

areas and in relatively short spurts then we should not expect to find many evolving forms in the fossil record.

So, by postulating that the major evolutionary changes occurred in limited areas or over limited periods of time, evolutionists have attempted to snatch victory out of the jaws of defeat. The fact remains that the long chains of fossils that are obviously required in order to demonstrate gradual development are not there. This attempt to explain their absence by claiming that the fossil record is biased⁸ is nothing less than an ad-

mission that, by its very nature, the fossil record will not yield the essential evidence needed to test evolution.

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8. The alleged bias in the fossil record is discussed at length in a paper by Professor F. H. T. Rhodes contained in *Proceedings of the Geologists' Association*, vol. 77, part 1, (1966), pp. 1-54. Although somewhat technical, the non-specialist will be able to detect much special pleading in his arguments in favour of a biased fossil record.

God—the first physicist

“Making something from nothing”

John C. Bilello

THIS IS A STORY about a dead cat and how the universe could have been made from absolutely nothing. Though it may be hard to imagine how there could be any connection between a dead cat and the universe, if the reader will bear with me I hope eventually to convince you that whether a cat lives or dies has a profound influence on everything. Before we get to our tale we need first to contemplate a few basic principles concerning the physical nature of the universe and the Word of God.

Consider what the psalmist David said about the relationship between God and His creation: “The heavens declare the glory of God; and the firmament shows His handiwork” (Ps. 19:1).^{*} This passage is without ambiguity; undoubtedly David believed that the glory of the Lord God was self-evident to any one who observed the wonders of the universe that He had created.

Scriptural standards of evidence require that two or three witnesses must agree for anything to be held true (Deut. 17:6). The glory of God is thus not only declared in His Word, but is also elegantly displayed in the things He created. The physical world all around us, stretching from the earth beneath us to the furthest reaches of the cosmos, is visible evidence of His existence, power and glory.

God and the laws of physics

It is erroneous to call the laws that govern the universe ‘natural Law’, because there is nothing natural about them. When the universe was cre-

ated, the laws of physics were created with them. The laws which govern the motions of the sun, moon and stars, and indeed of all creation, are the ordinances of the Lord God Almighty. *Thus in a very direct sense they are Divine, not natural laws that just happened by a quirk of fate.* The prophet Jeremiah declared: “Thus says the LORD, Who gives the sun for a light by day, and the ordinances of the moon and the stars for a light by night, Who disturbs the sea, and its waves roar (The LORD of hosts is His name): ‘If those ordinances depart from before Me’, says the LORD, ‘then the seed of Israel shall also cease from being a nation before Me forever’” (31:35,36; also 33:20,21). In a very real sense, Jeremiah makes us aware that the Lord God was (and is) the prime physicist, because it was the Lord God Who created both the universe *and* the physical laws that regulate its activities. It is the work of science to seek to understand the laws that govern the universe, and to answer the question, *How?* How does it all work? Only God knows *why* the laws of physics are in the form that they appear to be.

The laws of physics are written in the language of mathematics, and to one familiar with this form of communication these ordinances are exceedingly simple, which is in itself an amazing result. I will attempt in the discussion that

^{*} All Scriptural quotations are from the NKJV unless stated otherwise.

follows to avoid using all mathematical formulas in the hope that I will not scare off those unfamiliar with their intricacies. I do this at the risk of perhaps oversimplifying the physics for the sake of clarity for the reader who is a non-specialist, and with the hope that those mathematically knowledgeable will indulge me!

In His infinite wisdom the Lord made the intensity of light fall-off as the square of the distance away from a source (don't panic, this is not as difficult as it sounds, see the footnote if maths makes you uncomfortable!).¹ If this were not the case the millions, indeed billions, of stars and galaxies that fill the night sky would be so bright that we would never be able to go to sleep; but because the furthestmost are perceived as extremely dim the background night sky appears essentially black. In essence we are able to see with the naked eye only a few thousand nearby stars.

Another point that the prophet makes is worth remembering, that is, the constancy of the laws of physics, or, to paraphrase Jeremiah, *the physical laws established by God are as constant as His promises*. This constancy of physical law is a basic tenet of physics, and this is a principle in which the Scriptures completely agree. This constancy allows us to assume that the laws of physics are the same now as they have been in the past and will be in the future. Finally, these physical laws can be understood in the same way here on earth as they would be by an observer on some other planet revolving around a star in the distant reaches of some far-off galaxy.² Such an observer (assuming such an entity exists) would also conclude that intensity of light diminishes as the square of the distance that one moves away from the source.

Physical laws and truth

There is a tendency sometimes among religious people to dismiss the workings of science and scornfully deride it as the mere speculations of man, but that is an illogical conclusion contrary to sound thinking. Would any faithful believer dismiss the Bible simply because there are many opinions on interpreting its meaning (such opinions also come from the mind of man and are styled 'human philosophy')? Indeed, there are probably more diverse opinions on the meaning of many Scriptural passages between various Christian sects than ever found among scientists about the nature of physical laws. How does the faithful believer separate out truth from false-

hood when it comes to the Scriptures? The answer is straightforward: one must study carefully and diligently and compare Scripture with Scripture to find a consistent interpretation that is in accord with the whole counsel of the Word of the Lord. Care must be exercised to make sure nothing is taken out of context, and additional evidence may be sought from other reliable sources, including knowledge of the original languages of the text, which can often shed further light on an obscure passage.

The situation is really no different in science: observation and experiment are carefully done to verify the nature of physical laws, and then they are tested against new circumstances. The facts of science, established properly, need not be doubted, though the interpretation of these facts may indeed require a faithful point of view when it comes to issues that intersect the Bible and science.³ The faithful believer knows, as did King David three thousand years ago, that the marvellous workings of the universe must be due to a Divine Creator, whereas the atheist (who may or may not be a scientist!) sees only happenstance. In this regard, it is a point of view not very different from how the faithful believer considers prophecy in contradistinction to the non-believer. To a person of faith the return of Israel to the ancient land of their forefathers is a wondrous sign of fulfilled Bible prophecy, while to sceptics it is all a coincidence and an annoying one at that! The bottom line is that both the physics of the universe and the Scriptures are from the hand of the same Almighty God. By studying them both we can gain more insight into the nature of the power, glory and majesty of our heavenly Father. With this in mind, let us

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1. Falling-off as the square of the distance means that if we double our distance from a light source the intensity drops by a factor of four (4), and if we triple that distance the intensity decreases by a factor of nine (9), and so on. The intensity is obviously dropping off much faster than we are moving away from the source, and eventually the source intensity will fade so much that it will appear to go out.
 2. This constancy is not the same as uniformity principles sometimes invoked in other branches of science. The fundamental laws of physics are not theories but facts based on observed and verifiable phenomena. In this sense they differ completely from such concepts as the theory of evolution (that is, not the law of evolution).
 3. R. Roberts, *The Visible Hand of God* (3rd edition, The Christadelphian, 1925), chapters 1, 2.

return to our story of the mystery of the dead cat and find out what this has to do with the nature of the universe.

The breath of God

The object of this short article is to consider only one central idea relating to the creation of the universe, namely that it was created from NOTHING. This notion is sometimes expressed by the Latin phrase *ex nihilo*. The psalmist states that the "breath" of the Lord God created the universe.⁴ Moreover, in the New Testament, in the book of Hebrews, we read this remarkable statement: "By faith we understand that the worlds were framed by the word of God, so that the things which are seen were not made of things which are visible" (Heb. 11:3). Thus not only was the universe made by the explicit command of God, and, as a consequence of this command, as the psalmist tells us, His breath formed the cosmos, but also the matter that formed creation came from an invisible source.⁵ Now how are we to regard such declarations? In order to do so let us go to the two momentous discoveries in physics that took place just at the beginning of the past century, about 100 years ago. The first was quantum mechanics and the second the laws of relativity (with specific focus here on gravity). To understand some aspects of quantum mechanics we need to solve the mystery of the dead cat.

The laws of classical physics had envisaged a deterministic, clockwork universe. If one knew the current position of any entity and observed its motions at various times you could, in principle, predict its entire future and map out its past history. Everything was determined with complete exactitude. There was no uncertainty in the physical universe in the classical view, but that was all to change with the discovery of quantum mechanics. The quantum world-view is a very strange one indeed, and trying to explain it in simple ways that the general public can understand has spewed forth a plethora of what I would call God/physics 'pop' books. Such books no doubt are aimed at making laymen more knowledgeable about how modern physics has changed our views on the universe, and most accounts do have some remarkably mystical overtones. The royalties on such books have also raised certain physicists well above the usual poverty status of scientists!

What many of these accounts have emphasised is the realisation that the very act of meas-

uring the position and velocity of a particle perturbs and changes its behaviour. This is called the 'Uncertainty Principle', and it is a prime tenet of quantum mechanics. This idea is generally illustrated by the ubiquitous thought experiment of the mysterious 'dead/live cat in a box'.⁶

Let us imagine that we place a cat in a completely sealed box such that we can neither see nor hear the cat in that closed environment. We have also placed in the same box, prior to sealing it, a vial of cyanide gas with a lever that the cat can press to release the vapours. Now with the cat closed in the box, we ask the question at a particular instant of time: is the cat dead or alive? Clearly the cat must be one or the other. If it has pressed the lever and released the cyanide gas the cat is dead. But, equally, the cat could simply have fallen asleep in the enclosed environment and be alive (of course we have a box big enough so that there is sufficient air to keep the cat breathing, as long as it doesn't press the release for the cyanide gas). Since each possibility is equally likely, we can say that there is a fifty-fifty chance of the cat being dead or alive. Mathematically, this is equivalent to saying the cat is fifty per cent alive and fifty per cent dead as long as the box is sealed! However, once the box is opened we perturb the situation, and in a real sense the opening of the box fixes the outcome to certain life or death. If the cat is dead, we killed it, but if alive, we made a heroic rescue. The way the physicist would express this is through a quantum mechanical wave function of the 'cat in the box', which would determine a probability function that would give a fifty per cent chance of the cat being dead or alive in the sealed box. Once the box was open the wave function would collapse and give a hundred per cent chance of the final dead or alive observation.

Whilst the thought experiment of the fate of a cat in a sealed box with a vial of cyanide might seem a little silly, or even frivolous, nevertheless the point of the thought experiment has profound

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4. "By the word of the LORD were the heavens made; and all the host of them by the breath of His mouth" (Ps. 33:6, AV).
 5. Note the first clause of the BASF in this regard: "He hath, out of His own underived energy, created heaven and earth, and all that in them is".
 6. This thought experiment is due to Schrodinger. See P. Davies, *God and the New Physics*, Simon & Schuster Inc. (New York, 1983), ch. 8.

consequences. First note that one cannot separate the observer from the results of the experiment. Unless we physically open the box we can never really know whether the cat is dead or alive, or even fifty per cent dead and fifty per cent alive! All these situations are equally probable. Secondly, there is considerable ambiguity in just exactly what is going on inside the box, as long as it is sealed and we have no way of observing inside the box. This is a profound consequence of quantum mechanics, and is verified nearly every day in the many electronic devices that owe their design and operation to quantum not classical physics. These include integrated circuit televisions and stereos, cell phones, computers, lasers, and a host of other modern electronic marvels.

Energy from the vacuum

The outcome of the ideas embodied in the 'cat in the box' experiment established that probability functions could be used to determine the outcome for an ensemble of particles, but the individual behaviour of any one particle was uncertain. The very act of measuring any parameters relevant to the particle changed its behaviour. *The idea of a deterministic universe, where man could measure and predict all phenomena with absolute certainty, was dead!*

Other strange ideas emerged from observations of microscopic particles. The results of quantum mechanics predict (contrary to classical physics) that a particle can pass through an energy barrier that is much higher than the energy possessed by the particle itself. This is akin to us walking straight through a mountain without having to climb over the top; and indeed, just like my analogy, this phenomenon is called 'tunnelling', when an atomic particle passes through an energy barrier that classical physics says should block it. Only in this case the tunnel is like walking straight through the solid rock of the mountain. Finally, particles in the quantum world seem to appear and disappear in the vacuum without us ever being able to trace their individual history. In fact, the meaning of 'vacuum' itself becomes tenuous, and the quantum world considers (for purposes of calculation) that the vacuum state is really a 'virtual' state in which particles in the 'real' world can interchange energy with the vacuum. Hence in this view a vacuum does not mean the absence of everything, but, rather, virtual vacuum is a state teeming with unseen energy that can be

accessed and interchanged with particles in the real world. This may sound crazy, but it seems to be exactly what the Scriptures had in mind when the author of Hebrews says: "so that the things which are seen were not made of things which are visible" (11:3).

Gravitation and a created universe

Let us go one step further and look at the other breakthrough in twentieth-century physics, namely, Einstein's laws of gravitation, which led to his famous equation showing the equivalency of mass and energy. One can be converted into the other, as has been so horribly demonstrated by the atomic bomb. In the case of the bomb, matter is converted into energy. In the creation of the universe the process must have been the other way around. Now most physicists believe that the universe came about by an enormous spike of energy which arose out of the vacuum and has eventually cooled down and condensed into all the galaxies, stars and planets (and ultimately ourselves) that we find in the universe today. Scientists do not know what caused this singular incredible release of energy, and are reluctant to attribute it to the power of a Divine force, because such an assertion would be outside the laws of physics. Nevertheless we, as believers in the Lord God as revealed in the Scriptures, should have no problem acknowledging that this act of creation, *in the beginning*, was directly caused by the same Almighty God.

The basic idea of a gigantic energy singularity condensing to form all matter is so universally accepted today among physicists that it has come to be called the 'Standard Model'. Yet only forty years ago the idea of a universe subject to Newtonian gravitation still prevailed, as it had since the seventeenth century. In this classical view the universe had to be infinite and eternal. It is easy to see why this would be the view of Newtonian physics. Consider dropping a ball from the leaning tower of Pisa (as Galileo is reputed to have done). The ball falls to earth attracted by the mass of the planet. Newton explained these phenomena by generalising and stating that any two masses are attracted to each other by a force proportional to their masses and related inversely to the distance between them. Thus in reality when the ball fell to ground the earth actually also moved toward the ball, but the motion of the planet is so slight, due to the huge mass difference between the earth and the ball, that we do not usually perceive it. If we

take several balls of mass they will all be attracted to each other, and, in the absence of any other outside force, they will eventually all stick together. Thus, with this classical view, the cosmos could never have an outer bound, because the minute space was confined there would be no further mass to keep the universe stable, and eventually all the mass within the limits of the universe would attract and clump into one gigantic ball. However, observations of astronomers⁷ have shown that things are quite the opposite, namely that, instead of the universe tending to collapse into one massive lump, it is expanding dramatically outwards in a manner that suggests, not an eternal universe, but one that was created—in *the beginning*.

Scientists are still struggling to reconcile quantum mechanics and the general theory of relativity into one universal law that would explain completely the physics of the universe in a single simple formula.⁸ This unification law has not happened yet; the task is very difficult, and many scientists are working on it. Nevertheless, the

physical ideas that appear clearly from the realm of the quantum and relativity laws establish that the universe appears to have been created from nothing but a spike of pure energy, emanating from the vacuum (*from the breath of God*)⁹ and at a specific point in time (*in the beginning*). Classical physics could not conceive, nor explain, either of these two rather clearly stated Scriptural propositions. It is nice to see physicists catching up with the Word of God.

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7. The astronomer Edwin Hubble first observed the expanding universe in the 1920s. This expansion was actually predicted earlier in the General Theory of Relativity, but Einstein suppressed it by adding a negative energy term, since at the time he firmly believed in the eternal infinite universe of classical physics. He later called this his biggest mistake. Lately physicists are wondering whether such a negative energy does exist after all, but that would have to be the subject of another article!
 8. Called the 'Theory of Everything' or TOE.
 9. Please note 1 Timothy 6:16—light is a form of pure energy.

"After his kind"

Judith Evans

PLANTS WERE the first living organisms in God's work of creation. In Genesis 1:11 we read: "And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth". Compared with animals, plants are often thought of as simple organisms, and yet the secret life of plants is an incredible world that should leave us in awe of the Creator's wisdom.

This article seeks to explore some of those secrets that have enabled the plants to survive on this earth—providing beauty to the eye, being critical to the survival of all other life, and offering clear evidence of the purposeful design of a powerful Creator.

Colour and fragrance

"Consider the lilies of the field, how they grow; they toil not, neither do they spin: and yet I say unto you, That even Solomon in all his glory was not arrayed like one of these" (Mt. 6:28,29).

The sight of a field of flowers is a wonderful testament to the work of the Creator. Behind the beauty of the flowers, however, lies a complex

world of chemicals. The colour of the petals is determined by the presence of two main families of pigments: the *carotenoids* and the *anthocyanins*. The crimsons, purples, blues and creamy whites, as well as some reds and yellows, are usually members of the anthocyanin family of pigments; the oranges as well as some of the other yellows and reds are carotenoids.

To create even more colours, the pigments bond together with other compounds, already in the petals. For example, *tannin* (the compound that leaves a brown stain on our tea cups) is also found in a variety of other plants. When it bonds to the anthocyanin pigment it gives a range of blueness in petals. In cornflowers it is the combination of anthocyanin with the metal element iron that gives the blue colour. On the other hand, in *Hydrangea* the petals are blue or red depending on the balance between aluminium and molybdenum. Finally, the amount of the pigment can determine the colour, the blue cornflower having only a small amount of anthocyanin, the deep purple cornflower having a concentration of anthocyanin around thirty to fifty times higher.