THE CASE FOR EVOLUTION pdf

1: Humans As a Case Study for the Evidence of Evolution

The problem is that, once one moves beyond mere faith to look at the scientific arguments, the alternative explanation to creationism (or its cousin intelligent design) - namely, evolution - is a complicated matter and few people have the desire or the time or the understanding to study the case for evolution.

When I was a boy at a Roman Catholic school in the early s, I had to learn the Catechism and essentially this offered a three-word answer to the question which was: I soon came to believe that this answer was as wrong as it was inadequate. Consequently there are very few brief, accurate and intelligible pieces of writing on the origins of humankind. This essay attempts to address that gap. The theory of evolution was independently developed by Alfred Russel Wallace and Charles Darwin, but it was the latter who first set out the case in book form in his "On The Origin of Species" which was first published in In that book, humans were barely mentioned. It was only in "The Descent Of Man" published in that he spelled out how humankind too was the subject of evolution and shared an ancestor with the chimpanzee. Evolution therefore is an explanation for the origin of all life forms or species: It holds that all life forms have the same origin and that one form of life evolves into another through a process known as natural selection. How does this work? All life forms comprise cells which undergo a process of division. Most mutations are neutral or disadvantageous rather than potentially beneficial, if only because they are random and there are many more ways of becoming worse than of becoming better. Nature selects for preference those random mutations which confer on that life form a greater chance of survival and reproduction. Where one population is isolated from another that is, they cannot interbreed , species can and do develop different characteristics reflecting the local circumstances in terms of geography, climate, prey, predators and food supply. Although Darwin himself did not know this, the biological means by which these mutations conferring advantage are passed from one generation to another is particular genes in a gene pool. A gene is a length of DNA which is deoxribonucleic acid that contains the genetic instructions used in the development and functioning of virtually all known living organisms. The process of natural selection is incredibly slow in terms of human life spans, but there has been plenty of time for natural selection to work, since the Earth is around 4. So, in the natural world as opposed to a breeding centre or a laboratory , changes - such as a longer neck or a faster speed or a larger brain - take a long time to evolve, so long that one cannot identify the point at which one species actually becomes another. Natural selection can appear wasteful and cruel. Most species have not survived various mass extinctions. The most famous is the Cretaceous-Tertiary extinction of some 65 million years ago which resulted in the death of the dinosaurs. Today, as throughout evolution, most animals die young and painfully either through starvation or predation. It really is a brutal competition for survival with the fittest most likely to survive and pass its genes on to the next generation. But it is vital to appreciate that this is not a plan or a design. It is an automatic process of natural selection by random mutation. If there were no such process at work, we would not be here to consider it. Evolution explains the similarity of species Like any good scientific theory or law, evolution explains all the known facts in a consistent and convincing manner. Most especially, it explains convincingly how present day species are related to each other. It explains why the DNA code is invariant across all living creatures while individual genes vary. Evolution explains the geographical distribution of species Evolution explains why animals tend to live on the same continent as fossils that are probably their ancestors and why animals share the same continent with species that resemble them. Conversely, no frogs are found on oceanic islands because frogspawn is immediately killed by sea water. Evolution suggests that such locations would have few species because of the difficulty of crossing the ocean and that such places would have animal forms that are found nowhere else because the habitat is so distinct. This is exactly what we find: Natural selection is analogous with other forms of selection We are reinforced in our view that over time random mutations can through natural selection result in different types of life and different versions of animals because we observe that artificial selection - for instance, of cabbages, roses, pigeons, dogs and horses - and sexual selection - for instance between peahens and peacocks - does the same on a much shorter timescale. Evolution is confirmed by scientific dating methods We know that life has evolved over millions and millions of years and not a few

thousand years because of scientific dating techniques such as the decay of radioactive materials and carbon dating. All these dating techniques not only reveal a very long process of evolution but are remarkably consistent in the dates that they offer us. Evolution is confirmed by observation and experimentation The most striking case is the ever-increasing resistance of bacteria to anti-biotics. Bacteria multiply fast and are present in enormous numbers so that mutations that are resistant to a particular anti-biotic can occur easily. The more we use anti-biotics, the faster bacteria can evolve to be resistant to them. Another example is the increased frequency of tuskless elephants because of the killing of elephants for their ivory. The explanation is that the elephants that were not killed for their tusks were more likely to survive and became a growing band proportionally while their offspring with genes that did not produce tusks also had a better chance of survival. In , scientists found that the descendants of the transported lizards had significantly larger heads because they were eating more plant material. This was natural selection at work over a mere 37 years. The results were entirely consistent with the principles of natural selection through random mutation. This is exactly what the fossil record reveals. All fossils which have been found - and there are now very many - are in the correct temporal sequence. Specifically we now have a rich supply of intermediate fossils linking modern humans with the common ancestor that humans share with chimpanzees. You can view for yourself a selection of such fossils in most museums of natural history. Of course, the fossil record is not complete and never could be especially for animals which are not susceptible to being fossilised, but the fossil evidence in many major animal groups is strong and becoming ever stronger. Evolution is confirmed by the gene pool Darwin did not know about genes which were first suggested by the Austrian scientist Gregor Mendel, although Mendel himself did not use the term which was only coined in A gene is a length of DNA that contains the genetic instructions used in the development and functioning of all living organisms. As the science of genetics has rapidly developed, we have become capable of mapping the genetic code of different life forms and identifying the incredible similarity in genetic composition of life forms which have common ancestors as explained by evolution. The point is that shared DNA is confirmation of shared ancestry as set out in the theory of evolution. There is an absence of design If emergence of life was not the result of a process of natural selection through random mutation, then it might be that it was the result of a non-random process involving design which would suggest a designer God. In fact, it is clear that there is no design. On the contrary, there many instances of imperfection. A wonderful case occurs with the pouch of the koala bear which opens downwards instead of upwards as in a kangaroo, even though the koala spends its time hanging upright from trees. The explanation - provided by evolution - is that the koala is descended from a wombat-like ancestor who flung soil backwards, necessitating a pouch facing downwards. The most dramatic illustration that life was not designed by a beneficent God is that of the ichneumon wasp which paralyses a caterpillar and then lays eggs inside its body which hatch to produce young which proceed to devour the caterpillar alive one organ after another in an order which keeps the caterpillar alive and therefore fresh as long as possible. A classic example of imperfection is what is called the recurrent laryngeal nerve which takes a bizarre route from the brain to the larynx in mammals and humans. Another example is the odd detour taken by the vas deferens - the pipe that carries sperm from the testis to the penis - in male humans. A third example is found in the sinuses of humans which has its drainage hole in the top rather than the bottom, a consequence of our shift from being quadruped to biped. Yet another example occurs in the eye - often represented by creationists as a marvel of design - where the retina is back to front, a defect that has to be corrected by the brain. In fact, the human body abounds with imperfections which can only be explained by the long process of gradual evolution and modification. One more piece of evidence against any notion of design: Why is it there? There are currently two possible explanations. The first view is that it must have coded for proteins no longer used by the descendant of the entity that did have use for that protein. If this is the case, it is not a good design. All these redundant genes in every cell take energy to create. The other view scientists are considering is that this redundant DNA may have something to do with the structural integrity of the DNA helix. Proteins form complex structures using ionic bonds electrical repulsion and attraction. So nature can be beautifully simple and unnecessarily complex - but that is evolution not intelligent design. Over and above the routine imperfections to be found in the natural world, the absence of design at least by a rational and beneficient God

is evident from the vast wastefulness and immense cruelty of nature. Most animals die early, without even having the opportunity to create offspring, and they frequently die cruelly, eaten alive or torn apart by another animal, or die slowly, wasted by disease or starvation. Not a sensible or kind design or indeed any design. Evolution is a falsifiable theory Like any good scientific theory or law, evolution is falsifiable by contradictory evidence. There has been no such contradictory evidence. If one fossil was found in strata representing a period older or younger than one would expect to find it, then the theory would be massively challenged. This has never happened. There is a missing link in the tree of life There is no missing link. Since evolution is continuous and its speed varies enormously, in a strict sense all species are in transition and it is often difficult to identify categorically when a transition occurs from one species to another. However, since Darwin first enunciated his thesis, palaeontologists have discovered many intermediate forms between different groups of animals: The fossil Archaeopteryx is one of the most famous, discovered in , a mere two years after the first publication of "On The Origin Of Species". It had feathers like a bird, but teeth, claws and a bony tail like a dinaosaur. Ambulocetus, discovered in , is known as the walking whale. It could walk on four legs on land and in water and heard by picking up vibrations through its jawbone like modern whales. Tiktaalik, discovered in , is the link between fish and amphibian. It looked like a primative fish crossed with early four-legged animals and had lungs and gills plus fins that could support much of its weight [for more information click here]. Of course, from the perspective of a strict creationist who is determined to oppose and misunderstand evolution, each new intermediate form simply creates an extra missing link. The point is that the tree of life is not a series of distinct links but a very gradual morphing from one form to another. There are no fossils for intermediate animals such as a fronkey Of course not, because monkeys are not descended from frogs. Equally humans are not descended from chimpanzees. No modern species is descended from any other modern species. Instead evolution postulates that monkeys and frogs share a common ancestor in the same way that chimpanzees and humans share a common ancestor. Indeed, if one goes back far enough in the tree of life, then every species shares an ancestor with every other one. There are gaps in the fossil record Of course, there are. This is not surprising. It is the inevitable result of chance fossilisations, chance discoveries, and immigration events.

2: 15 Answers to Creationist Nonsense - Scientific American

Along the way, he presents a case for evolution that is understandable, interesting, easy to read and compelling. If any single book has a chance of persuading an honest and curious creationist to reconsider, this is it.

Closing remarks What is Universal Common Descent? All existing species originated gradually by biological, reproductive processes on a geological timescale. Modern organisms are the genetic descendants of one ancient, original species broadly defined as a communal population of organisms exchanging genetic material. Genetical "gradualness", a much misunderstood term, is a mode of biological change that is dependent on population phenomena; it is not a statement about the rate or tempo of evolution. Truly genetically gradual events are changes within the range of biological variation expected between two consecutive generations. Morphological change may appear fast, geologically speaking, yet still be genetically gradual Darwin , pp. Though gradualness is not a mechanism of evolutionary change, it imposes severe constraints on possible macroevolutionary events. Likewise, the requirement of gradualness necessarily restricts the possible mechanisms of common descent and adaptation, briefly discussed below. Common Descent Can Be Tested Independently of Mechanistic Theories In this essay, universal common descent alone is specifically considered and weighed against the scientific evidence. In general, separate "microevolutionary" theories are left unaddressed. Microevolutionary theories are gradualistic explanatory mechanisms that biologists use to account for the origin and evolution of macroevolutionary adaptations and variation. These mechanisms include such concepts as natural selection, genetic drift , sexual selection, neutral evolution, and theories of speciation. The fundamentals of genetics, developmental biology, molecular biology, biochemistry, and geology are assumed to be fundamentally correctâ€”especially those that do not directly purport to explain adaptation. However, whether microevolutionary theories are sufficient to account for macroevolutionary adaptations is a question that is left open. Therefore, the evidence for common descent discussed here is independent of specific gradualistic explanatory mechanisms. None of the dozens of predictions directly address how macroevolution has occurred, how fins were able to develop into limbs, how the leopard got its spots, or how the vertebrate eye evolved. None of the evidence recounted here assumes that natural selection is valid. None of the evidence assumes that natural selection is sufficient for generating adaptations or the differences between species and other taxa. Because of this evidentiary independence, the validity of the macroevolutionary conclusion does not depend on whether natural selection, or the inheritance of acquired characaters, or a force vitale, or something else is the true mechanism of adaptive evolutionary change. The scientific case for common descent stands, regardless. Furthermore, because it is not part of evolutionary theory, abiogenesis also is not considered in this discussion of macroevolution: In evolutionary theory it is taken as axiomatic that an original self-replicating life form existed in the distant past, regardless of its origin. All scientific theories have their respective, specific explanatory domains; no scientific theory proposes to explain everything. Quantum mechanics does not explain the ultimate origin of particles and energy, even though nothing in that theory could work without particles and energy. Scientific theories are validated by empirical testing against physical observations. Theories are not judged simply by their logical compatibility with the available data. Independent empirical testability is the hallmark of scienceâ€”in science, an explanation must not only be compatible with the observed data, it must also be testable. By "testable" we mean that the hypothesis makes predictions about what observable evidence would be consistent and what would be incompatible with the hypothesis. Simple compatibility, in itself, is insufficient as scientific evidence, because all physical observations are consistent with an infinite number of unscientific conjectures. Furthermore, a scientific explanation must make risky predictionsâ€” the predictions should be necessary if the theory is correct, and few other theories should make the same necessary predictions. As a clear example of an untestable, unscientific, hypothesis that is perfectly consistent with empirical observations, consider solipsism. The so-called hypothesis of solipsism holds that all of reality is the product of your mind. What experiments could be performed, what observations could be made, that could demonstrate that solipsism is wrong? Even though it is logically consistent with the data, solipsism cannot be tested by independent

researchers. Any and all evidence is consistent with solipsism. Solipsism is unscientific precisely because no possible evidence could stand in contradiction to its predictions. For those interested, a brief explication of the scientific method and scientific philosophy has been included, such as what is meant by "scientific evidence", "falsification", and "testability". In the following list of evidences, 30 major predictions of the hypothesis of common descent are enumerated and discussed. Under each point is a demonstration of how the prediction fares against actual biological testing. Each point lists a few examples of evolutionary confirmations followed by potential falsifications. Since one fundamental concept generates all of these predictions, most of them are interrelated. So that the logic will be easy to follow, related predictions are grouped into five separate subdivisions. Each subdivision has a paragraph or two introducing the main idea that unites the various predictions in that section. There are many in-text references given for each point. It must be stressed that this approach to demonstrating the scientific support for macroevolution is not a circular argument: Simply put, the theory of universal common descent, combined with modern biological knowledge, is used to deduce predictions. These predictions are then compared to the real world in order see how the theory fares in light of the observable evidence. In every example, it is quite possible that the predictions could be contradicted by the empirical evidence. In fact, if universal common descent were not accurrate, it is highly probable that these predictions would fail. These empirically validated predictions present such strong evidence for common descent for precisely this reason. The few examples given for each prediction are meant to represent general trends. By no means do I purport to state all predictions or potential falsifications; there are many more out there for the inquiring soul to uncover. The worldwide scientific research community from over the past years has discovered that no known hypothesis other than universal common descent can account scientifically for the unity, diversity, and patterns of terrestrial life. No alternate explanations compete scientifically with common descent, primarily for four main reasons: When evaluating the scientific evidence provided in the following pages, please consider alternate explanations. Most importantly, for each piece of evidence, critically consider what potential observations, if found, would be incompatible with a given alternate explanation. If none exist, that alternate explanation is not scientific. As explained above, a hypothesis that is simply compatible with certain empirical observations cannot use those observations as supporting scientific evidence. How to Cite This Document Many people have asked how to cite this work in formal research papers and academic articles. This work is an online publication, published by the TalkOrigins Archive. There are standard academic procedures for citing online publications. For example, if you last accessed this page on March 12, , and used version 2. The Scientific Case for Common Descent. Finally, there is this possibility: Rather, it is whether or not the theory gives predictions that agree with experiment. It is not a question of whether a theory is philosophically delightful, or easy to understand, or perfectly reasonable from the point of view of common sense. And it agrees fully with experiment. So I hope you can accept Nature as She is - absurd. Feynman , from the introductory lecture on quantum mechanics reproduced in QED:

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3: The case for evolution in public health policy â€“ The Stanford Daily

Despite definitive legal cases that have established the unconstitutionality of teaching intelligent design or creationist ideology in science class, the theory of evolution remains consistently.

Origins[edit] State Representative John W. Butler , a Tennessee farmer and head of the World Christian Fundamentals Association , lobbied state legislatures to pass anti-evolution laws. He succeeded when the Butler Act was passed in Tennessee, on March 25, Presented in Problems , which described the theory of evolution, race, and eugenics. The two sides brought in the biggest legal names in the nation, William Jennings Bryan for the prosecution and Clarence Darrow for the defense, and the trial was followed on radio transmissions throughout the United States. According to Robinson, Rappleyea said, "As it is, the law is not enforced. If you win, it will be enforced. If I win, the law will be repealed. Scopes , a Dayton high school science and math teacher. The group asked Scopes to admit to teaching the theory of evolution. Scopes added to the group: Raulston accelerated the convening of the grand jury and " Hicks , two brothers who were local attorneys and friends of Scopes, but the prosecution was ultimately led by Tom Stewart , a graduate of Cumberland School of Law , who later became a U. Stewart was aided by Dayton attorney Gordon McKenzie, who supported the anti-evolution bill on religious grounds, and described evolution as "detrimental to our morality" and an assault on "the very citadel of our Christian religion". Wells asking him to join the defense team. Wells replied that he had no legal training in Britain, let alone in America, and declined the offer. Bryan had originally been invited by Sue Hicks to become an associate of the prosecution and Bryan had readily accepted, despite the fact he had not tried a case in thirty-six years. As Scopes pointed out to James Presley in the book Center of the Storm, on which the two collaborated: Darrow originally declined, fearing that his presence would create a circus atmosphere, but eventually realized that the trial would be a circus with or without him, and agreed to lend his services to the defense, later stating that he "realized there was no limit to the mischief that might be accomplished unless the country was aroused to the evil at hand". McKenzie and William Jennings Bryan. It was Mencken who provided the trial with its most colorful labels such as the "Monkey Trial" of "the infidel Scopes". It was also the first United States trial to be broadcast on national radio. Principally because of Clarence Darrow, this strategy changed as the trial progressed. The earliest argument proposed by the defense once the trial had begun was that there was actually no conflict between evolution and the creation account in the Bible; later, this viewpoint would be called theistic evolution. In support of this claim, they brought in eight experts on evolution. But other than Dr. Maynard Metcalf, a zoologist from Johns Hopkins University , the judge would not allow these experts to testify in person. Instead, they were allowed to submit written statements so that their evidence could be used at the appeal. Darrow apologized the next day, keeping himself from being found in contempt of court. Mencken in The presiding judge, John T. Raulston, was accused of being biased towards the prosecution and frequently clashed with Darrow. At the outset of the trial, Raulston quoted Genesis and the Butler Act. Malone promised that there would be no duel because "there is never a duel with the truth. The judge declared that all of the defense testimony on the Bible was irrelevant and should not be presented to the jury which had been excluded during the defense. On the seventh day of the trial, the defense asked the judge to call Bryan as a witness to question him on the Bible, as their own experts had been rendered irrelevant; Darrow had planned this the day before and called Bryan a "Bible expert". This move surprised those present in the court, as Bryan was a counsel for the prosecution and Bryan himself according to a journalist reporting the trial never made a claim of being an expert, although he did tout his knowledge of the Bible. Bryan accepted, on the understanding that Darrow would in turn submit to questioning by Bryan. Although Hays would claim in his autobiography that the cross-examination of Bryan was unplanned, Darrow spent the night before in preparation. The scientists the defense had brought to Daytonâ€”and Charles Francis Potter , a modernist minister who had engaged in a series of public debates on evolution with the fundamentalist preacher John Roach Straton â€”prepared topics and questions for Darrow to address to Bryan on the witness stand. Darrow used these examples to suggest that the stories of the Bible could not be scientific and should not be used in

teaching science with Darrow telling Bryan, "You insult every man of science and learning in the world because he does not believe in your fool religion. It is to keep these gentlemen from saying I was afraid to meet them and let them question me, and I want the Christian world to know that any atheist, agnostic, unbeliever, can question me anytime as to my belief in God, and I will answer him. Bryan, gauging the effect the session was having, snapped that its purpose was "to cast ridicule on everybody who believes in the Bible". Darrow, with equal vehemence, retorted, "We have the purpose of preventing bigots and ignoramuses from controlling the education of the United States. Darrow asked where Cain got his wife; Bryan answered that he would "leave the agnostics to hunt for her". However, after another angry exchange, Judge Raulston banged his gavel, adjourning the court. We claim that the defendant is not guilty, but as the court has excluded any testimony, except as to the one issue as to whether he taught that man descended from a lower order of animals, and we cannot contradict that testimony, there is no logical thing to come except that the jury find a verdict that we may carry to the higher court, purely as a matter of proper procedure. We do not think it is fair to the court or counsel on the other side to waste a lot of time when we know this is the inevitable result and probably the best result for the case. After they were brought in, Darrow then addressed the jury, telling them that: We came down here to offer evidence in this case and the court has held under the law that the evidence we had is not admissible, so all we can do is to take an exception and carry it to a higher court to see whether the evidence is admissible or not We do not see how you could. We do not ask it. Darrow closed the case for the defense without a final summation. Under Tennessee law, when the defense waived its right to make a closing speech, the prosecution was also barred from summing up its case, preventing Bryan from presenting his prepared summation. Scopes never testified since there was never a factual issue as to whether he had taught evolution. Scopes later admitted that, in reality, he was unsure of whether he had taught evolution another reason the defense did not want him to testify , but the point was not contested at the trial. Science is a magnificent force, but it is not a teacher of morals. It can perfect machinery, but it adds no moral restraints to protect society from the misuse of the machine. It can also build gigantic intellectual ships, but it constructs no moral rudders for the control of storm-tossed human vessel. It not only fails to supply the spiritual element needed but some of its unproven hypotheses rob the ship of its compass and thus endanger its cargo. In war, science has proven itself an evil genius; it has made war more terrible than it ever was before. Science has taught him to go down into the water and shoot up from below and to go up into the clouds and shoot down from above, thus making the battlefield three times as bloody as it was before; but science does not teach brotherly love. Science has made war so hellish that civilization was about to commit suicide; and now we are told that newly discovered instruments of destruction will make the cruelties of the late war seem trivial in comparison with the cruelties of wars that may come in the future. If civilization is to be saved from the wreckage threatened by intelligence not consecrated by love, it must be saved by the moral code of the meek and lowly Nazarene. His teachings, and His teachings alone, can solve the problems that vex the heart and perplex the world. Your honor, I feel that I have been convicted of violating an unjust statute. I will continue in the future, as I have in the past, to oppose this law in any way I can. Any other action would be in violation of my ideal of academic freedomâ€”that is, to teach the truth as guaranteed in our constitution, of personal and religious freedom. I think the fine is unjust. First, they argued that the statute was overly vague because it prohibited the teaching of "evolution", a very broad term. The court rejected that argument, holding: Evolution, like prohibition, is a broad term. In recent bickering, however, evolution has been understood to mean the theory which holds that man has developed from some pre-existing lower type. This is the popular significance of evolution, just as the popular significance of prohibition is prohibition of the traffic in intoxicating liquors. It was in that sense that evolution was used in this act. It is in this sense that the word will be used in this opinion, unless the context otherwise indicates. It is only to the theory of the evolution of man from a lower type that the act before us was intended to apply, and much of the discussion we have heard is beside this case. The court rejected this argument, holding that the state was permitted to regulate his speech as an employee of the state: He was an employee of the state of Tennessee or of a municipal agency of the state. He was under contract with the state to work in an institution of the state. He had no right or privilege to serve the state except upon such terms as the state prescribed. His liberty, his privilege, his immunity to teach

and proclaim the theory of evolution, elsewhere than in the service of the state, was in no wise touched by this law. Third, it was argued that the terms of the Butler Act violated the Tennessee State Constitution , which provided that "It shall be the duty of the General Assembly in all future periods of this government, to cherish literature and science. The court rejected this argument, [45] holding that the determination of what laws cherished science was an issue for the legislature, not the judiciary: The courts cannot sit in judgment on such acts of the Legislature or its agents and determine whether or not the omission or addition of a particular course of study tends "to cherish science. Fourth, the defense lawyers argued that the statute violated the provisions of the Tennessee Constitution that prohibited the establishment of a state religion. The Religious Preference provisions of the Tennessee Constitution section 3 of article 1 stated, "no preference shall ever be given, by law, to any religious establishment or mode of worship". We are not able to see how the prohibition of teaching the theory that man has descended from a lower order of animals gives preference to any religious establishment or mode of worship. So far as we know, there is no religious establishment or organized body that has in its creed or confession of faith any article denying or affirming such a theory. So far as we know, the denial or affirmation of such a theory does not enter into any recognized mode of worship. Since this cause has been pending in this court, we have been favored, in addition to briefs of counsel and various amici curiae, with a multitude of resolutions, addresses, and communications from scientific bodies, religious factions, and individuals giving us the benefit of their views upon the theory of evolution. Examination of these contributions indicates that Protestants, Catholics, and Jews are divided among themselves in their beliefs, and that there is no unanimity among the members of any religious establishment as to this subject. Belief or unbelief in the theory of evolution is no more a characteristic of any religious establishment or mode of worship than is belief or unbelief in the wisdom of the prohibition laws. It would appear that members of the same churches quite generally disagree as to these things. Further, the court held that while the statute forbade the teaching of evolution as the court had defined it , it did not require the teaching of any other doctrine, so that it did not benefit any one religious doctrine or sect over the others. Nevertheless, having found the statute to be constitutional, the court set aside the conviction on appeal because of a legal technicality: The court is informed that the plaintiff in error is no longer in the service of the state. We see nothing to be gained by prolonging the life of this bizarre case. On the contrary, we think that the peace and dignity of the state, which all criminal prosecutions are brought to redress, will be the better conserved by the entry of a nolle prosequi herein. Such a course is suggested to the Attorney General.

4: Itskinsâ€™ Evolution Case for iPhone 5/5S Review | www.enganchecubano.com

No Evolution at Present. The lack of a case for evolution is most clearly recognized by the fact that no one has ever seen it happen. "Evolution, at least in the sense that Darwin speaks of it, cannot be detected within the lifetime of a single observer.".

Definition[edit] Francis Collins describes theistic evolution as the position that "evolution is real, but that it was set in motion by God", [3] and characterizes it as accepting "that evolution occurred as biologists describe it, but under the direction of God". It covers a wide range of beliefs about the extent of any intervention by God, with some approaching deism in rejecting the concept of continued intervention. Just as different types of evolutionary explanations have evolved, so there are different types of theistic evolution. Morris and John D. Morris , point out that there are different terms which have been used to describe different positions: The Jesuit paleontologist Pierre Teilhard de Chardin was an influential proponent of God-directed evolution or "orthogenesis", in which man will eventually evolve to the " omega point " of union with the Creator. Eugenie Scott states in Evolution Vs. Creationism that it is a type of evolution rather than creationism, despite its name, and that it is "hardly distinguishable from Theistic Evolution". Alternatives to evolution by natural selection Historians of science and authors of pre-evolutionary ideas have pointed out that scientists had considered the concept of biological change well before Darwin. Linnaeus had initially embraced the Aristotelian idea of immutability of species the idea that species never change , but later in his life he started to challenge it. Yet, as a Christian, he still defended "special creation", the belief that God created "every living creature" at the beginning, as read in Genesis, with the peculiarity a set of original species of which all the present species have descended. Let us suppose that the Divine Being in the beginning progressed from the simpler to the complex; from few to many; similarly that He in the beginning of the plant kingdom created as many plants as there were natural orders. These plant orders He Himself, there from producing, mixed among themselves until from them originated those plants which today exist as genera. Nature then mixed up these plant genera among themselves through generations -of double origin hybrids and multiplied them into existing species, as many as possible whereby the flower structures were not changed excluding from the number of species the almost sterile hybrids, which are produced by the same mode of origin. We imagine that the Creator at the actual time of creation made only one single species for each natural order of plants, this species being different in habit and fructification from all the rest. That he made these mutually fertile, whence out of their progeny, fructification having been somewhat changed, Genera of natural classes have arisen as many in number as the different parents, and since this is not carried further, we regard this also as having been done by His Omnipotent hand directly in the beginning; thus all Genera were primeval and constituted a single Species. That as many Genera having arisen as there were individuals in the beginning, these plants in course of time became fertilised by others of different sort and thus arose Species until so many were produced as now exist Later, in a number of experiments carried out between and , the Augustinian friar Gregor Mendel , aligning himself with the "new doctrine of special creation" proposed by Linnaeus, [20] concluded that new species of plants could indeed arise, although limitedly and retaining their own stability. British natural theology , which sought examples of adaptation to show design by a benevolent Creator, adopted catastrophism to show earlier organisms being replaced in a series of creations by new organisms better adapted to a changed environment. Charles Lyell also saw adaptation to changing environments as a sign of a benevolent Creator, but his uniformitarianism envisaged continuing extinctions and replacements. In continental Europe, the idealism of philosophers including Lorenz Oken developed a Naturphilosophie in which patterns of development from archetypes were a purposeful divine plan aimed at forming humanity. The idealist Louis Agassiz , a persistent opponent of transmutation, saw mankind as the goal of a sequence of creations, but his concepts were the first to be adapted[by whom? The book became a best-seller and popularised the idea of transmutation in a designed "law of progression". The scientific establishment strongly attacked Vestiges at the time, but later more sophisticated theistic evolutionists followed the same approach of looking for patterns of development as evidence of design. When formulating homology he adapted idealist

philosophy to reconcile natural theology with development, unifying nature as divergence from an underlying form in a process demonstrating design. His conclusion to his On the Nature of Limbs of suggested that divine laws could have controlled the development of life, but he did not expand this idea after objections from his conservative patrons. Others supported the idea of development by law, including the botanist Hewett Watson and the Reverend Baden Powell , who wrote in that such laws better illustrated the powers of the Creator. Religious views of Charles Darwin When Charles Darwin published On the Origin of Species in , many liberal Christians accepted evolution provided it was reconciled with divine design. The clergymen Charles Kingsley and Frederick Temple , both conservative Christians in the Church of England , promoted a theology of creation as an indirect process controlled by divine laws. Some strict Calvinists welcomed the idea of natural selection , as it did not entail inevitable progress and humanity could be seen as a fallen race needing salvation. Aubrey Moore also accepted the theory of natural selection, incorporating it into his Christian beliefs as merely the way God worked. I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number. Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype. But analogy may be a deceitful guide. Nevertheless all living things have much in common, in their chemical composition, their germinal vesicles, their cellular structure, and their laws of growth and reproduction. We see this even in so trifling a circumstance as that the same poison often similarly affects plants and animals; or that the poison secreted by the gall-fly produces monstrous growths on the wild rose or oak-tree. I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed by the Creator. He added "On the other hand, we do not mean to deny that such intelligence may act according to law that is to say, on a preconceived and definite plan ". Between and Owen published a theory of derivation proposing that species had an innate tendency to change in ways that resulted in variety and beauty showing creative purpose. Both Owen and Mivart insisted that natural selection could not explain patterns and variation, which they saw as resulting from divine purpose. Argyll attempted to reconcile evolution with design by suggesting that the laws of variation prepared rudimentary organs for a future need. Acceptance of evolution by religious groups According to Eugenie Scott: The process and means by which hominization occurs is a key problem in theistic evolutionary thought, at least for the Abrahamic religions , which hold as a core belief that animals do not have immortal souls but that humans do. Theistic evolution typically postulates a point at which a population of hominids who had or may have evolved by a process of natural evolution acquired souls and thus with their descendants became fully human in theological terms. This group might be restricted to Adam and Eve , or indeed to Mitochondrial Eve , although versions of the theory allow for larger populations. The point at which such an event occurred should essentially be the same as in paleoanthropology and archeology , but theological discussion of the matter tends to concentrate on the theoretical. The term " special transformism " is sometimes used to refer to theories that there was a divine intervention of some sort, achieving hominization. George Jackson Mivart , but tended to come under attack from both the theological and biological camps. St George Jackson Mivart argued instead in his On the Genesis of Species that the deity, equipped with foreknowledge, sets the direction of evolution orthogenesis by specifying the laws that govern it, and leaves species to evolve according to the conditions they experience as time goes by. Larson stated that the theory failed as an explanation in the minds of biologists from the late 19th century onwards as it broke the rules of methodological naturalism which they had grown to expect. Atheism and Evolution The major criticism of theistic evolution by non-theistic evolutionists focuses on its essential belief in a supernatural creator.

5: Evolution: a paleontologist's perspective (article) | Khan Academy

Humans As a Case Study for the Evidence of Evolution by Martin Nickels Illinois State University This article was originally published in Creation/Evolution, Issue XIX (Winter) by the National Center for Science Education, and is reprinted by permission of Dr. Nickels.

This means that we can take advantage of this interest and use it to deal with one of the most important ideas in all of science, namely evolution. Second, because of the amount of scientific evidence that exists for human evolution, we are in the enviable position of being able to draw upon knowledge from many areas of scientific research and build one of the strongest cases for evolution in all of biology. Third, because of our primary focus on humans, we can underscore and reinforce the idea that humans are indeed animals that is to say, we are a part of the natural world rather than a creature set apart from it. This idea becomes even more important, of course, when we make the case that humans are a natural product of biological processes. Fourth, by making the case convincingly for human evolution, we pretty much assure that making the case for any other species will be that much easier. Fifth, we have the opportunity to illustrate several important aspects of the nature of science and scientific knowledge. These include using such criteria as independent lines of evidence, concordance or consistency of evidence and the predictive power found in the patterns inherent in nature to advance scientific understanding of the world we live in and have emerged from. The focus of this discussion is to illustrate both the strength of the many lines of scientific evidence supporting the idea of human evolution and the importance of the concordance or agreement that exists among them. Some of the most important criteria by which the strength of any scientific theory is assessed include the number of independent lines of evidence that are concordant with one another and the ability to use knowledge of one line to predict the pattern we should find in another. Thus, using humans as a case study in evolution also allows us to illustrate some broader aspects of the nature of science and how one can judge the overall strength of any scientific theory or explanation. Scientists deal with evidence, not proof, in the sense that we deal with information and data that must be made sense of or interpreted rather than being, pardon the expression, self-evident. Mathematicians and logicians may deal in undeniable proof because of the nature of the abstract ideas and concepts that they deal with, but scientists must discover the patterns inherent in the natural world and then explain them in light of our understanding of the natural processes that we must use to account for those patterns. Scientists have, in turn, developed criteria to assess and evaluate the relative merits of alternative explanations of the evidence. These criteria include valuing concordance among independent lines of evidence and the ability to predict one line of evidence from another as ways to distinguish better explanations from worse ones. Now, let me turn to 12 lines of Evidence for Human Evolution. Category number 1 Hierarchical Taxonomic Classification is a good example of a pattern that can, of course, be explained by special creation. Linnaeus did just that. But Darwin a century later explained the same set of ordered relationships between organisms as being the result of divergent evolution and shared ancestry. More important, though, is the fact that organisms created de novo need not show varying degrees of similarity to one another. Each creature could be constructed completely differently from every other creature and made from very different materials. Humans need not look like apes, but we do. We show varying degrees of similarity to them and we are made of the same stuff. We could have been created this way but we must look like this if, indeed, we have evolved and diverged from a relatively recent common ancestor. Another important and seldom appreciated characteristic of the evolutionary explanation for the existence of organisms in naturally nested or hierarchical groupings is that it allows us to predict that organisms with certain combinations of features -- such as chimpanzees with wings, flowers with bony skeletons, or humans with hooves instead of feet -- are biologically impossible because of the unbridgeable gaps produced by the major divergent evolutionary events that separate chimps from birds, flowers from vertebrates, and humans from horses. An all-powerful creator, of course, could create almost any combination of such fantastic and fanciful creatures. Number 2 Comparative Anatomy and Number 3 Comparative Embryology are similar to Number 1 in that organisms could have been deliberately formed to resemble one another but they need not have been. But if organisms

share varying degrees of evolutionary kinship with one another, then such anatomical and embryological similarities are mandatory. There is probably no more powerful or striking example of such similarity than that seen among the fetuses of primates, especially the hominoids. Category Number 4 Comparative Biochemistry is of special interest and importance. This is due to the fact that the agreement or concordance of the biochemical evidence with the anatomical evidence illustrates another important consideration when evaluating the strength of evolutionary theory: If the same overall pattern of biochemical similarities did not agree with the pattern based on anatomical comparisons, evolutionary theory would have been in serious trouble. But the patterns do agree and evolutionary theory is all the stronger because of that. Number 5 Adaptive Compromises and Number 6 Vestigial Structures are both very difficult to explain as being the result of deliberate design or special creation since they represent such "poor" engineering. But they are exquisite examples of the constraints inherent in biological systems evolving over time and having only existing ancestral structures available for modification in the face of new and often competing selective pressures. The special case of biogeography pertinent to human evolution, of course, is that in Darwin used the work of Huxley and others which showed that humans most resemble chimpanzees and gorillas who live only in Africa to predict where we would most likely find fossils of our own earliest ancestors - Africa. That Darwin was correct is borne out by Category Number 8 Paleobiogeography as, indeed, all of the earliest-known hominids are from Africa and nowhere else. But the fact that Darwin could use evidence from biogeography to predict what the pattern should look like in a completely separate body of evidence - the fossil record - is a wonderful example of how concordance among separate lines of evidence is both a testable prediction of a scientific theory and further support for a theory - in this case, evolution - when the prediction is borne out. Number 9 the Fossil Sequence for hominids is just a single case study of the general pattern present in the overall fossil record. That pattern is that modern species are not found throughout the fossil record from top to bottom - which they should be if all species were formed at one time at the very beginning of life on this planet. Instead, what we discover is less and less evidence of modern species as we go deeper and deeper into the fossil and geological record - a pattern both predicted by evolutionary theory and completely consistent with evolutionary theory. Indeed, this is the only pattern consistent with evolutionary theory. And there is no more impressive fossil series one can use to illustrate this pattern than the overall hominid fossil sequence. There is also no more pedagogically powerful example for students than that of our own lineage. Number 10 Fossil Intermediates refers to the fact that, regardless of the mode or rate of evolutionary change, there should be evidence of morphological continuity over time in the fossil record if species are evolutionarily linked and related to one another. Is there a better classroom example one can use to illustrate this point than a fossil like Lucy with her mixture of ape-like and humanlike features? I sometimes think that as physical anthropologists we are especially blessed to have such a wonderful example to use in our teaching. Number 11 the Ecological Coherence of Fossil Assemblages is an especially powerful point to use when countering the associated claims of Flood Geology that many creationists make. But the fact that successive fossil assemblages actually contain ecologically-coherent groups of species common to specific environments counters this creationist claim by illustrating that environments come and go and come again many times over time but the species within them change. It is indeed remarkable that this theory has been progressively accepted by researchers, following a series of discoveries in various fields of knowledge. The convergence, neither sought nor fabricated, of the results of work that was conducted independently is in itself a significant argument in favor of this theory. The fossil record, then, is not merely a jumbled collection of drowned flood victims but a record consisting of ecological snapshots of the natural history of life on this planet. The number of ecologically coherent paleoanthropological and archeological sites from Laetoli, Lake Turkana, Olduvai Gorge on up to the present is stunning, and all provide excellent examples for us to use in our teaching. Finally, Number 12 the Archeological Record of stone tools and other artifacts is a uniquely human line of evidence available to us because we teach about human natural history. No other organism has left such a record of its behavioral evolution. More importantly, the pattern of change in the lithic prehistory of humans parallels that of the fossil record in its change from more primitive to more modern over time. The archeological record uniquely enriches our study of human evolution. Only an evolutionary explanation can rationally account for these lines

of evidence both individually and collectively. Indeed, it is their combined strength that supports evolution so extraordinarily well. In conclusion, the fact that there are so many lines of evidence in support of the idea of human evolution simply means that we, as physical anthropologists, have an unrivaled opportunity to teach about evolution and effectively confront creationism in our classrooms. We have the best case study for evolution in all of biology. Let us rejoice in that and use it in our teaching. The opportunity is yours, and I hope you all take advantage of it. Many thanks to Craig Nelson of Indiana University for helping me develop and enrich my thinking about the strength of the case for evolution in general. He encouraged me to apply several of these lines of evidence to humans as a case study.

6: Evo-Ed: Cases for Effective Evolution Education

The scientific case for common descent stands, regardless. Furthermore, because it is not part of evolutionary theory, abiogenesis also is not considered in this discussion of macroevolution: abiogenesis is an independent hypothesis.

We were never intended to self-isolate with technology, which has lead to social dysfunction, particularly amongst the youth. Of course, to determine what is indeed natural to us, we must look to human evolutionary history. Regardless of if technology has actually created some social malaise, the idea is a step towards understanding the modern implications of ancestral human lifestyles. Many evolutionary biologists claim that we underestimate the current relevance of those lifestyles. For example, the recently created journal Evolutionary Applications tries to use our understanding of human evolution to reform public health practices. Their call is made especially relevant by the growing field of epigenetics. This mostly occurs in the womb, though it also takes place throughout development. When exposed to them, the body alters the course of its physiological development â€" through modifying its gene expression â€" to better fit that environment. The ability to respond to certain cues is the result of long-term evolution. The reception of those cues, though, occurs at the individual level, and many are received from the previous generation, generally via the fetal environment. Epigenetics and evolution, when taken together, help to explain certain conditions and diseases. Two outcomes of human adaptation are most relevant to personal wellness and public health policy: Evolution makes frequent errors in what is known as mismatch. Some negative health factors can be passed on epigenetically. First is the concept of evolutionary mismatch. This is a phenomenon that results when a species is not fit to its environment, either as the result of a mutation or a significant change to its environment. For humans, the most commonly cited example of mismatch is our stress response. Stress just had to keep proto-humans alive until they reproduced and perhaps took care of a few children. The idea of an outdated stress response is not a novel concept , but it has been cast in a new light by epigenetics. A cyclical problem results, which predisposes each subsequent generation to chronic stress. This, I believe, is the most crucial outcome of recent research on human adaptive mechanisms. To have our decisions directly affect the health of our children demands a new way of thinking about health. While some transferable health choices are more clearly avoidable, like the effect of smoking during pregnancy , others are so complex that it would be a full-time job for anyone to worry about all of them. Instead, we need a new approach to public health that reflects recent developments in our understanding of adaptive mechanisms and mismatch. The primary policy difference would be that we more proactively intervene in the development of problems to which people are epigenetically predisposed. There is now a new level of ethical responsibility to public health. Epigenetic studies inform us that this bioethical argument applies to all sorts of health and lifestyle components including nutrition and weight management if the mother is obese, the child is more likely to be. I do think, however, that we could take them more seriously and these findings are reason to do so. There are already known solutions to reducing stress, including community support. Yet, as the Harvard Business Review has recently shown , loneliness is in epidemic proportions and is itself a common cause of chronic stress. Perhaps, then, one solution to reduce chronic stress would a public health policy focused more upon outreach and community-based solutions to stress. For example, local governments could hold initiatives to get more people to exercise or fund more fitness resources. Exercise reduces stress , and people are more likely to exercise if others get them to do so. However, chronic stress is just one example of evolutionary mismatch which, when left untreated, is inherited by the next generation. There are many others, partially due to the fact that society acts as a rapidly changing environment. Resultantly, one of the best things you can personally do is to learn more about the modern impacts of human evolution. You can, however, build an understanding of what is generally good for people as a result of our evolutionary history. More importantly, scientific literacy, as has been highlighted for the policy battle over climate change in America, is key to reaching public policy informed by science. We now need to use that knowledge to raise support for the issue and to advocate for smarter health policies to deal with chronic stress and other cases of mismatch. Your support makes a difference in helping give staff members from all backgrounds the opportunity to develop important

professional skills and conduct meaningful reporting. All contributions are tax-deductible.

7: Theistic evolution - Wikipedia

A noted evolutionary biologist examines the creation controversy, explaining the fallacies behind the claims of creationists and providing a straightforward interpretation of the theory of evolution.

On a practical level these efforts may backfire. But more important, Christians should be encouraging the study of science in general, and evolutionary biology in particular. Far from presenting a threat to faith, science can reinforce and strengthen it. It has worked that way for me. As a Christian I find that the most objectionable aspect of trying to suppress knowledge about the origins of life on this planet, not to mention the creation of the universe itself, is what such efforts say about God. Over the past several hundred years, scientists have opened the frontiers of the human imagination by revealing how vast this universe truly is. Rather than seeing our cosmos as a rather limited system with the earth at its center, heaven above and hell below, we now understand that this planet is only one among a multitude, that our sun, rather then being the principal light that "rules the day," is actually only one among billions of such stars. Our appreciation for the vastness of space has expanded beyond the wildest imagination of our ancestors living only a few short decades ago. Likewise, our appreciation for the magnitude and mystery of time has grown exponentially. Rather than seeing time itself bound by what some students of the Bible asserted was an absolute limit of some several thousand years since creation, we now see that the history of the cosmos is measured in the millions of years, and likewise the future stretches forward beyond what any prophet is capable of seeing. This was perhaps the most important single contribution that Charles Darwin made to our understanding of life on this planet. Before Darwin people generally saw life on this planet as rather static; things did not change very much from the moment of creation several thousand years ago. After Darwin, we have come to see our past, like our future, stretching out before us farther than we can imagine, and all of time, past, present and future is full of change and surprise. Life is not confined to a narrow slice of several thousand years in which most things remain the same; rather life is active and dynamic, constantly changing and evolving. And once one sees what a vast and boundless cosmos this is, it is literally impossible to revert to a more simplistic view. Along with these ever expanding horizons of space and time that science has opened up for all of us, we have recovered a richer and I must say deeper understanding of the nature of God. Rather then seeing God as a monarch sitting on a throne in heaven and manipulating events here on earth like some supernatural puppet master, we now have a far deeper appreciation for the greatness of the God who could have conceived such a vast and dynamic cosmos in the first place. With every increase in our understanding of the complexity of the universe, we have a correspondingly deeper appreciation for the majesty, the grandeur and the glory of God. In this, we are not coming up with something radically new. Rather we are only rediscovering something very old, that more original, awareness that the wonder of this world and everything in it is a reflection of the still greater majesty of God. As the psalmist put it long ago: There is a hunger for a world that is simpler, safer, saner than the one we now inhabit. It is out of such fear and such anxiety that fundamentalist movements grow, not only within Christianity, but within Islam, within Judaism, within every culture and religion. And it is out of such fear that strategies of repression and censorship are born. Including the recent efforts in Kansas and several other states to suppress, restrict, or censor what science teachers can teach. The problem is, of course, that once the genie of science gets out of the bottle, it is simply impossible to stuff her back in. Despite all the effort to reduce human knowledge to what is comforting and familiar, the facts simply will not cooperate. And once you see that God is big enough to encompass all that we see and all that we know, a smaller deity is simply no longer credible. Intelligent Design vs Evolution: A False Dichotomy Apparently the long standing controversy over "creation science" has been upstaged by the newer confrontation between advocates of "intelligent design" and evolution. President Bush brought the authority of his office to bear upon the topic with his comment that "intelligent design" should be taught "alongside" evolution in public schools. Those who frame the conversation between science and religion as a debate or confrontation, have it wrong. And the mistake can be costly to both science and religion.

THE CASE FOR EVOLUTION pdf

8: 29+ Evidences for Macroevolution: The Scientific Case for Common Descent

These books present a persuasive and compelling case that the theory of evolution is fundamentally and fatally flawed.

In , in Webster v. In , in Peloza v. In , in Freiler v. Tangipahoa Parish Board of Education , the United States District Court for the Eastern District of Louisiana rejected a policy requiring teachers to read aloud a disclaimer whenever they taught about evolution, ostensibly to promote "critical thinking". Noting that the policy singled out the theory of evolution for attention, that the only "concept" from which students were not to be "dissuaded" was "the Biblical concept of Creation", and that students were already encouraged to engage in critical thinking, the Court wrote that, "In mandating this disclaimer, the School Board is endorsing religion by disclaiming the teaching of evolution in such a manner as to convey the message that evolution is a religious viewpoint that runs counter to Besides addressing disclaimer policies, the decision is noteworthy for recognizing that curriculum proposals for "intelligent design" are equivalent to proposals for teaching "creation science". Freiler v Tangipahoa Board of Education , No. High school biology teacher LeVake had argued for his right to teach "evidence both for and against the theory" of evolution. The school district considered the content of what he was teaching and concluded that it did not match the curriculum, which required the teaching of evolution. In January , in Selman et al. Cobb County School District et al. The disclaimer stickers stated, "This textbook contains material on evolution. Evolution is a theory, not a fact, regarding the origin of living things. This material should be approached with an open mind, studied carefully, and critically considered. The school district, however, appealed to the 11th Circuit Court of Appeals and in May the Appeals Court remanded the case to the district court for clarification of the evidentiary record. On December 19, , the lawsuit reached a settlement; the Cobb County School District agreed not to disclaim or denigrate evolution either orally or in written form. On December 20, , in Kitzmiller et al. District Court Judge John E. The reference book Of Pandas and People is available for students to see if they would like to explore this view in an effort to gain an understanding of what Intelligent Design actually involves. As is true with any theory, students are encouraged to keep an open mind". Furthermore, Judge Jones ruled that "ID cannot uncouple itself from its creationist, and thus religious, antecedents". In reference to whether Intelligent Design is science Judge Jones wrote ID "is not science and cannot be adjudged a valid, accepted scientific theory as it has failed to publish in peer-reviewed journals, engage in research and testing, and gain acceptance in the scientific community". This was the first challenge to the constitutionality of teaching "intelligent design" in the public school science classroom. Tammy Kitzmiller, et al. Dover Area School District, et al.

THE CASE FOR EVOLUTION pdf

9: The case for evolution

The ability to respond to certain cues is the result of long-term evolution. The reception of those cues, though, occurs at the individual level, and many are received from the previous generation.

Advertisement In Brief Despite definitive legal cases that have established the unconstitutionality of teaching intelligent design or creationist ideology in science class, the theory of evolution remains consistently under attack. Creationist arguments are notoriously errant or based on a misunderstanding of evolutionary science and evidence. Hundreds of studies verify the facts of evolution, at both the microevolutionary and macroevolutionary scaleâ€"from the origin of new traits and new species to the underpinnings of the complexity we see in life and the statistical probability of such complexity arising. Today that battle has been won everywhereâ€"except in the public imagination. Embarrassingly, in the 21st century, in the most scientifically advanced nation the world has ever known, creationists can still persuade politicians, judges and ordinary citizens that evolution is a flawed, poorly supported fantasy. When this article first went to press in , the Ohio Board of Education was debating whether to mandate such a change. Prominent antievolutionists of the day, such as Philip E. The good news is that in the landmark legal case Kitzmiller v. Dover in Harrisburg, Pa. The bad news is that in response, creationists have reinvented their movement and pressed on. Consequently, besieged teachers and others are still likely to find themselves on the spot to defend evolution and refute creationism, by whatever name. Nevertheless, even if their objections are flimsy, the number and diversity of the objections can put even well-informed people at a disadvantage. It also directs readers to further sources for information and explains why creation science has no place in the classroom. These answers by themselves probably will not change the minds of those set against evolution. But they may help inform those who are genuinely open to argument, and they can aid anyone who wants to engage constructively in this important struggle for the scientific integrity of our civilization. Evolution is only a theory. It is not a fact or a scientific law. Many people learned in elementary school that a theory falls in the middle of a hierarchy of certaintyâ€"above a mere hypothesis but below a law. Scientists do not use the terms that way, however. So when scientists talk about the theory of evolutionâ€"or the atomic theory or the theory of relativity, for that matterâ€"they are not expressing reservations about its truth. In addition to the theory of evolution, meaning the idea of descent with modification, one may also speak of the fact of evolution. Although no one observed those transformations, the indirect evidence is clear, unambiguous and compelling. All sciences frequently rely on indirect evidence. Physicists cannot see subatomic particles directly, for instance, so they verify their existence by watching for telltale tracks that the particles leave in cloud chambers. Natural selection is based on circular reasoning: That is, rather than labeling species as more or less fit, one can describe how many offspring they are likely to leave under given circumstances. Drop a fast-breeding pair of small-beaked finches and a slower-breeding pair of large-beaked finches onto an island full of food seeds. Within a few generations the fast breeders may control more of the food resources. Yet if large beaks more easily crush seeds, the advantage may tip to the slow breeders. In pioneering studies of finches on the Galpagos Islands, Peter Grant and Rosemary Grant of Princeton University observed these kinds of population shifts in the wild. The key is that adaptive fitness can be defined without reference to survival: Evolution is unscientific because it is not testable or falsifiable. It makes claims about events that were not observed and can never be re-created. This blanket dismissal of evolution ignores important distinctions that divide the field into at least two broad areas: Microevolution looks at changes within species over timeâ€"changes that may be preludes to speciation, the origin of new species. Macroevolution studies how taxonomic groups above the level of species change. Its evidence draws frequently from the fossil record and DNA comparisons to reconstruct how various organisms may be related. Natural selection and other mechanismsâ€"such as chromosomal changes, symbiosis and hybridizationâ€"can drive profound changes in populations over time. The historical nature of macroevolutionary study involves inference from fossils and DNA rather than direct observation. Yet in the historical sciences which include astronomy, geology and archaeology, as well as evolutionary biology , hypotheses can still be tested by checking whether they accord

with physical evidence and whether they lead to verifiable predictions about future discoveries. For instance, evolution implies that between the earliest known ancestors of humans roughly five million years old and the appearance of anatomically modern humans about , years ago , one should find a succession of hominin creatures with features progressively less apelike and more modern, which is indeed what the fossil record shows. But one should notâ€”and does notâ€”find modern human fossils embedded in strata from the Jurassic period 65 million years ago. Evolutionary biology routinely makes predictions far more refined and precise than this, and researchers test them constantly. Evolution could be disproved in other ways, too. If we could document the spontaneous generation of just one complex life-form from inanimate matter, then at least a few creatures seen in the fossil record might have originated this way. If superintelligent aliens appeared and claimed credit for creating life on Earth or even particular species , the purely evolutionary explanation would be cast in doubt. But no one has yet produced such evidence. It should be noted that the idea of falsifiability as the defining characteristic of science originated with philosopher Karl Popper in the s. More recent elaborations on his thinking have expanded the narrowest interpretation of his principle precisely because it would eliminate too many branches of clearly scientific endeavor. Increasingly, scientists doubt the truth of evolution. No evidence suggests that evolution is losing adherents. Pick up any issue of a peer-reviewed biological journal, and you will find articles that support and extend evolutionary studies or that embrace evolution as a fundamental concept. Conversely, serious scientific publications disputing evolution are all but nonexistent. In the mids George W. Gilchrist, then at the University of Washington, surveyed thousands of journals in the primary literature, seeking articles on intelligent design or creation science. Among those hundreds of thousands of scientific reports, he found none. Krauss, now at Arizona State University, were similarly fruitless. Creationists retort that a closed-minded scientific community rejects their evidence. Yet according to the editors of Nature, Science and other leading journals, few antievolution manuscripts are even submitted. Some antievolution authors have published papers in serious journals. Those papers, however, rarely attack evolution directly or advance creationist arguments; at best, they identify certain evolutionary problems as unsolved and difficult which no one disputes. In short, creationists are not giving the scientific world good reason to take them seriously. The disagreements among even evolutionary biologists show how little solid science supports evolution. Evolutionary biologists passionately debate diverse topics: These disputes are like those found in all other branches of science. Acceptance of evolution as a factual occurrence and a guiding principle is nonetheless universal in biology. Anyone acquainted with the works of paleontologist Stephen Jay Gould of Harvard University knows that in addition to co-authoring the punctuated-equilibrium model, Gould was one of the most eloquent defenders and articulators of evolution. Punctuated equilibrium explains patterns in the fossil record by suggesting that most evolutionary changes occur within geologically brief intervalsâ€”which may nonetheless amount to hundreds of generations. When confronted with a quotation from a scientific authority that seems to question evolution, insist on seeing the statement in context. Almost invariably, the attack on evolution will prove illusory. If humans descended from monkeys, why are there still monkeys? This surprisingly common argument reflects several levels of ignorance about evolution. The first mistake is that evolution does not teach that humans descended from monkeys; it states that both have a common ancestor. The parent species may survive indefinitely thereafter, or it may become extinct. Evolution cannot explain how life first appeared on Earth. The origin of life remains very much a mystery, but biochemists have learned about how primitive nucleic acids, amino acids and other building blocks of life could have formed and organized themselves into self-replicating, self-sustaining units, laying the foundation for cellular biochemistry. Astrochemical analyses hint that quantities of these compounds might have originated in space and fallen to Earth in comets, a scenario that may solve the problem of how those constituents arose under the conditions that prevailed when our planet was young. But even if life on Earth turned out to have a nonevolutionary origin for instance, if aliens introduced the first cells billions of years ago , evolution since then would be robustly confirmed by countless microevolutionary and macroevolutionary studies. Mathematically, it is inconceivable that anything as complex as a protein, let alone a living cell or a human, could spring up by chance. Chance plays a part in evolution for example, in the random mutations that can give rise to new traits , but evolution does not depend on chance to create

organisms, proteins or other entities. As long as the forces of selection stay constant, natural selection can push evolution in one direction and produce sophisticated structures in surprisingly short times. On average, the program re-created the phrase in just iterations, less than 90 seconds. The Second Law of Thermodynamics says that systems must become more disordered over time. Living cells therefore could not have evolved from inanimate chemicals, and multicellular life could not have evolved from protozoa. This argument derives from a misunderstanding of the Second Law. If it were valid, mineral crystals and snowflakes would also be impossible, because they, too, are complex structures that form spontaneously from disordered parts. The Second Law actually states that the total entropy of a closed system one that no energy or matter leaves or enters cannot decrease. Entropy is a physical concept often casually described as disorder, but it differs significantly from the conversational use of the word. More important, however, the Second Law permits parts of a system to decrease in entropy as long as other parts experience an offsetting increase. Simple organisms can fuel their rise toward complexity by consuming other forms of life and nonliving materials. Mutations are essential to evolution theory, but mutations can only eliminate traits. They cannot produce new features. Mutations that arise in the homeobox Hox family of development-regulating genes in animals can also have complex effects. Hox genes direct where legs, wings, antennae and body segments should grow. In fruit flies, for instance, the mutation called Antennapedia causes legs to sprout where antennae should grow. These abnormal limbs are not functional, but their existence demonstrates that genetic mistakes can produce complex structures, which natural selection can then test for possible uses. Moreover, molecular biology has discovered mechanisms for genetic change that go beyond point mutations, and these expand the ways in which new traits can appear. Functional modules within genes can be spliced together in novel ways. Comparisons of the DNA from a wide variety of organisms indicate that this is how the globin family of blood proteins evolved over millions of years.

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