Improbable singularities—evolution is riddled with them

Alex Williams

Evolutionists claim their story of origins is based upon science only. This is not true. The evolution story (including its cosmic origins) consists of a long series of unique one-off events that are best described as singularities. Science can only deal with repeatable events, so singularities are normally beyond its reach. However, when evolutionary events are claimed to be naturalistic, repeatable, and subject to chance, then we can use probability theory to calculate the likelihood that they only happen once. The conclusion is that a long series of singularities is indistinguishable from a long series of miracles. As it turns out, all stories of origin consist of a series of singularities, so all of them are beyond the reach of scientific analysis. However, the causes and consequences of origin stories are open to scientific enquiry. The big events in the evolution story all lack credible causes. The biblical story does have a credible cause—Almighty God—and its consequences have abundant peer-reviewed supporting evidences in creationist literature. Regardless of evidence, however, the singularity problem is a reminder that origin stories are not built primarily upon science, but on history (notably the imagined eons of time in evolution), philosophy, and a resulting worldview.

On 29 March 1863, four years after publishing the first edition of his Origin of Species, Charles Darwin wrote to his friend and mentor Dr Hooker saying, in part, “I have long regretted that I truckled to public opinion, and used the Pentateuchal term of creation, by which I really meant ‘appeared’ by some wholly unknown process. It is mere rubbish, thinking at present of the origin of life; one might as well think of the origin of matter.”[1,2] Surprisingly, what Darwin thought to be the harder of the two problems—the origin of matter—was the sooner explained. In 1905 Albert Einstein published his Special Theory of Relativity, including his famous equation $E = mc2$. Matter can be derived from energy (in accordance with the laws of quantum physics) and vice versa. It was the origin of life that turned out to be the harder problem.

Today, the origin of life, together with the finely tuned universe that supports it, has to be likewise traced back to the quantum world. Some claim that universes can emerge from quantum fluctuations within ‘nothing’ (a quantum vacuum).[3] I doubt this. But I do not doubt the recent discovery that life depends crucially upon quantum technology.[4]

However, in this article we don’t need to know anything at all about where things come from because I want to focus solely upon the results—life and the universe. If universes and life can arise from any naturalistic cause whatsoever, then they will continue to arise whenever those same causes continue operating. If they don’t continue to arise it must mean they only happened once. Things that happen just once are called singularities, and we can use the laws of probability to search for them. The evolutionary worldview relies from beginning to end on singularities, and when we apply probability theory to look for them, we find that they don’t exist.

Problems with probability

Physicist Stephen Hawking said in his ‘masterpiece’[5] *A Brief History of Time* that it is possible (though unlikely) for the molecules of gas in a sealed box to all move down one end and occupy only one half of the box. “The probability … is many millions of millions to one, but it can happen.”[6] This is not true. Dr Hugh Ross, founder of Reasons to Believe, fell into the same trap[7] so I shall use the scenario to illustrate some basic principles of probability theory.

Hawking’s first error was to put probability in apposition to an event in a way that implies the small but finite probability caused or gave reason for the event to occur. But chance is not a force that can do things, and probability is nothing more than a set of theoretical tools that humans have developed to help them make decisions about uncertain events. A good decision is one that avoids ‘false positive’ outcomes (a Type I error) and ‘false negative’ outcomes (a Type II error). For example, if a medical test says you have cancer when you don’t (a false positive) it can cause unnecessary anxiety and expensive, wasteful, medical treatment (with potential associated negative side effects). But if the test says you don’t have cancer when you do have it (a false negative) it may put your life in danger. Doctors use the history of such tests to do probability calculations to help them make the best decision. If a *confident* decision cannot be made they will recommend further testing.

A basic rule of probability is that $p = 1-q$, where p is the probability that an event will happen, and q is the probability that it will not happen. The Null Hypothesis (simplest assumption) in statistical testing is that there is no difference between some test measure and zero. If this assumption is proven false (at some calculated level of *confidence*) then the Alternate Hypothesis is accepted that it is different from zero. As the value of p becomes smaller, the value of q becomes larger, so a *confident* decision must strike a balance between Type I and Type II errors. The tables in the back of statistical textbooks carry a set of p values that optimize these risks, usually $p = 0.05$, 0.01, and 0.001. Hawking's own probability statement gives us a value of $p < 0.000000000001$, and we will see shortly that it is not significantly different from zero. We should place *no confidence* in his reasoning, even by his own criteria.

But astonishingly, Hawking vastly underestimated the size of his problem. To understand why, we need to simplify his scenario. Suppose his box has just one molecule of gas in it and that in order to examine the contents we insert a partition at the half-way point so the molecule is either in the left (L) or right (R) hand end. There is a 100% probability that the gas molecule is either in L or in R. Add a second gas molecule, and to calculate combinations we must now label them, say A and B. The possible combinations are: (underlined groups signify all in one end) [A & B in L], [A & B in R], [A in L & B in R], and [B in L & A in R]. So the probability of both molecules being in one end only is two cases out of four, or 50%. Add a third molecule, C, and we get these combinations: [A, B & C in L], [A, B & C in R], [A & B in L & C in R], [A in L & B, C in R], [A, C in L & B in R], [B in L & A, C in R], [B, C in L & A in R], [C in L & A, B in R]. The probability is now two cases in eight, or 25%. Add a fourth molecule and the probability drops to 2 cases in 16, or 12.5%, and so on. The results are plotted in figure 1.

The pattern that emerges is that there are always only two possibilities of Hawking being correct (all in L or all in R), while the number of possible combinations rises as 2^n where n = the number of gas molecules. The Binomial distribution describes this situation where one of two outcomes is possible. It shows that with 10 molecules $p = 0.001$, and with 20 molecules $p = 0.000001$. However, a shoe box of ordinary air would contain something in the order of 10^{23} (a hundred thousand million trillion) molecules of gas. So the probability of Hawking being correct is not "many millions of millions to one" but just two chances in $2^{100,000,000,000,000,000,000,000}$, or about 1 chance in $10^{30,000,000,000,000,000,000,000}$. Since there are only about 10^{80} atoms in the universe, Hawking's decision to say "it can happen" is an excruciating Type I error!

But there is a much more fundamental error in Hawking's scenario. The movements of gas particles are not chance events; they are determined by the laws of motion. Probability theory can be applied to such events only as an approximation to physical reality. Chance cannot accomplish what the laws of physics prohibit. Being a physicist Hawking should have asked himself whether the laws of physics would permit such a scenario. The first law of motion says a body that is moving or at rest will continue in that state unless a force acts upon it. At normal room temperature and pressure the gas molecules—mostly nitrogen (N_2) and oxygen (O_2)—zip around at more than a thousand miles per hour,[8] bouncing about like billiard balls on a billiard table but in 3-dimensions.

Suppose that gas molecules did begin to concentrate down one end of Hawking's box. Molecules in the transition region between the dense region and the empty region will face numerous obstacles if they move towards the dense region. They will bounce around among lots of other gas molecules adding to the pressure and temperature in that end. On the other hand, molecules that move towards the empty region will face no such resistance, so trillions of them will always be zipping back into the empty region at over a thousand miles per hour. Hawking's scenario could never eventuate.

People often apply probability theory inappropriately and an entertaining overview is presented in David Hand's book *The Improbability Principle: Why coincidences, miracles, and rare events happen every day*.[9] But in trying to explain everything with chance, Hand falls into the same trap as Hawking and Ross by applying probability theory to imaginary events that are divorced from physical reality. Astrobiologists make their living doing this very same thing. They 'guesstimate' a multitude of probabilities and insert them into the terms of the famous Drake equation to calculate the number of extraterrestrial intelligent civilizations in our galaxy and universe. Such applications are purely imaginary—using chance as a surrogate for ignorance—without proper regard for whether the proposed events are physically possible.[10]

The singularity problem

As stated, a singularity is a unique event that only happens once. Singularities must have special causes, not common causes. Things that have common causes produce common events, not singularities. For example, rain is a common event (in most places on Earth) caused by particular aspects of the hydrological cycle. Rain generally falls downwards, not upwards, because gravity generally pulls things towards the centre of the earth. If rain is ever observed to move upwards, then it can usually be explained by an updraft in air currents—another facet of planetary climate.

In physics, a gravitational singularity occurs in the heart of a 'black hole'. When a large star burns up all its nuclear fuel it collapses in on itself, and it is a prediction of Einstein's

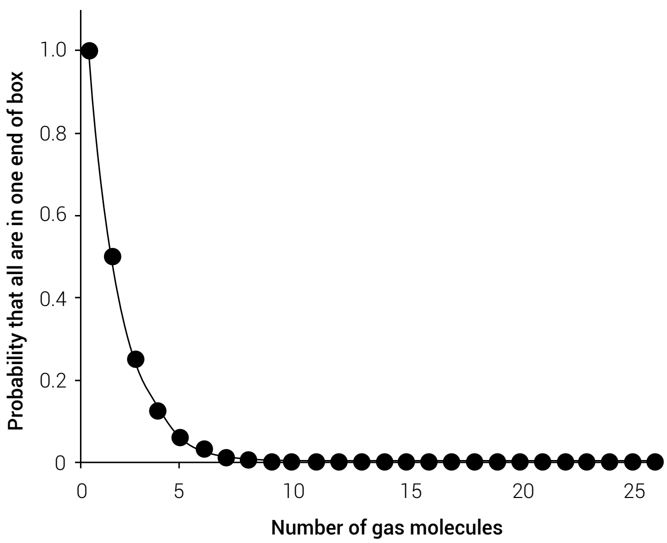

Figure 1. Probability that all gas molecules will accumulate in one end of Hawking's box, plotted against the number of molecules in the box.

General Relativity that its internal self-gravitational attraction overcomes all resistance to its core collapsing, thereby sucking everything nearby (including light, thus the name 'black hole') into a black hole with a singularity at its centre. This is a single point with density and temperature approaching infinity in an infinitesimally small volume, according to the theory. Once this happens there is no way of reversing it. This kind of event can happen many times because there are many large stars, but it can only happen once to a particular star because it is irreversible, on the timescale commonly assumed for the universe.

In mathematics, a singularity is a point in a given algebraic function where the derivative (rate of change) is undefined, but every near-neighbourhood point does have a derivative. This kind of singularity is somewhat like a sheet of metal along which the algebraic function describes straight lines, but at a particular point there is a hole (a singularity) across which it is *not* possible to travel in a straight line.

Singularities in the biochemical evolution of life on Earth were drawn to popular attention by Nobel Prize-wining biochemist Christian de Duve in his excellent book *Singularities: Landmarks on the Pathways of Life*.[11] He used the word 'singularity' to describe all the many barriers to progress in the development of life for which we currently have no naturalistic explanation. His first example was *homochirality* and it provides us with an easy way to illustrate the singularity principle.

Homochirality

Life's molecules are generally 100% pure in their chemical composition. In contrast, environmental materials such as air, soil, and water are always mixtures of many different chemicals.[12] Life is built upon carbon-based molecules and many of these have a property called *chirality*—they can exist in two forms that are mirror-images of each other (like our left and right hands) and these are called *enantiomers*. Cells generally use only 100% pure forms of just one of the two enantiomers (e.g. left-handed amino acids and right-handed sugars).[13] Such 100% pure forms are said to be *homochiral* (of the same *chirality*).

Laboratory experiments that produce amino acids and sugars always produce an approximately 50:50 mixture of the left- and right-handed forms. Likewise, amino acids that have been found in meteorites are mixed. The problem that Christian de Duve faced was how to turn a 50:50 mixture into a 100% pure version of just one—and always the same—enantiomer. There is no known way of doing it in an environmental setting because both enantiomers have the same chemical properties. It can only be done in the laboratory with specialized equipment.

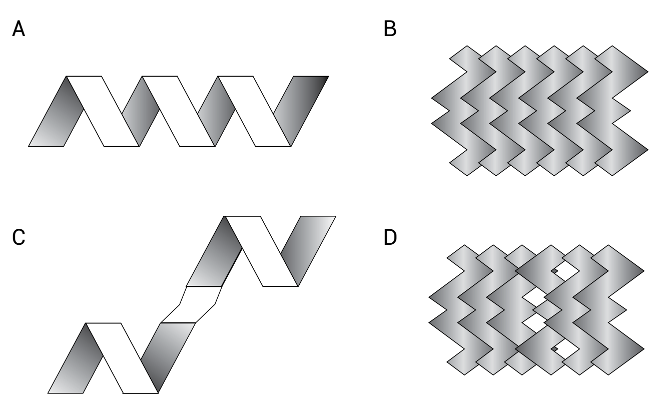

Figure 2. Homochirality is essential in maintaining the correct secondary structure of proteins. The homochiral alpha-helix (A) and beta-sheet (B) are both made of 100% left-handed amino acids. If even one right-handed molecule is present, it destroys the helix (C) and creates a defect in the sheet (D).

The reason that cells *must* use *only* homochiral molecules is illustrated in figure 2. The *primary structure* of a protein is expressed in its sequence of amino acids. Its *secondary structure* is expressed in the way the long protein chain folds up to make a functional piece of molecular material that can then be formed into a molecular machine. The most common folding patterns are the *alpha-helix* (figure 2A) and the *beta-sheet* (figure 2B) forms. These patterns are possible only if *every* amino acid joins up in exactly the same way. The *alpha-helix*, for example, will continue turning around on itself in a symmetric helical pattern only if every single unit within it follows the pattern.[14] If just one right-handed amino acid is included, then the symmetrical pattern of the *alpha-helix* is disrupted (figure 2C). Likewise, if even one right-handed molecule is included in the *beta-sheet*, then it causes a defect in the material (figure 2D).

Stanley Miller's pioneering 1953 origin-of-life experiments used electricity to simulate lightning strikes in gas/liquid mixtures and produced some trace amounts of useful amino acids. However, such experiments create more problems than they solve. They produce a mucky mess containing many more useless chemicals than originally present,[15] so the system is much further away from the 100% purity that life requires!

Homochirality is just one of the many kinds of problems that de Duve faced over and over again throughout his book. He did an excellent job of making suggestions on how to overcome these barriers, but in the end had to admit defeat. Something very special indeed must have happened to produce each one of the extraordinary and varied outcomes that he listed among life's basic requirements—things that no-one has ever observed to happen in the natural world. That is why he called the book '*Singularities*'.

Singularities, miracles, and universes

Singularities present evolutionists with a severe, but generally overlooked, problem. Because singularities only happen once they are indistinguishable from miracles. A miracle, according to the American Heritage Dictionary of the English Language, is "An event that appears inexplicable by the laws of nature and so is held to be supernatural in origin or an act of God". De Duve's list of singularities included all the major components of the first prokaryote cell, plus those of the first eukaryote cell, plus the requirements for multi-cellularity, right up to the origin of man. However, singularities are not just confined to biochemistry—they are *everywhere* in the evolutionary worldview, right back to the origin of the universe.

The big bang theory of the origin of the universe begins in a gravitational singularity. There is no way to get a universe out of such a singularity, so the supposed 'big bang' event had to have been another singularity. The imagined subsequent history was recently summarized by a group of expert critics as consisting of: General Relativity Theory + Dark Matter + Dark Energy + Inflation.[16] The latter three of these four are purely imaginary, and General Relativity Theory fails when applied to spiral galaxies and galaxy clusters so it cannot be trusted to describe the whole universe. These critics seriously suggested adding a further imaginary 'Dark Force' to the theory to get it working better! Creationist expert John Hartnett has shown that Carmeli's Cosmological Relativity Theory can produce better explanations that do not need such imaginary components.[17]

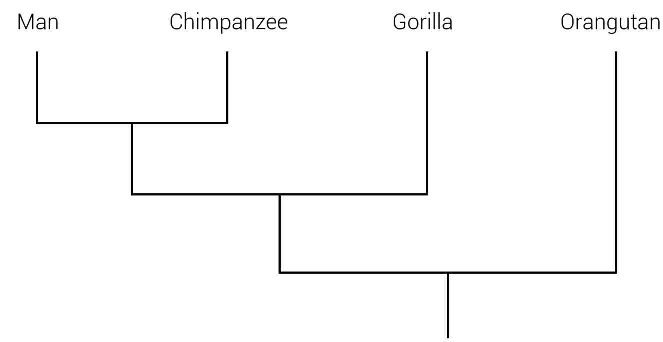

Figure 3. A tree diagram of Hominid evolution, based on DNA sequence comparisons. Redrawn from Lecointre & Le Guyader, *The Tree of Life*, 2006.

According to theory, the big bang fireball should have produced equal amounts of 'matter + anti-matter' (mostly hydrogen and anti-hydrogen) but the anti-matter has not been observed, so another singularity is required to make it 'disappear'. Then another 'monster universe' of 'cold dark matter' (many times the size of the big bang) had to have come into being by some entirely unknown singularity. Then by another singularity the cold dark matter spontaneously organized itself into countless galaxy- and star-sized clumps, which could then gravitationally pull the expanding cloud of matter-gas into the clumpy stars and galaxies that we see today, as far as our telescopes can reach. This theory doesn't work when applied to our local group of galaxies so it certainly should not be trusted to explain the universe.[16]

Planet formation "still suffers from a large number of unsolved mysteries" and it requires multiple singularities to explain why every known planetary system is different.[18] Even the very first step—the accretion of stardust—faces a "seemingly unsurmountable 'meter-size barrier' for the growth of particles".[19] Most scientists give the impression that they can explain the whole universe with science, but the more we get to know about it, the more miraculous it appears.

Singularities everywhere

A large catalogue of singularities confronts us in the phylogenetic trees that adorn textbooks on evolutionary biology. Consider the example of the Hominid tree in figure 3.

Christian de Duve highlighted the problem in these diagrams with questions such as: Why did only one line of hominids lead to modern man? Why did only one line of fish develop lungs and walk onto land and become amphibians? We could add to his list by asking: Why did only one line of amphibians turn into reptiles? Why did only one line of reptiles turn into birds? Why did only one line of reptiles

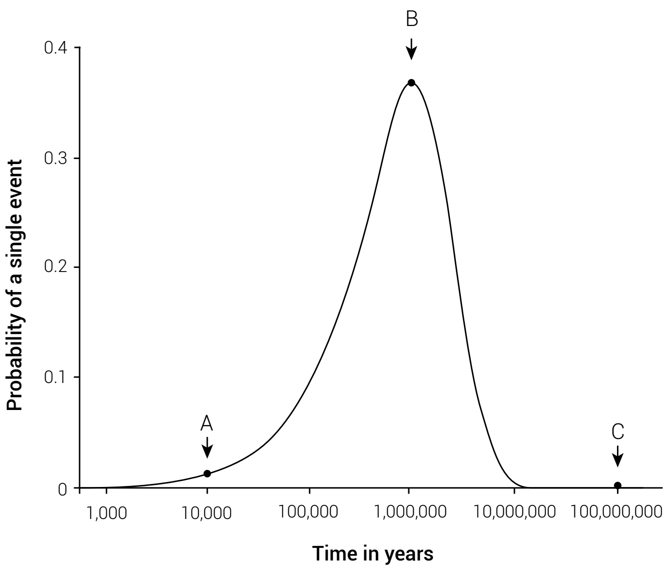

Figure 4. The probability of just one evolutionary event occurring during a range of different times, when its expected frequency is once in a million years, according to the Poisson distribution.

turn into mammals? Why did only one line of mammals turn into primates?

Another approach to the problem is via 'Murphy's Law'. Murphy's Law says that if anything can go wrong it will. It arose in the field of marine engineering design. Design engineers need to build safety factors into their designs to deal with all the possible things that can go wrong. This is especially important in shipbuilding because if something goes wrong at sea, people die. Design engineers therefore need to expect the worst to happen, and then design their structures in the full knowledge that if something can go wrong it will.

A more positive statement of this principle is that 'if something can happen, then it probably will happen eventually'. Singularities become problematic for evolutionists when they claim that their stories only appeal to natural causes and repeatable random events. We then have to ask, "How often will it happen?" If it can happen once in a million years (or 5 or 10 million years), then it could have happened a multitude of times in the 600 million years currently assigned to the reign of multicellular life on Earth. Singularities become impossible in this timeframe!

Probability of single events

We can use probability theory to estimate the likelihood that an evolutionary event will happen just once and only once. That is, if an event can happen and it does happen, then, like rain falling or stars exploding, it may happen more than once. On the other hand, if it is to qualify as a singularity, then we need to know the probability of it happening just once and only once.

For single random events that occur at variable time intervals, the Poisson distribution can tell us, for a given expected frequency of occurrence, how often an event is likely to occur during a given time interval. For example, if someone claims that a particular kind of evolutionary event can occur once in a million years, then we can use the Poisson distribution to calculate the probability that it might occur 0, 1, 2, 3, or 10, or any other number of times during any particular time period. We can also use the Poisson distribution to find the probability of an event occurring just once during different lengths of times, as plotted in figure 4. In this case there is a small probability that it could occur once in ten thousand years (point A). It is most likely to occur just once after a million years (point B). However, after a hundred million years the probability is zero (point C) because it would have occurred many times by then.

Now let's see what the probabilities are for various numbers of events at any given time. Figure 5 shows the probability curve for the expected number of evolutionary events after 10 million years when the expected frequency is once in a million years.

This graphs shows why singularities are so troublesome when the timescale is greater than the time needed for the event to occur once. If an evolutionary event can occur once in a million years, then after 10 million years it is most likely to have occurred 10 times (point B). The probability of it occurring 20 times (point C) at $p = 0.002$ is four times greater than the probability of it occurring just once (point A) where $p = 0.0005$.

Probability of multiple singularities

Singularities are not the greatest problem facing evolutionary biology—an almost infinitely greater problem is how to deal with long series of singularities! Take, for example, the lineage that supposedly led from single-celled ancestors to humans. In his book *The Ancestor's Tale: A Pilgrimage to the Dawn of Evolution*, Richard Dawkins traced the evolutionary history of humans backwards through time. He estimated that there were about 40 critical evolutionary events required to turn the single-celled ancestor into a human.[20]

Now there are some differing opinions among evolutionary biologists over particular transition points, and opinions change as new fossils are discovered. But in general, at any one time, the consensus is usually that one particular fossil (or fossil species) represents the best evidence of the transitional form or common ancestor. That is, if a fossil is known, then biologists tend to be satisfied with that and do not require a multitude of ancestors—it is simply assumed that one is both necessary and sufficient. Dawkins followed this reasoning, and his uniformitarian worldview allowed only one kind of driving mechanism for the evolutionary process—what we see happening around us today, mostly natural selection of natural variation.

There are differing time intervals between Dawkins' 40 critical events, but for the sake of simplicity let's just take the average length of time and call it *T*, so that the whole sequence would require a total time of 40 x *T*. Using the method illustrated in figure 5 for single random events we can see that the first evolutionary event should have taken place about 40 times by now. That is, if such an event can occur once in time *T* then it should occur, on average, about 40 times during a period of 40 x *T*. Similarly, the second event should have occurred about 39 times, the third about 38 times, the fourth about 37 times and so on. Only the last evolutionary event in the series would be expected to have occurred just once. That is what we would expect to happen, on average. What is the likelihood that each of the 40 steps occurred just once, and only once?

When we go to a shop and buy multiple items, the total amount we pay is the sum of the prices for each individual item. The order in which the items are entered into the register doesn't matter. However, with probabilities like this series of 40 events we must *multiply* the probabilities because each event is dependent upon the event preceding it. So the probability that all events will occur just once is the probability of getting just one event when 40 are expected, multiplied by the probability of getting one event when 39 are expected, and so on. The result is such a tiny number (1 chance in 10^{308}) that there are not enough atoms in the universe to make it happen. It simply cannot happen.
If we now bring this argument back to Dawkins' *Dawn of Evolution*, the first event after the origin of life was a transition from one (unknown) to two fundamentally different types of prokaryotic life (bacteria, archaea). If such a transition really can occur naturalistically, then we should today see something like 40 fundamentally different types of prokaryotic life. Since we don't see this (and we could elaborate this reasoning through all 40 steps) we can conclude that probability had nothing to do with it.

The origin of species

One obvious rejoinder to this calculation is that speciation usually occurs via populations, and populations can number in the millions. Only rarely does a new species arise from a single founding individual. Jean-Jacques Kupiec argues that the fundamental realities in biology are not species, but individual lineages. Each one is different from every other, and it is the collective histories of individuals that we should be studying rather than trying to squeeze them into man-made categories.[21] If Dawkins' 40 crucial events happened to multitudes of variable individuals at any one time, then his problem with singularities would disappear.

But Charles Darwin faced a similar problem when he looked at the fossil record. If his theory had been correct—that all species had evolved from other species via long sequences of small changes—then the fossil record should consist of endless examples of transitional forms. But the fossil record is *not* like that. It shows that species usually appear fully formed, and remain much the same throughout their history. Gaps are real. Palaeontologist Stephen Jay Gould called this 'the central fact of the fossil record'.[22]

In similar manner, if Kupiec's theory is correct, then we should expect to see endless examples of transitional forms among living organisms today. In general this again is *not* what we see. Most organisms fit fairly well into their species categories. Yes, there are continuous and widespread variations, but humans are very easily distinguished from their nearest supposed relatives, the chimpanzees and gorillas. Taxonomists do have problems trying to sort out a few notoriously variable species complexes but most species are usually clear-cut and non-problematic once they have been studied and described in adequate detail.

In contrast, Dawkins' 40 transitional events were not species-level transitions. The first half of his list consisted of the largest 'jumps' of all across the highest levels in the taxonomic hierarchy—the phyla! According to leading experts, the origin of the multi-cellular phyla in the

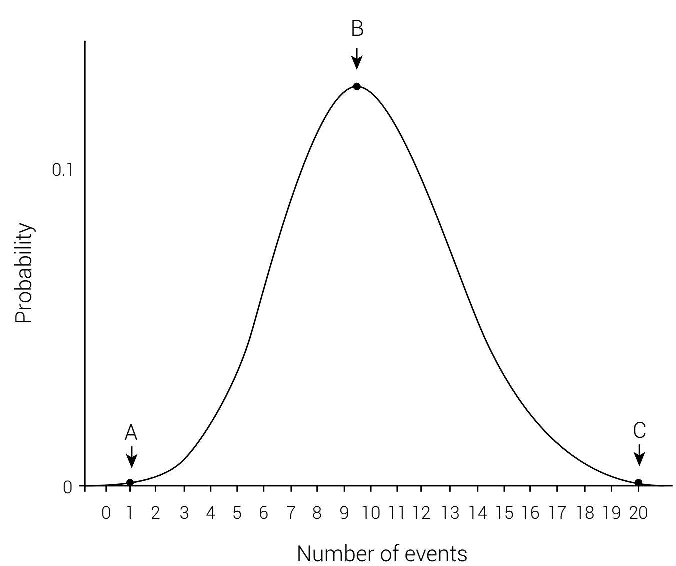

Figure 5. The likely numbers of evolutionary events after 10 million years, when the expected frequency is once in a million years, according to the Poisson distribution.

Pre-Cambrian era poses a severe challenge. Smithsonian palaeontologist Douglas Erwin called it a conundrum.[23] Caltech developmental biologist Eric Davidson said that the differences between the phyla are due to unchanging upper-level control circuits that are conserved in all descendants. "A strong conclusion … is that the evolutionary process generating the [animal] body plans was in many ways very different from the evolutionary changes that can be observed at the species level in modern animals."[24] These experts are telling us that they cannot explain the big differences.

The second half of Dawkins' transitional events covers the evolution story from fish to humans. Among these transitions the smallest step is the most recent one—the origin of humans from an ape-like ancestor. No-one has any idea how or why one lineage of apes changed into humans while the others remained as apes. And the timescale of human genome decay, even as acknowledged by leading evolutionary geneticists, shows it cannot possibly have survived for the supposed multiple millions of years required for this transition.[25] Since this smallest of all steps remains a singularity, then all of the larger steps preceding it also qualify as singularities, and Dawkins' problem remains unsolved.

Conclusion

The entire evolutionary worldview—from the origin of the universe to the origin of the human intelligence that contemplates it—consists of a series of singular events that are indistinguishable from a multitude of miracles. Scientists cannot study singular events, only repeatable ones. But when evolutionists claim that the evolutionary process is naturalistic, repeatable, and a product of chance, then we can use the laws of probability to test that claim. It turns out to be impossible. But evolutionists are not the only ones with this problem. Everyone who has a story of origins (the Bible included) will find it consists of the same thing—a long series of singular events. The big question, therefore, is which one (if any) is correct? There is widespread evidence in creationist literature supporting the biblical account. But regardless of evidence, this singularity problem is a reminder to all of us that origin stories are not primarily based on science, but on worldview.

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