Level 1 Questions

1. **What is the theory of evolution?** The theory of evolution is the scientific explanation for the diversity of life on Earth. It posits that all species of organisms arise and develop through natural selection of small, inherited variations that increase the individual's ability to compete, survive, and reproduce. Often attributed to Charles Darwin, the theory is supported by evidence from a wide range of scientific disciplines, including paleontology, genetics, ecology, and embryology.
2. **Can you explain the concept of natural selection?** Natural selection is a mechanism of evolution where individuals that have certain heritable traits survive and reproduce at higher rates than other individuals because of those traits. Over time, this process causes species to adapt to their environment as advantageous traits become more common in the population.
3. **What is the role of mutations in genetics?** Mutations are changes in the DNA sequence of a cell's genome. They play a crucial role in genetics by providing genetic variation, which can be acted upon by natural selection. While most mutations have little to no effect on an organism's fitness, some can be beneficial and others can be harmful.
4. **Define the term 'species' in a biological context.** A species is the basic unit of classification and a taxonomic rank in biology. It is often defined as the largest group of organisms capable of interbreeding and producing fertile offspring, or as a group of organisms that share a common lineage and maintain distinct genetic characteristics.
5. **How do molecules differ from atoms?** Atoms are the basic units of matter and the defining structure of elements. A molecule is made up of two or more atoms that are chemically bonded together. Molecules can consist of atoms from the same element or different elements, thus making them the smallest fundamental unit of a chemical compound.
6. **What is the basic structure of DNA and why is it important?** DNA, or deoxyribonucleic acid, is composed of two long chains of nucleotides twisted into a double helix. Each nucleotide includes a sugar (deoxyribose), a phosphate group, and a nitrogenous base. DNA is vital because it contains the genetic instructions used in the development and functioning of all known living organisms and many viruses.
7. **Describe what a protein is and its function in the cell.** Proteins are large, complex molecules made up of amino acids and are essential for the structure, function, and regulation of the body's tissues and organs. They perform a vast array of functions within organisms, including catalyzing metabolic reactions (as enzymes), DNA replication, responding to stimuli, and transporting molecules from one location to another.
8. **What is meant by 'fitness' in the context of evolutionary biology?** In evolutionary biology, 'fitness' refers to an organism's ability to survive and reproduce in a particular environment. It's often quantified as the number of offspring an individual contributes to the next generation or its genetic contribution to future populations.
9. **Briefly explain the concept of a genetic code.** The genetic code is the set of rules used by living cells to translate information encoded within genetic material (DNA or mRNA sequences) into proteins. It is essentially a biological cipher, where sets of three nucleotides (codons) correspond to specific amino acids used in protein synthesis.
10. **What is a cell, and why is it considered the basic unit of life?** A cell is the smallest unit that can live on its own and that makes up all living organisms and the tissues of the body. A cell's ability to perform the functions of life, including reproducing (cell division), responding to stimuli, maintaining homeostasis, metabolizing energy, and growing, explains why it is considered the basic unit of life. Cells can exist as independent units of life (such as in unicellular organisms) or can form colonies or tissues as in multicellular organisms.

Level 2 Questions

1. What is the "Big Question" that Axe poses at the beginning of "Undeniable"?
   - 1. The "Big Question" that Axe poses at the beginning of "Undeniable" is the question of origin, specifically, human origin and how we got here. He notes that Darwin's idea of evolution through natural selection brings awkwardness, not in terms of 'survival of the fittest' which is a truism, but in explaining the astounding richness of life[1].
   - > Of all the controversial ideas to come from modern science none has brought more awkwardness than Darwin's idea of evolution through natural selection. We know natural selection means "survival of the fittest" which in one sense isn't at all controversial. Indeed Darwin's observation that fitter individu- als are apt to have more offspring is so obvious it hardly needs to be stated. But how can something with so little content— a truism—possibly explain the astounding richness of life? The biggest question on everyone's minds has never been the question of survival but rather the question of origin— our origin in particular. How did we get here
2. How does Axe propose life originated, according to his book?

- While Douglas Axe does not seem to explicitly state his alternative proposal for how life originated, he does express personal discontent with the view of life as a fluid construct molded by natural selection from a simple ancestor. He suggests that if he were committed to the idea of natural selection being the creator of life, he would have to come to terms with this view, indicating that he finds it contradictory to his perception of the natural world[1].
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  Though I personally dislike this fluid view of life I would have to come to terms with it if I were committed to the idea of natural selection being life's creato

3. Describe the concept of "Common Science" as explained by Axe.
   - 3. According to Douglas Axe, the concept of "Common Science" involves viewing prior understanding as a foundation for refined understanding, even when new knowledge replaces the old. He discusses how teachers do not tell students to abandon their experiences or previous lessons, such as their understanding of motion from swimming, cycling, or skateboarding when they move on to Newton's laws in physics. This respect for understanding and recognition that it is never perfect or complete is a part of refining one's knowledge. However, Axe points out that these courtesies are surprisingly withheld when it comes to the intuitive belief in design. He argues that common science itself supports the design intuition because we know, for example, that bricks and breakfasts are only made if someone makes them. When this same intuition is applied to the origin of life, like the primordial soup, it is rejected for Darwin's theory, which Axe considers to be a significant discrepancy and a big mistake[1].
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     presupposes both a general respect for understanding and a humble recognition that it is never perfect or complete. Oddly these basic courtesies are withheld when it comes to the universal design intuition. The story of oracle soup con- vinced us we all have this intuition and we now see in simple terms how common science supports it. Bricks and breakfasts are made only if someone makes them. We know of no excep- tions. With that assurance we confidently apply the same intu- ition to primordial soup— only to be told we're wrong. The people who correct us make no serious attempt to refine the design intuition in order to explain why it would work 61 Undeniable_9780062349583_i_viii_1_296_2 61 5/2/16 4:39 PM Douglas Axe for one soup but not the other. We're simply expected to ignore the discrepancy. Apparently our otherwise trustworthy design intuition must be overruled for the sake of Darwin's theory. But intuitions aren't easily overruled. The psychology pro- fessors I quoted in chapter 2 Alison Gopnik and Deborah Kelemen are acutely aware of this. Their proposed solution is for teachers to begin replacing their students' design intuition with the counterintuitive evolutionary alternative at an early age. As Gopnik put it "The secret may be to reach children with the right theory before the wrong one is too firmly in place."2 But if the design intuition is a product of common science then surely to oppose it in the name of science is to make a big mistake

4. In what way does Douglas Axe critique Darwinian evolution?
   - 4. Douglas Axe critiques Darwinian evolution by pointing out what he calls a "gaping hole" in evolutionary theory, which was first noted by the Dutch botanist Hugo De Vries and later echoed by scientists Walter Fontana and Leo Buss. He mentions that natural selection may explain the survival of the fittest but not the arrival of the fittest, implying that evolutionary theory fails to account for the origin of new species or even new genes. Instead, the modern theory assumes the existence of the very entities it is supposed to explain. Axe suggests that scientists often overlook this issue or are allowed to critique it only if they do not challenge the overarching materialistic worldview of science. He likens this to a road repair crew being permitted to use a jackhammer as long as they patch everything up before leaving, implying that criticisms are tolerated only if the critic can claim to have filled the hole in the theory or at least made progress in that direction .
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5. Summarize Axe's position on the improbability of complex protein structures evolving through chance.
    - 5. Summarizing Axe's position on the improbability of complex protein structures evolving through chance, he argues that the root problem for blind evolutionary searches is the impossibility of finding the necessary functional coherence. Proteins manifest impressive functional coherence as molecular inventions, implying the intricate and precise arrangement of amino acids folding into a stable three-dimensional structure, which cannot be replicated by a random sequence. Axe equates the difficulty of achieving such functional coherence through blind chance to the improbability of having a coherent arrangement of letters or pixels by random selection, indicating that such complexity is highly unlikely to arise spontaneously[1].
    - proteins. In fact the root problem in both cases is the impossibility of finding the necessary functional coherence by blind searches because proteins as molecular inventions exhibit impressive functional coherence in themselves. Figure 10.6 helps us understand what functional coher- ence means in the context of a single protein chain. The value of ribbon diagrams like the one shown on the left side of the figure is that we can see where the chain forms either of the two regular conformations that characterize all folded proteins: alpha helices (shown as coils) or beta strands (shown as arrows). But that visual clarity comes at the cost of oversimplification as the more physically accurate stick representation on the right shows. Among the sticks we can with some effort discern a jagged version of the graceful path traced out by the ribbon on the left but we also see what appears to be a messy jumble of darkly colored appendages jutting out from that path in all directions. Believe it or not the functional coherence of this Figure 10.6 The role of the amino- acid appendages in forming protein structures. The three pic- tures each depict a portion of the smaller of two proteins that form the photosynthetic enzyme rubisco (shown at the bottom right of Figure 10.4). The middle image is a superposition of the ribbon diagram (left) and the stick representation (right). 179 Undeniable_9780062349583_i_viii_1_296_ 179 5/2/16 4:39 PM Douglas Axe protein lies within that complex "jumble

Level 5 Question

Question:

Level 5 Questions (5 Questions) Questions that require knowledge from different sources and disciplines Context: Scientists have grappled with reconciling biological evolution1,2 with the immutable laws of the Universe defined by physics. These laws underpin life's origin, evolution and the development of human culture and technology, yet they do not predict the emergence of these phenomena. We present assembly theory (AT) as a framework that does not alter the laws of physics, but redefines the concept of an 'object' on which these laws act. AT conceptualizes objects not as point particles, but as entities defined by their possible formation histories. This allows objects to show evidence of selection, within well-defined boundaries of individuals or selected units. Summary: In essence Assembly Theory attempts to explain where physics and biology meets by suggesting that objects which are the most 'efficient' to create more replicas of themselves dominate a closed system against objects that are 'less efficient'. The measure of efficiency is based on the number of recursive steps necessary to create a component. Question: This paper published in Nature is an attempt for evolutionists to bridge the gap between physics and biology. Does the existence of this paper discredit Axe's arguments that there is a fundamental lack of a gap between physics and biology?

Answer:

The existence of the paper published in *Nature* on Assembly Theory (AT) as a new framework attempting to bridge the gap between physics and biology does not necessarily discredit Douglas Axe's arguments. In fact, Axe acknowledges that biological systems often perform at or near limits set by basic physical principles[1]``[2]. He highlights that biologists should have by now grasped what life is deeply enough to have a clearer intellectual appreciation of it, which could then influence and shed new light on every subdiscipline within the field of biology[3].

Axe calls for scientists to develop and seriously consider ideas that deeply connect with the nature of biology. For him, such efforts are indicative of a vibrant scientific community[4]. This suggests that while Axe sees value in integrating physics and biology, he also stresses the importance of expanding our understanding of life beyond materialist approaches that have traditionally dominated the discourse.

It isn't so much about a "fundamental lack of a gap" between physics and biology in Axe's view but rather about how different scientific perspectives can contribute to a more profound and comprehensive understanding of life. Therefore, the paper in *Nature* on AT may be an example of the type of efforts Axe is advocating for—efforts that should be encouraged and taken seriously within the scientific community to advance our understanding of life.

Reference:

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   Strikingly when we do this (and there are not so many cases where it has been done!) the performance of bio- logical systems often approaches some limits set by basic physical principles

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   In other words in design situations where human engineers would want to push the limits of physical possibility if they could we often find that biological systems operate at or near those limits

3. **file-EEgY4ZWWryUGNMiA1rFQf47V**

   Since all these facts came out of the old school firmly situ- ated on the old road you may be wondering about the benefit of relocating biology to a new school on the new road. Here I go back to our mental picture. The greatest loss suffered by our imaginary old- school computer scientists is not a short- age of observations made as outsiders peering into their subject but rather their having excluded themselves from becoming insiders—from grasping their subject deeply enough to become participants in it. Now by suggesting that the materialist com- mitment has likewise excluded biologists from participating 270 Undeniable_9780062349583_i_viii_1_296_ 270 5/2/16 4:39 PM Undeniable in their discipline I don't mean biologists would be designing and building new life forms if Darwin hadn't taken us down the wrong road.10 I mean that biologists ought by now to have grasped what life is with enough clarity to inspire a much deeper intellectual appreciation of life. That insight completely missing from today's biology would shed new light on every subdiscipline. For something so fundamental not to have this comprehensive effect is inconceivable

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So if this is where the thoughts go are we allowed to go with them? My point— my plea—is that scientists ought to be encour- aged not only to develop ideas that touch biology so deeply but also to take those ideas seriously enough to test and extend them. Efforts of this kind ought to be hailed as the surest sign that the scientific community is alive and well. If we can agree on that then there are bright days ahead