems without sacrificing the strengths of scientific creationism.

A Strategy for the 21st Century

The future of creationism can be best pictured in terms of the biblical picture of enlarging our tents. By this I mean that the same doctrinal truths taught by the scientific creationists should be maintained – with vigor – but that their defense be undergirded by theology and philosophy. The gestalt switch necessary to this approach is the appreciation that creationism is a part of a Christian worldview that is battling another worldview which underlies evolution and uniformitarian geology.

The clash of worldviews operates across the spectrum of knowledge, since a worldview is a comprehensive lens for evaluating reality. Therefore, science has its place, but it is not the whole show. This has several advantages: (1) it overcomes the problems of accessibility to interested non-scientists, (2) it resolves fundamentally inconclusive arguments inherent to empiricism, and (3) it allows Christians to avail themselves of the historical intellectual inheritance of Christianity. What is this worldview that we face?

The Worldview of Naturalism

Today, Naturalism is the dominant worldview of Western intellectual culture, having displaced its primary competitor, Christianity (Figure 1). Its advocates trace its roots to ancient Greece and Rome, but Enlight-

enment Naturalism is a post-Christian absence of conscious faith in which ultimate reality is reduced to physical matter, a metaphysic that is paradoxically a denial of metaphysics. The position and motion of matter/energy cause everything that has happened, is happening, or will happen. God is a false myth, the supernatural a dream, the soul an illusion, and the afterlife nonexistent.

Since reality is defined as matter and motion, there is no essential difference between mind and matter. A crucial corollary to all of reality being either matter or energy is the idea that the human understanding of reality thus depends on science. If there is no God, there can be no revelation, and theology is a waste of time. Instead, knowledge consists of the best human understanding of physical phenomena. Science, and only science, offers hope for sure and certain knowledge. This position has come to be called positivism, and the 18th century philosopher David Hume captured its spirit early on in his famous conclusion:

When we run over our libraries, persuaded of these principles, what havoc must we make? If we take in our hand any volume; of divinity or school metaphysics, for instance; let us ask, "Does it contain any abstract reasoning concerning quantity or number?" No. "Does it contain any experimental reasoning concerning matters of fact and existence?" No. Commit it then to the flames: for it can contain nothing but sophistry and illusion (Hume, 1777, section 12).

Little has changed in this regard among scientists.

Most scientists today are positivists, claiming, along with Comte, that all valid descriptive knowledge of reality belongs to science.... The dogmatic claims of positivism are widely prevalent at the end of the twentieth century, not only among scientists, but also among all those who have been miseducated in our colleges and universities, as well as in the unthinking multitudes who are overly impressed by the achievements of science and technology (Adler, 1993, p. 76).

Because of its belief that reality is

matter in motion and is understood through the method of positive science, Naturalism faces a profound dilemma regarding history. It needs a strong grasp on history to support evolution and uniformitarian natural history - its heavy artillery in the war against the Christian worldview. But the logical consequence of a stranglehold on knowledge by science is a weak history, since only knowledge based upon observation is valid.

Only one thing can salvage history for Naturalism – the unlimited extrapolation of present day observations back across time. This was the need that propelled Charles Lyell to prominence in the early 19th century. Lyell, who was known as a great observer of geologic phenomena, held to a strict uniformity of rate and process that opened the door to history for Naturalism. His ideas succeeded in wrenching history away from the Bible and into the arena of science.

This bias against historical truth in the Bible remains today for two reasons. First, biblical history cannot (they suppose) address the vast majority of historic time. Secondly, science has "proven" that the biblical accounts are not accurate.

Finally, the bias is reinforced by the impressive volume of scientific information that swamps the paltry verses of Genesis, supporting the view that truth depends on the volume of knowledge (another bias of empiricism). Thus, our framing of the debate in terms of Darwinian biology and Lyellian geology has missed the submerged part of the iceberg. The reason that the arguments of scientific creationism have not convinced the scientific community is

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that devotees of the worldview of Naturalism have a religious commitment that cannot be shaken by a few inconvenient facts. For two centuries, this worldview has been attempting to undermine the foundations of Christianity. Creationists need to understand that Naturalism is even more vulnerable to the very same kind of attack. What does this attack entail?

Defeating Naturalism

Oriental martial arts have become wildly popular in the west. Hollywood has replaced the cowboy's six-shooter with the ninja's throwing star. One of the attractions of martial arts is the frequent emphasis on using an opponent's strengths to defeat him. This simple principle holds the key to defeating the worldview of Naturalism.

How does one go about attacking a worldview? First, one must recognize that it is an integrated entity that spans the breadth of intellectual disciplines and is held together by the glue of faith. Thus, a worldview cannot be totally destroyed; it can only be rendered foolish in the eyes of most. Traditionally, debate revolves around (1) errors of fact, (2) errors of reasoning, and (3) presuppositional errors. I believe that the latter two are the most important for debating worldviews, while the methodology of scientific creationism has focused on errors of fact. Scientists commonly shy away from theology and philosophy, and creation scientists rightfully distrust those theologians who have abdicated their defense of Christian tenets of origins and history. However, we are all theologians by default; it only remains whether we will be competent or incompetent ones. The coming generation of creationists must fight a worldview, not simply empirical data and derivative theories.

Finding and attacking presuppositional errors is a method that goes to the vitals of any worldview. I suggest that these errors can be found in the three cornerstones of modern Naturalism: (1) materialism, (2) positivism, and (3) the uniformitarian justification of history. It is important to see that logical connections exist between them. If reality is matter, then science is the means to comprehend reality, and the unlimited extrapolation of uniformitarianism allows science to swallow history.

Once we understand how Naturalism has been constructed, then we can find its (generally unrecognized) weakness. Ordinarily,

we would suppose that we should focus on the differences between Christianity and Naturalism. But like pictures hiding within patterns, we begin to see weaknesses when our focus shifts away from the differences between the two worldviews and onto their similarities. That is because Naturalism was shaped by its early history.

Rising in opposition to Christianity, it attempted to use science as its primary weapon to destroy the Christian foundation of redemptive history. Uniformitarianism provided the philosophical justification for the abduction of history by science. If the present could be perfectly extrapolated into the past, then science could rescue history from its revelatory shackles. As an aside, that is the connection the Intelligent Design advocates have missed, and despite their brilliant attacks on materialism and positivism, they will not topple Naturalism until they address uniformitarianism.

The formal argument against Naturalism rests on that worldview's dependence on science. Science will ultimately betray Naturalism, because science is the child of Christian faith, not Enlightenment philosophy. Although science has been turned to the "dark side," its internal logic screams for close links to its historical home of Christian theology.

... Christian theology was essential for the rise of science. In demonstration of this thesis I first summarize much recent historical work to the effect that not only did religion not cause the "Dark Ages," nothing else did either — the story that after the "fall" of Rome a long dark night of ignorance and superstition settled over Europe is as fictional as the Columbus story. In fact, this was an era of rapid and profound technological progress by the end of which Europe had surpassed the rest of the world. Moreover, the so-called "Scientific Revolution" of the sixteenth century was the normal result of developments begun by Scholastic scholars started in the eleventh century. (Stark, 2003, p. 123).

Because the fathers of modern Naturalism were steeped in the Christian worldview, they assumed many of its truths without reflection. Those Enlightenment thinkers were more "Christian" than they

realized. Therefore, many of the doctrines of Naturalism are supported by Christian presuppositions.

Since presuppositions usually are the part of the proverbial iceberg below sea level, most people then (and now) never noticed their existence. But if we shine the light of truth on Christian axioms used by Naturalism, that worldview will be convicted of a blatant internal contradiction — using Christian assumptions to support anti-Christian conclusions.

They cannot have it both ways, and will be forced to substitute consistent presuppositions (with appropriate justifications) to replace the Christian ones. If they cannot, then the worldview of Naturalism will be formally (logically) invalid, having failed truth tests of consistency and coherence. At that point, the origins/history debate must by default be settled within the Christian worldview.

Some Formal Flaws of Naturalism

But, first things first. What are the formal flaws in Naturalism? What follows is a short summary of several of the most glaring inconsistencies.

1. *The Idea that Nature Can Be Known.* Science, as we know, grew from the conscious replacement of the worldview of classical philosophy with that of Christianity. The medieval Scholastics were forced to choose between the rational universe of Aristotle and that of the Bible — freely created by a transcendent, infinite, eternal, and unchanging God.

No Christian could ultimately escape the implications of the fact that Aristotle's cosmos knew no Jehovah. Christianity taught him to see it as a divine artifact rather than a self-contained organism. The universe was subject to God's laws; its regularities and harmonics were ... a result of providential design. The ultimate mystery resided in God rather than in Nature ... The only sort of explanation science could give must be in terms of descriptions of processes, mechanisms, interconnections of parts. Greek animism was dead ... The universe of classical physics, in which the only realities were matter and motion, could begin to take shape (A.R. Hall as cited in Glover, 1984, p. 83).

Although modern Naturalists reject the Christian doctrine of creation, they retain the derivative mechanistic method of studying it and its accompanying empirical tradition. They cannot justify either from materialism nor can they explain the purpose in nature that makes it comprehensible.

2. *The Idea that Man can Know It.* Even if nature holds the potential to be understood, science is still not possible unless man can connect with that “knowability.” Furthermore, man must in some sense transcend nature to play the role of the observer. Christianity allows both because man: (1) was created in the image of God, (2) was an immortal spiritual being, transcending material nature, and (3) had the promise of dominion over the creation, implying the ability to comprehend it.

Naturalism obviously cannot justify man’s role as scientist based on these doctrines, and so it must find its own. Claiming special status for man by touting him as the pinnacle of evolution does not meet the necessary criteria, nor does the more recent New Age promise of some future evolution into “gods.” Man, the pinnacle of evolution, is still a part of the system and without the *imago dei* there is no transcendence and consequently the loss of objectivity.

Actually, the internal logic of Naturalism is better reflected by those who assert the place of plants and animals to be equal or superior to that of man! Thus, Naturalism traps man within nature without any of the attributes that permit him to be a scientist, but still he practices science - because he believes that it disproves Christianity.

3. *What about History?* History in the worldview of Naturalism seems essential, but very little reflection is needed to see that its value is not intrinsic, but lies in its being a weapon against Christianity. Logically, history within Naturalism seems doomed to determinism, rendering it of no consequence. Only a biblical worldview can impute value to history and to man’s role, because of the relationship between God and man played out on the stage of time.

Naturalists cling to a Christian appre-

ciation of history in their pursuit of “missions” in life, yet they never ask why they should bother to “save the whales” in a deterministic world. This misplaced mission-oriented character of man reveals yet another stolen Christian presupposition. Naturalism has no valid basis for history.

Similarly, concepts of linear, unidirectional time, the idea of progress, and of transcendent purpose in history are derived from Christian theology. Naturalism has stolen the Christian concept of time, exhibited by a beginning (the Big Bang), a period of conservation of the created order, and an end (oscillation to another big bang).

Likewise, the idea of progress is a tenet of Christian theology. Inherent in the biblical presentation of redemptive history is the idea of progress, man moving toward the fulfillment of ultimate perfection on a new Earth. A comparison of these similarities — millennia old in Christianity; cen-

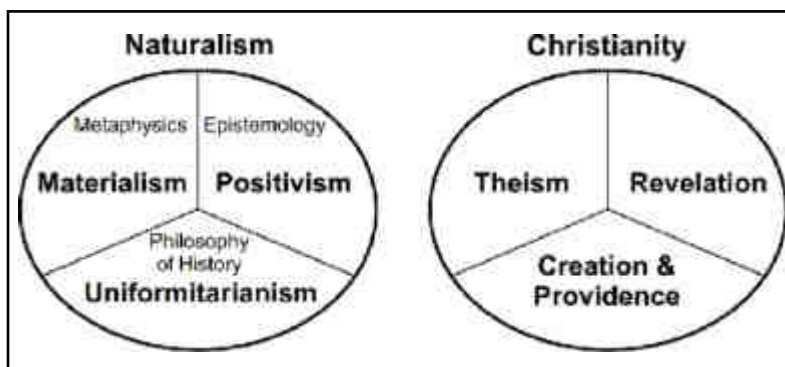


Figure 1. The worldviews of Naturalism and Christianity are contrasted by a triad of metaphysics, epistemology, and their basis for history.

tures in Naturalism – certainly suggests that Naturalists have been caught once again with their hands in the cookie jar of Christian axioms.

4. *Uniformity and Uniformitarianism.* Naturalism justifies moving history beneath science by virtue of the axiom of uniformitarianism (Figure 1). Logic demands the pure uniformitarianism of Hutton and Lyell.

But Lyell held a complex view of uniformity that mixed this consensus about method with a radical claim about substance – the actual workings of the empirical world. Lyell argued that all past events – yes, every single one – could be explained by the action of causes now in operation. No old causes are extinct; no new ones have been introduced. Moreover, past causes

have always operated – yes, always – at about the same rate and intensity as they do today. No secular increases or decreases through time. No ancient periods of pristine vigor or slow cranking up. The earth, in short, has always worked (and looked) just about as it does now (Gould, 1997, p. 105).

How did he get away with it, and more importantly, why do his disciples continue to?

Lyell then pulled a fast one – perhaps the neatest trick of rhetoric, measured by subsequent success, in the entire history of science. He labeled all these different meanings as “uniformity,” and argued that since all working scientists must embrace the methodological principles, the substantive claims must be true as well. Like wily

Odysseus clinging to the sheep’s underside, the dubious substantive meanings of uniformity sneaked into geological orthodoxy – past an un-discerning Cyclops, blinded with Lyell’s rhetoric – by holding fast to the methodological principles that all scientists accepted (Gould, 1997, p. 119).

Even if we ignore that Lyell’s semantic trickery was invalid (Reed, 2001), Naturalism still faces a tremendous hurdle — the Christian origin of uniformity. Naturalism cannot justify faith in invariant natural law apart from God. The Christian fathers of science justified uniformity based on the character of God; Naturalism must jettison that rationale when they jettison God. So how can they justify uniformity? Logic would demand that it be done using science, but our limited observation in time and space cannot possibly do so. Like so many other axioms of science, uniformity is derived from Christian theology.

5. *Truth and Reality.* Finally, the fundamental assumption of knowledge in general and science in particular is that there is a conjunction of human knowledge, reality, and truth. Only the biblical doctrine of creation can support this very basic require-

ment. God, as ultimate reality, tells us to understand Him, in part through understanding His work of creation. Thus, it stands to reason that man can understand both created reality and its creator.

Furthermore, if man possesses God's image, then man can be expected to acquire understanding of nature. Clearly, Naturalism cannot justify its use of this assumption, and the practical implications are staggering. For example, if we are not confident in the intersection of truth and reality in science, how can we justify its multimillion-man research effort? No scientist claims to have exhaustive truth, but all assume that their little bit of truth will "fit" with those of other scientists, and that if they do not, that the error is with the research, not the assumption of universal truth. This bold assumption makes sense in the Christian worldview alone.

Conclusion

Creationists should move beyond the scientific challenge to evolution and uniformitarian geology, also taking aim at the underlying worldview of Naturalism. That can best be accomplished by challenging the underlying assumptions of Naturalism that have been stolen from Christianity. That analysis demonstrates that Naturalism is formally invalid because it's deeply-buried Christian assumptions are at odds with

its anti-Christian conclusions. Larceny is profitable as long as no one notices, but when the spotlight is aimed in the right direction, the long arm of logic must act.

Unless Naturalism can replace these Christian doctrines with substitutes consistent with the rest of its worldview, the entire worldview should be considered false. All of the empirical data in the world cannot save Naturalism from formal flaws.

The philosophy which forbids you to make uniformity absolute is also the philosophy which offers you solid grounds for believing it to be general, to be almost absolute. The Being who threatens Nature's claim to omnipotence confirms her in her lawful occasions. Give us this ha'porth of tar and we will save the ship. The alternative is really much worse. Try to make Nature absolute and you find that her uniformity is not even probable. By claiming too much, you get nothing. You get the deadlock, as in Hume. Theology offers you a working arrangement, which leaves the scientist free to continue his experiments and the Christian to continue his prayers (Lewis, 1961, p. 106).

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Speaking of Education

Commentaries on recent news from education

Editor's note: All S.O.S. (Speaking of Science) items in this issue are kindly provided by David Coppedge. Opinions expressed herein are his own. Additional commentaries and reviews of news items by David, complete with hyperlinks, can be seen at: www.creationsafaris.com/crevnews.htm. Unless otherwise noted, emphasis is added in all quotes.

Who Wins and Loses in the Darwin Wars?

Sandra Lilley, writing in *MSNBC News*, pictures sad-faced students, whose scientific inquisitiveness has been stifled by the controversy over evolution. The article starts with a touching photo of a young girl, a look of wonder in her eyes, examining a toy human skeleton. "Science is becoming a political 'hot potato' for some students," she describes, "transforming **what should**

- *Who Wins and Loses in the Darwin Wars*
- *Reports Differ on Kansas Evolution Debates*
- *Kansas Debate Reverberates in Holland*
- *Battlefront Dispatches*

be a dynamic, fascinating topic into a total turn-off . . . And some students are choosing silence over losing a prom date."

Lilley quotes only pro-evolution spokespersons (some nominal Christians) who express the opinion that the next generation of scientists is being threatened by creationists and politicians raising a ruckus

over evolution, leaving students bewildered over a conflict they don't understand, preferring to avoid the subject as a result.

The only evidence offered for evolution in the article is from Ken Miller: "If a child becomes a pharmacist and someone develops a resistance to a drug, *that is evolution*," he said. Miller argues that society will be at a disadvantage if we don't teach evolution, which he equates with basic science.

A different point of view was offered by high school science teacher Doug Cowan (Port Orchard, Washington), writing for the *Christian Science Monitor*. In his experience, he claims, students become stimulated over his non-sectarian "teach the controversy" approach.

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Tobacco and Tomato Plants

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from the caterpillar or larval stage which has a spike on the posterior portion of its body. The tomato hornworm's spike is straight and has a blue-black color, while the tobacco hornworm's spike is curved and red.

These herbivores, that can defoliate a tomato plant in a matter of days, are considered "potentially the most destructive insect pests of tobacco" (R. J. Reynolds Tobacco Co.). The species of these seemingly insatiable insects are properly named *Manduca* – the Latin word for devourer. The adult state of the hornworm is a sphinx or hawk moth (Figure 2).

Often, one of the feasting hornworms is covered with eggs or cocoons of a small braconid wasp (Figure 3). The larvae of the wasp feed internally on the hornworm, killing it and emerging as adults to continue the life cycle of the wasp (Figure 4). How does this wasp parasitoid find its well-hidden prey? It is attracted to the hornworm herbivore by scents or volatiles purposely emitted by the plant (Wolfson, 1992).

Plant volatiles

It is postulated that there are three possible metabolic pathways that produce volatiles in plants (Pare and Tumlinson, 1996, p. 97; Gatehouse, 2002, pp. 157-160). One pathway leads to the emission of indole, a second to the release of leafy green volatiles and jasmones, and the third produces terpenes. Oral secretions or regurgitant from herbivores allow the plant "... to identify and differentiate herbivore feeding from mere mechanical wounding" (Pare and Tumlinson, 1996, p. 93).

There are both local (at the wound site) and total-system responses to a feeding herbivore. Possibly, different volatile blends may be released from the plant if a different chewing herbivore is involved.

Plant defenses

It is thought that the wounding of a tomato



Figure 2. Adult state of tobacco hornworm.
Image number UGA 1440118,
R. J. Reynolds Tobacco Company Slide Set.

plant produces a polypeptide called systemin, which is composed of 18 amino acids. It is considered a systemic signaling molecule that causes the production of proteinase inhibitors (Ryan et al., 2002). The inhibitors interfere with the digestive en-



Figure 3. Tobacco hornworm larva with parasitoid pupal cases on the body. Image number UGA 0590089.

Photographer, Robert L. Anderson, USDA Forest Service.

zymes in the herbivore's gut, reducing its ability to continue feeding (Orozco-Cardenas, et al., 1993, p. 8274). The action of systemin can possibly also induce one of the pathways for the production of volatiles (to attract the wasp parasitoid) in a continuing cascade of biochemical reactions (Gatehouse, 2002, pp. 149-154).

In response to wounding, tobacco

plants appear to manufacture several trypsin (proteinase) inhibitors (Ryan et al., 2002) as well as release of volatiles in their systemic reaction to hornworm feeding. It is likewise possible that the release of volatiles is entirely independent of the formation of proteinase inhibitors in both plants.

Native Tobacco Plants

Generally the direct defense of the native tobacco plant, *Nicotiana attenuata*, in response to herbivory is the production of highly toxic nicotine (which is used in some insecticides). The tobacco hornworm, however, is nicotine-tolerant. Unfortunately, the braconid wasp parasitoid (*Cotesia congregata*) that preys on the hornworms is sensitive to nicotine.

As the larvae of *C. congregata* begin to feed on hornworms which have eaten leaves having a high nicotine content, they suffer an increased mortality rate. But amazingly, when the tobacco plant detects the oral secretion from a hornworm which is eating the leaves, it suppresses the induced nicotine response, while at the same time continuing to release volatile terpenes, which then attract wasps (Halitschke et al., 2000, p. 409)! The tobacco plant, by suppressing its nicotine response, does what is necessary to attract the parasitoid wasps and preserve their lives.

Timing of Emission of Volatiles

Plants suffering herbivory release a greater quantity of volatiles during daylight hours when wasp parasitoids are actively foraging for prey. At night the plants reduce the amount of volatile emissions when the wasps are not active. Tests have shown that even if the

same temperature is maintained at night, this day-night cycle of release is unchanged (Pare and Tumlinson, 1996, p. 97; Halitschke et al., 2002, p. 408; Dudareva et al., 2004, p. 1898).

Stored or Freshly Produced?

Are the defensively-induced volatiles that are given off by plants stored in their tissues

or are they formed de novo? Some plants do store defensive compounds in their tissues, but it is generally conceded that induced volatiles are manufactured de novo. Thus, there is often a delay of 12-24 hours before these chemicals are released (Dunareva et al., 2004, p. 1899; Pare and Tumlinson, 1996, p. 95; 1999, pp. 325-328). Dunareva et al. concluded that

the release of volatiles from vegetative organs following herbivore damage seems to be a general property of plant species. (p. 1893)

Plant Communication with Volatiles

Although controversial, it is claimed that plants damaged by either mechanical means or herbivory release volatiles, and nearby undamaged plants respond to these signals by inducing higher levels of resistance against herbivores (Karban et al., 2000). Wild (native) tobacco plants grown in close proximity to sage brush were monitored in a test program. Some sagebrush bushes were mechanically clipped, causing the release of an epimer of a methyl jasmonate volatile. Tobacco plants close to the clipped bushes suffered less herbivore damage than did those plants near uncut sagebrush. The clipped-sagebrush volatile signal is thought to have induced the production of an anti-nutritive compound in the nearby tobacco plants, thus reducing herbivory.

Some controversy exists among those workers studying the functions of plant scents; therefore, what we have presented in this note should be considered to be tentative. Concepts may change as more data become available. We hope to continue writing on the fascinating subject of plant volatiles.

Evolutionary Speculations

The recent nature of much of the research on plant scents likely has prevented the acceptance of a unified evolution model. The suggestions we have seen in the literature generally fall into two categories: (1)

descent from a common ancestor, and (2) improvement of plant fitness. Pickersky (2004, p. 514) noted that "Volatile plant compounds probably evolved to repel herbivores, but they now perform a remarkable range of functions."

He further stated that some emitted volatile compounds are found in most plant species; however, there are certain released scents which are found in one, or only a few, species.

Another suggestion is that the interaction of plant, herbivore, and carnivore "... has been explained as an evolutionary outcome of a reliability-detectability problem faced by carnivores searching for herbivores ..." Dicke and van Loon (2000, p. 239). Turling et al. (1995, p. 4173) discussed the possibility of coevolution of plant-insect interactions.

This brief account does not exhaust the evolutionary thought on the subject, but it does serve to illustrate how naturalists attempt to explain the origin of plant scents.

Another Origin Option

We suggest another possibility for the origin of the intricate relationship of plant defenses against herbivores involving parasitoids. The Creator designed such interactions knowing the needed solution in advance. We cannot imagine how natural selection or mutation processes could simultaneously bring inter-working systems into existence successfully. The mathematical probability of random, non-guided processes developing such a chain of relationships must be so low as to suggest impossibility.

The formation of proteinase inhibitors and the timing of the release of plant volatiles to attract wasps, causing the eventual demise of a herbivore, are amazingly complex interactions. The action taken by wild tobacco plants, when prompted by oral secretions of a *M. sexta* caterpillar, is another complex process. The plant reduces its formation of nicotine (a direct defense mechanism) as it releases plant volatiles to attract adults of *C. congregata*, the larvae of which can kill the hornworm, without risking a higher mortality rate. We consider these examples as direct evidence of design.

When did such interactions originate? According to Klotz (1980), herbivory was likely introduced after the original Creation. Possibly, immediately following the Creation, the abundance of lush vegetation and a slower rate of herbivore damage posed no threat to plant extinction. After the Fall of man, the rate of herbivory may have in-



Figure 4. Small wasps in the petri dish are the adult parasitoids which emerge from the cocoons attached to the hornworm larva. The fly pupa also emerged from the same hornworm. Image number 1327004.

Photographer, Alton N. Sparks, University of Georgia.

Often, even closely related species that diverged from a common ancestor only a few million years ago (at most) can have substantially different bouquets. (p. 519)

Ryan et al. (2002, p. S260) observed that since the polypeptide signaling occurs in both animals and plants:

Polypeptide signaling may have had its origins in ancestral organisms that predated plants and animals providing a foundation for the evolution of polypeptide signaling in all modern eucaryotes.

Dicke and van Loon (2000) considered that herbivore-induced plant volatiles increase plant fitness, since there is greater seed production as a result "... of reduced consumption rate of parasitized herbivores" (p. 237). Pickersky and Gershenson (2002, p. 241) cited studies which indicated that plant volatiles released as a defensive mechanism render a beneficial effect on plants by a definite increase in reproductive fitness.

creased dramatically, and parasitism became necessary to reduce this activity. At this time, the Creator may have devised complex systems by modifying plants, introducing defensive mechanisms involving parasitoids. Alternatively, the capability of insects to parasitize, and the capability of plants to respond defensively, may have been a part of the original creation.

Conclusion

We suggest that the interaction of plants, herbivores, and parasitoids is an amazing tribute to the Creator's handiwork. Assigning the origin of these processes to the Creator does not diminish scientific inquiry and the desire to further elaborate the intricate nature of these amazing relationships. We are, in fact, even more motivated to investigate these interactions so that we can more completely understand God and His creation.

Glossary

de novo - afresh or anew

epimers - molecules that differ only in the spatial arrangement of atoms around a single carbon atom

green leaf volatiles - compounds, generally comprised of six-carbon aldehydes, alcohols, and esters, which are emitted by plants

indole - an aromatic, heterocyclic, organic compound with a formula C_8H_7N

jasmone - cisjasmone, with a chemical

formula $C_{11}H_{16}O$ having a floral-green, jasmine-like odor

methyl jasmonate - one of the main odor components of jasmine

parasitoid - insect species whose larvae develop as parasites on other insect species

polypeptide - a peptide consisting of two or more amino acids

proteinase - any enzyme taking part in the breaking down of proteins by splitting internal peptide bonds to produce peptides

terpenes - compounds consisting of five-carbon units (isoprene units) joined together in a regular pattern, usually head to tail

trypsin - a proteinase

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Editor's note: All photos used by permission. www.forestryimages.com

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Dr. Williams, who is retired from the CRS Board of Directors, has a Ph.D. in engineering. Dr. Howe, with a Ph.D. in botany, is on the Board and serves as the biology editor for the CRS Quarterly.

Speaking of Education

...continued from page 5

I am a public high school biology teacher, and I do an unusual thing. I **teach my students more than they have to know about evolution**. I push them to behave like **competent jurors** - not just to **swallow** what some **authority** figure tells them to believe - not even me - but **rather to critically analyze, with an open mind**, the **evidence** set before them. . . . Teenagers, not surprisingly, find this approach **exhilarating**.

He finds that the students "perk up" when he points out that "contrary to their large and monolithic biology textbook, some highly credentialed scientists insist that there are limitations to Darwin's theo-

ry." When he displays some of the alleged evidences for evolution that have been found fraudulent (Piltdown Man, Haeckel's embryos), "the sleepy looks in the classroom usually vanish."

Cowan, however, is not on an anti-evolution crusade. He also lays out all the "reputable evidence for evolution," the "pillars of evolutionary theory" such as bacterial resistance, finch beaks, and genetically altered fruit flies, then challenges the class to reason whether these observed microevolutionary changes can be extrapolated into macroevolution.

By maintaining a neutral stance, letting them examine all the evidence and make up their own minds, Cowan says his approach is on firm legal footing. Students and parents alike seem to appreciate his method. Students feel liberated to weigh the evidence for themselves. "The job of

the scientist, I explain, is to find the best explanation to a problem, not just to defend his or her own position at all costs." For support, he quotes Charles Darwin: "A fair result can be obtained only by fully stating and balancing the facts and arguments on both sides of each question."

Evolution *and* anti-evolution can be taught skillfully and poorly. Reporting on either can be done skillfully or poorly. Herein are two examples for you to evaluate.

No reputable anti-evolutionist wants students to become afraid of the controversy over evolution and become tempted to shut up. No reputable pro-evolution teacher should want the class to be indoctrinated, nor have a student feel browbeaten for having honest questions about evolution. Cowan seems to have hit the sweet spot. Can anyone really doubt that learning to think critically is going to help the next

generation of scientists? The only losers in the Darwin Wars, when fought fairly, are the indoctrinators who don't want the students to know about Haeckel and Piltdown and the other dirty laundry in the textbook.

Lilley, S. 2005. Turned off science: Students may be the real victims of the evolution wars. *MSNBC Interactive*. June 3, www.msnbc.msn.com/id/8074471/

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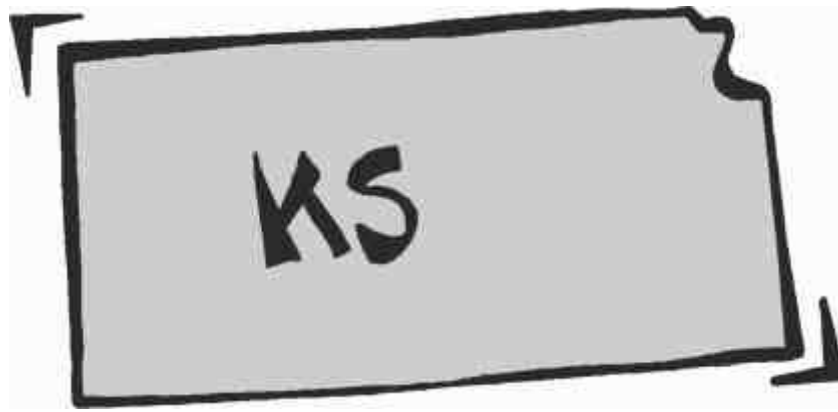
Reports Differ on Kansas Evolution Debates

How is the debate over evolution in Kansas going? It depends on whom you ask. An Associated Press story, reported at MSNBC News, focused on personal attacks between board members. The Discovery Institute, by contrast, focused on the content of the new proposed standards that allows a "common-sense" approach for teaching all the science about evolution, including the problems with Darwin's theory.

MSNBC's title suggests that both sides are bickering, claiming "School board members hurl insults at each other." But if you look into the article, the only ones hurling insults are the evolutionists; the other side is just putting up their shields. All Connie Morris said was, after being insulted, "Had you attended, you would have been informed. You would be sitting here as informed individuals and not arrogantly calling us dupes."

The article claims Morris mentioned the moderates by name in print, but does not say she insulted them like the Darwinists did; she only derided evolution itself, the article says. The evolutionists, though, called the conservatives "dupes" of intelligent design advocates, and claimed that their decision was based on "absolute and total fraud." Judge for yourself which side is acting with civility and responsibility.

The majority conservatives had invited the pro-evolution moderates to come to the hearings, but they wouldn't. The Darwin Party could have contributed to the discussion, but they chose instead to sit and pout.



If they had been listening, they would realize that the Board is taking no position on intelligent design.

The new standards are very mild. They do not call for teaching creation or intelligent design, but only for permitting critical thinking about evolution, so that it is treated like any other scientific theory, not like a sacred cow. No advocates of a scientific theory would worry about that unless their position was weak.

Associated Press. 2005. Evolution debate gets personal in Kansas: School board members hurl insults at each other. *MSNBC.com*. June 15, www.msnbc.msn.com/id/8235272/

Discovery Institute. 2005. New draft of Kansas science standards praised for encouraging critical analysis of evolution. *Discovery Inst. News*. June 14, www.discovery.org/

Kansas Debate Reverberates in Holland

All that the Dutch education minister Maria van der Hoeven wants to do is have some public debate about intelligent design. Such a suggestion has caused an uproar among scientists who claim she wants make Holland the "Kansas of Europe," taking Holland back to the Dark Ages (Enserink, 2005). On the contrary, van der Hoeven explains, she thinks it will promote dialogue between Christians, Jews and Muslims who are all united over the notion of a creator.

The education minister is not a card-carrying member of the intelligent design movement, and explains she is not trying to impose or ban anything. She was apparently impressed by the arguments of Cees Dekker, "a renowned nanophysicist at Delft University of Technology who believes that the idea of design in nature is 'almost inescapable.'"

While trying to encourage discussion, she has had to spend much time defending

herself over this "tempest in a teacup" as she called it.

Why are scientists "scolding her" and saying it is "not her business to get involved in biology"? One possible reason is that the news from Kansas "has made us all a bit more sensitive." Another may be the rumblings within her country: "Even in Holland, there are plenty of people ready to

castrate Darwin," said biochemist Piet Borst. He thinks that "Vigilance is important" on this issue. Dekker and van der Hoeven are taking this in stride:

Dekker says he's puzzled by the outcry, but chalks it up to a "Pavlov reaction" to ID. "Many scientists associate it with **conservative Christians, Kansas, and George Bush** — so it **has to be bad**," he says. He hopes the debate will get more serious after the impending publication of a collection of **22 essays about ID and related themes, most of them by Dutch scientists**, which he has co-edited. Van der Hoeven has agreed to receive the first copy of the book at a ceremony in The Hague next week.

Enserink ends with the reaction of John Calvert, supporter of ID in Kansas, to the idea of a debate over ID in Holland. "I think it's a dynamite idea," he said.

This is another remarkable story on the growing influence of the intelligent design movement around the world, even in liberal Holland, where the words George Bush, conservative Christianity, and Kansas produce Pavlovian barks. Enserink points out that Holland is "not quite Kansas — after all, this is the country that legalized euthanasia and invented gay marriage."

Yet, even there, a small but committed cadre of scientists, politicians, and laymen find the arguments for intelligent design compelling, and they want the debate to be heard. They are not castrating Darwin. His impotence is his own.

Dutch scientists are justly proud of their layman forerunner, the staunch Christian creationist from Delft, Antony van Leeuwenhoek — the father of microbiology (see

DeYoung, 2000) – who helped lead science out of the Dark Ages (if there ever was such a period). He demonstrated how creation-oriented science can be the best in the world, full of vitality and motivation and excellence.

When all the Darwinists can do is scream “Dark Ages,” you know their sunset is coming. But when it is sunset on one side of the worldview, it’s sunrise on another.

Enserink, M. 2005. Is Holland becoming the Kansas of Europe? *Science* 308:1394.

DeYoung, D.B. 2000. Pioneer naturalists. *Creation Matters* 5(2):1.

Battlefront Dispatches

Activities in the Darwin-vs-Design controversy continue to generate national news. Here are a few other highlights:

- The Sternberg Museum in Kansas is trying to reinforce arguments for evolution, according to Voice of America news (Schlender, 2005). Proud of his *T. rex* display, curator Greg Liggett claims that “if the school curriculum changes to include theories such as Intelligent Design, critical scientific inquiry in Kansas classrooms might go the way of the dinosaurs.”
- Larry Caldwell got Eugenie Scott of the NCSE to apologize for making libelous statements about him (Caldwell, 2005). He threatened a lawsuit because she had written untrue and defamatory things about his attempt to allow criticisms of Darwinism in Roseville, California schools. In addition, the California Academy of Sciences agreed to remove links to Scott’s article from their website, and publish a letter by Caldwell and a retraction by Scott in an upcoming issue of the Academy’s magazine, where her allegations were originally made (O’Leary, 2005).
- The American Association for the Advancement of Science (AAAS) has joined in fighting intelligent design with internet resources. It posted a website called *Evolution on the Front Line* to reinforce efforts to combat “efforts in Kansas and elsewhere to weaken or compromise the teaching of evolution in public school science classrooms.”
- Nobelist Charles Townes, inventor of the maser and laser, was interviewed by *UC Berkeley News* (Powell, 2005). A nom-

inal Protestant Christian, he was tolerant of ID but not too keen on Biblical creationism. He treats the six days of Genesis 1 as an analogy, and allows for some evolution, saying, “People who are anti-evolution are working very hard for some excuse to be against it. I think that whole argument is a stupid one.”

- State senator Mike Fair is advocating giving students an opportunity to hear alternatives to Darwinism in South Carolina schools, according to the The State newspaper. The article quotes a Baptist pastor in Greenville, claiming that “striving to live the Christian way of life has absolutely nothing to do with one’s view of evolution.” Rev. Baxter Wynn continues, “It is not necessary to choose between Christianity and evolution – they are not mutually exclusive.” Those sentiments are in stark contrast to those held by the nearby, staunchly fundamentalist school that teaches young earth creationism, Bob Jones University.
- A house bill in Pennsylvania may put intelligent design (ID) in the schools, according to Fox News. However, the pro-ID Discovery Institute encourages teaching the controversy, but recommends against mandating the teaching of intelligent design.
- Yahoo News attempted to pour hot lava over creationists with its publishing of a French article entitled, “**US radicals blow their tops** over volcano movie as Darwinism debate rages” (emphasis added; Agence France Presse, 2005). It talked about how many customers are not buying the evolutionary line in several IMAX films, like *Volcanoes of the Deep Sea*, that suggests life may have originated deep in the ocean.

Yahoo’s piece was not a volcano, but a mud pot; better, a fumarole. Darwinists are the ones erupting when people object to having philosophical naturalism in the form of chemical-evolution mythology crammed down their throats. So what are the Darwin Party “imagers” going to do in a free market economy? Force the customers to watch their cartoons?

Many IMAX films, when they stick to observable facts, are wonderful explorations into the natural world. Adding wild, evolutionary speculations is only distracting.

Pastors and scientists should refrain from speaking out on an issue they obvi-

ously don’t understand. The “Reverend” Baxter Wynn, if he was quoted accurately, appeared to be utterly ignorant of the controversy and what his Bible says about it. His statement simultaneously commits the either-or fallacy and shouts peace, peace, when there is no peace.

Charles Townes, bless his holy heart, is a smart engineer but a weak philosopher. His comments play right into the hands of those who would banish his Christian beliefs from public discussion.

What we need are more men like Larry Caldwell, able to stand up to the lies of the dogmatic Darwinists and get them to back down. Somebody ought to turn Liggett’s big lie back on him.

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Robinson, B. 2005. Greenville senator challenging standard for teaching evolution. *TheState.com*. June 17, www.thestate.com/mld/thestate/news/local/11915729.htm

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Erratum

In the article entitled *Log Cabins and Laboratories: The Long-Lasting Effects of Compromise* (Volume 10, No. 1, pp. 3-4), the following quotation was attributed to G.K. Chesterton:

The tragedy of disbelieving in God is not that a person ends up believing in nothing; alas! It is much worse. He may end up believing in anything.

It appears that this quotation, though widely attributed to Chesterton, is not found in any of his printed works (see http://en.wikipedia.org/wiki/G._K._Chesterton#Quotes).

— Glen Wolfrom
Editor

***All voting and sustaining members must subscribe to the following Statement of Belief:**

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.
2. All basic types of living things, including man, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The great flood described in Genesis, commonly referred to as the Noachian Flood, was an historic event worldwide in its extent and effect.
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The account of the special creation of Adam and Eve as one man and one woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all mankind. Therefore, salvation can come only through accepting Jesus Christ as our Savior.

Creation Calendar

Note: Items in "Creation Calendar" are for information only; the listing of an event does not necessarily imply endorsement by the Creation Research Society.

July 17 - 22

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2006

June 8 - 10

Annual Meeting of Board of Directors

Creation Research Society

Lancaster, SC

2005 CRS Board of Directors and Staff

Pictured here are the members of the 2005 Board of Directors and CRS professional staff who attended the annual meeting which was held June 2-4 in Bozeman, MT.

Left to right: Dave Rodabaugh, George Howe, Ron Samec, Mike Oard, Gene Chaffin, Dave Kaufmann, Ted Aufdemberge, Hank Giesecke*, Kevin Anderson*, Glen Wolfrom, Russ Humphreys, Danny Faulkner, Gary Locklair, and Don DeYoung

Not present: John Reed

* Kevin Anderson (Director of the Van Andel Creation Research Center) and Hank Giesecke (Head of Development) are professional staff members located at the VACRC, Chino Valley, AZ location.



Photography by Sabrina Locklair

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All by Design

by Jonathan C. O'Quinn, D.P.M., M.S.

A Nose of Distinction

According to Genesis, living things were created according to kinds by an intelligent Creator, not by accident. Anatomical study of the nose of the moose reveals a design that supports the notion of a planned creation.

Moose rely on underwater vegetation for nourishment, diving to depths of 16 feet or more to browse for food. Specialized nasal structures allow moose to close their nostrils while underwater. The domed shape of the moose's nose is formed by a specialized cartilage framework. On each side lies a unique structure, similar to a pulley, that enhances the function of specific muscles that help pull each nostril shut. Also on each side lies a smaller cartilage structure that forms a mobile joint, allowing a back-and-forth sliding motion. Specialized muscle attachments allow the nostril to widen or narrow as the joint moves.

The moose's nasal passages have large

open spaces, which the moose can widen or squeeze together. By moving air from certain spaces into other spaces, the moose can change air pressure within its nasal passages to close off the inner passages. Just within each nostril, there is also a thick connective tissue pad that can be pulled in to further block the outer nasal passages while diving.

The complex design of this system involves a perfect union of bone, muscle, and connective tissue. Such specialized structures must work properly from day one in order for the species that uses them to survive, suggesting that they could not have evolved piecemeal as evolutionists believe.

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