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Honors 444B

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Hi Professor,

I wanted to let you know that this class has been the best discovery I have taken thus far. All the topics were very informative and interesting. You made me think critically on subjects I never wondered about and you were very engaged in my own life outside the classroom, which I appreciate. I am currently on the last few pages of *Rocket Boys.*  Fantastic recommendation. The book has inspired me to improve my body of knowledge in rocketry. I am sure you don’t remember the specifics of the book, but I will be adding prodigious to my daily vocabulary. I hope you have a great summer, and please feel free to email me anytime if you are interested in next years launches. The team will probably be making a newsletter type resource that can inform people events that are coming up regarding the club.

Respectfully,

Charlie

Quiz 3 2018

1. ***How are synthetic organisms different from GMOs? There are similarities but what are the differences? (10 points)***

Synthetic organisms, which is the result of synthetic biology, at its core, involves bringing engineering to biotechnology. Genetically modified organisms usually only have one engineered gene. This gene could help with insect populations or it could make them grow larger yields for farming. Synthetic biology aims to not only alter organisms by a couple selected genes but create organisms with entirely new gene clusters. This differs from GMOs in that they don’t limit themselves to what life is currently out there. The goal of synthetic biology and creating synthetic organisms is to create life. What is so controversial in the subject is if we have the right to play ‘God.’ Another question to ask ourselves is if we can, should we? iGEM, a synthetic biology company, is hard at work expanding our knowledge in synthetic organisms. There goal is to create new food sources that can expand our food production limits to heights that far exceed what GMOs are capable of. This can be frightening to think that the food in the future can be created purely by man, but not of nature. In general, GMOs and synthetic organisms are similar, but synthetic organisms are an upcoming field that strives to move past GMOs in terms of gene engineering to create sequences that have not existed by natural events.

1. ***What are 2 potential benefits and 2 potential adverse aspects of synthetic organisms. (16 points)***

There are many benefits and adverse effects that can come from synthetic organisms. Two major benefits include higher crop yields and creating crops more sustainable. By creating new gene sequences, we are able to create entirely new organisms, capable of producing things that have never been possible before. This allows for scientists to create larger yields that can feed more people or animals. Sustainable farming is crucial to long-term farming. Synthetic organisms will be able to pave the way to agriculture that we have never experienced. There are possibilities that have been unattainable due to restrictions with current gene sequencing available. That will change once we are able to create new life that can have different characteristics.

The adverse effects that most concern people are the uncontrolled escape of new synthetic organisms in ecosystems and the rise of new invasive species to different ecosystems. We are entering a period of genetic engineering that has never been tested before. We are unaware of the effects of releasing an organism has on a new ecosystem, whether it is for farming or other means. The species that is released can also leak into other habitats that can cause unwanted affects. They could become an invasive species that is, sometimes, uncontrollable.

If synthetic organisms will be used in actual real-life situations, we have to pay extreme attention to the consequences that could come from it. The research that requires this level of synthetic biology will also let us lean into the inner working of how life works.

1. ***What are 2 potential biological and 2 physical/chemical (i.e., non-biological) effects of removing a top predator from an environment? (20 points)***

Two potential biological effects of removing a top predator include the population explosion of the prey and the trophic cascade of the ecosystem. A population explosion for the species of prey is the most obvious consequence of removing a top predator. The predator-prey relationship is entwined together. When predator levels are high, the prey population will be low because of the increased hunting. But these levels will not hold because the predators will be unable to support their young, dropping their numbers. When predators are removed all together, the opposite is true. The prey population will explode to large levels. This results in a trophic cascade that affects the ecosystems down to its roots, literally. The initial impact of the disappearance of a natural top predator does not end in the increase of populations of its prey. Without the predators to limit the population of many herbivores in an ecosystem, their growth goes unchecked. This puts huge strain on the plant life of an ecosystem which can result in impeding plant reproduction. This leads to an extreme trophic cascade that can, in extreme cases, lead to the destruction of an ecosystem.

Two potential physical/chemical effects of removing a top predator from an ecosystem include behavioral changes in the remaining species and population sickness resulting in migration. Behavioral changes can be seen in the prey once the top predators from the ecosystem are removed. This was shown in Yellowstone National Park when the wolf population disappeared for a few years. This resulted in a large deer population that needed to be controlled by culling. The deer began to no longer need to constantly evade the constant pressure of being hunted. Instead of browsing softly on plants, they could remain in one place, eating their food down to the roots. Degradation began to occur in these locations. Once wolves were reintroduced, their behavior changed, but took time to readjust to the different stimuli from the wolves. Sickness and migration can ensue on large populations of prey as well. As food becomes scarcer, the populations can be malnourished, and many will become sick. The sick and malnourished will seek new habitats to feed on. Herbivores, or the prey, can likely be found in backyards and gardens because of the need to find more food. This affects different ecosystems that, with the top predators, would not be intruded on.

In general, many side effects can occur when there is a change in the food cycle. Top predators level out and control many cycles within an ecosystem or habitat. They should not be tempered with because even humans struggle controlling mother nature.

1. ***Do you think trophy hunting is ethical? Why or why not? (15 points)***

Humans are different than the life we live with on Earth. We can control our surrounding, harness power and do work with it. We have attained the ability to no longer spend our time struggling to survive, but to thrive. Our ancestors had to spend their days hunting to feed their families, their friends. Hunting is rooted in our history, but should it be anymore? When the necessity of hunting became obsolete for the common man, trophy hunting became a well-known, popular sport to engage in. Whether it is in competitions or social outings, people want to kill and treasure the biggest, or most valuable finds in the forest. But is it ethical? I think that life should be taken to support other life. Humans have been fighting to rise above the food pyramid to become an omnipotent ruler.

We no longer need to fit into the food pyramid like every other animal but create our own in farm ‘factories’ all over the world to support our numbers. To kill another animal and not contribute it to continue other life is not only unethical, but cruel. It is our responsibility as an intelligent species to not kill without a justified reason. A sport that prays on the weaker is not a sport, but murder. It makes me question many people who seek that thrill to overcome another lifeform. People can spend upwards of $50,000 to gain the permit to kill different exotic animals around the world, including rhinos in Africa. If that seems like a sustainable and ethical sport to foster and support around the world, we must define the meaning of human decency regarding other life.

1. ***Should scientists bring back any extinct species? Why or why not? (15 points)***

Humans have achieved the knowledge to bring back species from extinction. This can be from selective breeding, genome editing, or cloning. The question of de-extinction is a controversial subject regarding the impact it could have to ecosystems around the world. Every animal has a specific role to play, wherever they are. The passenger pigeon, which was one of the earlies man-made extinct animals, disappeared at the dawn of the 20th century. When alive, they played a crucial role in the habitat they lived in. At the dawn of the 19th century, their numbers were estimated to be 5 billion. They helped shape the forests they resided in by supporting the seed dispersal that many oaks needed (with their droppings). But since then, their used-to natural habitats have changed and transitioned into a collective that no longer relies on the passenger pigeon. Is it a good decision to bring them back even though the effects of their sudden appearance are a mystery? If there is one thing that Earth and the appearance of life has shown us, it would be that life finds a way.

Many ecosystems have found their own, beautiful way to cope with extinction, whether it be man-made or not. But if there is a way to bring back extinct species, will it ultimately happen? Is it the human tendency to do what is new and unknown ensure that we will begin to explore the de-extinction of select species? I believe that there could be a few species that should be brought back, each with different reasons, different pros and cons. The wooly mammoth is one that is a popular pick to be brought back. Besides the coolness of the achievement, scientist believe that they would help transition the artic ecosystems back into the grasslands that were common before they were extinct. Large herbivores help knock down large trees and assist in the spreading of grass seeds. This case of de-extinction has scientific backing on the impact it would have on Earth. Overall, with the ability of de-extinction within grasp, it opens possibilities to bring back certain species that would have beneficial impacts to its respective habitat. Therefore, with caution and due-diligence, scientists should be able to bring back species that have been discussed to have beneficial impacts on its surroundings.

1. ***What are 2 pieces of scientific evidence against the existence of free will in humans and 2 that support it. Results from studies. You do not need to go into great detail about the study design, methods, etc., but focus on the results that led to the conclusion that there either is or is not free will. Give a reference for each study cited. (16 points)***

In one study, participants solved word puzzles in which the words were associated with either rudeness or politeness. The study was double-blind, meaning that only the test designers were aware of the test. This eliminates a lot of the bias that can arise from either the participants or administrators knowing the goals of the test. The results showed that the participants exposed to the rudeness puzzle were much more likely to interrupt the experimenter in a part of the task. The interesting, and results in favor of the non-existence of free will, part was that the participants were unaware that the word puzzles affected their behavior. That test and scenario is one of many that impact our decisions sub-consciously. This evidence was found in ‘Is Free Will an Illusion’ by Shaun Nichols.

The second piece of evidence that supports the non-existence of free will is the presentation of five white circles to participants on a computer screen. The participants were given a small amount of time to pick a circle before one of them turned red. The selection of the circle turning red was completely randomized, so we should expect a percent chance of 20% for when a participant picks the circle that turns red. Instead, the results were above 30 percent. This suggests that participants’ minds had sometimes swapped the order of events in conscious awareness, creating a type of an illusion that a choice had preceded the change of the circle when it was biased by it. When the delay time of the change in color of the circle was increased to compensate for slower reaction times, the results lowered to around 20 percent. This allowed the mind to no longer play this trick in consciousness and get wind of the color change before a conscious choice was finished. This study was found in “What Neuroscience Says about Free Will” by Adam Bear. These two studies illustrate that there is strong evidence in that free will is merely a figment of our imagination.

In the favor of free will, one study tested participants with requiring them to step on a gas pedal when they were prompted with a green light, and vice versa with a red. A computer was attached to the participant, reading the early signs of brain activity from the new stimuli. When the computer noticed the brain activity, it quickly switches the light to the other color. Given this, the participants should have never been able to respond to the stimuli. But, red lights that appeared too close to the start of a response could not be completely inhibited, there “simply wasn’t time for the new cancellation signal to overtake the earlier command to move. Still, the principle stands — these results suggest at least some of the activity identified by Libet can, in fact, be vetoed by conscious will.” The author of the study continues to explain that this can be counted towards the ability of free will. This study was explained in “Neuroscience and Free Will Are Rethinking Their Divorce” by Christian Jarrett.

The second study that supports free will was to have volunteers perform movements at random interval times while not counting or planning when to make future movements but making a move as soon as they could. Then “an externally controlled "stop-signal" sound was played at random intervals and the volunteers had to cancel their intent to move. Whenever there was an action (a movement), the authors documented (and graphed) any tones that occurred before that action.” They compared their test results to the computer they were using to gather brain activity and concluded that movement from brain activity began, on average, before human movement. The authors concluded that the “generation of awareness” occurred after the action, but more importantly, that it was probably not the cause of the movement.

1. ***Do humans make free choices or are we using a complex central nervous system to respond to external and internal stimuli (input) where the responses can be modified by learning (memory, conditioning, education, etc., all related to memory)? Explain your answer and briefly discuss the potential consequences of your answer. This is really a thought questions that there is no set answer, so the grade will depend on the demonstrated effort, background work, and depth of thought. (20 points)***

I made the decision to treat myself to a piece of cake today but was this decision of my own or simply a figment of my imagination? Many philosophers believe that no one has free will, and no one ever will. Our choices are already decided, necessary outcomes to the events of the past, or they are simply random. Free will in this context can be described as the ability to make a decision without prior experience influencing it, which includes the inherent influences we are given at birth. A common approach that philosophers have used to create data on the issue was to ask participants in a study the following prompt:

*“Imagine a universe in which everything that happens is completely caused by whatever happened before it. So what happened in the beginning of the universe caused what happened next and so on, right up to the present. If John decided to have french fries at lunch one day, this decision, like all others, was caused by what happened before it.”*

In my opinion, all problems should be solved with a physics approach: boil things down to their fundamental truths and rise from there. If you read this prompt from that point of view, like many Chinese, Columbians and Indians seem to do, you would have a large majority of the database agree with that statement. But, in America, many disagreed with it. They believe that not everything needs prior instruction to function. There have been extensive biological tests to enable us to gain more knowledge in what goes into making a decision, whether small or large. The stimuli we are given externally or internally, known as an input, will be analyzed by our complex internal systems and pushed out as an action, also known as an output. These outputs cause a memory that play a role in all future stimuli that are similar to the ones before. This can be illustrated by eating dessert: it might make you feel good, but the thought of changing your physical appearance from it can cause many people to workout or eat healthier in the future. The influence of looking good can also be traced back to primal mating instincts which causes us to want to appear attractive to others that will have an influence on our future. The free choice that many people believe that they can control is not only a figment of imagination, but unattainable. We, as humans, naturally use our stimuli to make more intelligent and informed decisions as we grow old.