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Colossal Return of The Wooly Mammoth

Jeff Goldblum in the movie *Jurassic Park* said, “Your scientists were so preoccupied with whether or not they could, they didn’t stop to think if they should.” We are at a turning point in our history where we are, as many would say, trying to recreate Jurassic Park by trying to resurrect a wooly mammoth (“The Mammoth"). As a response to Jeff Goldblum’s quote, I say we absolutely should. This essay is an open letter to four scientists and other scientists who are similarly skeptical of this project: Love Dalén, professor of evolutionary genetics at the Swedish Museum of Natural History, Joseph Frederickson, a vertebrate paleontologist and director of the Weis Earth Science Museum in Menasha, Paul Knoepfler, a professor at UC Davis School of Medicine in Cell Biology and Human Anatomy, Matthew Cobb, a professor of zoology at the University of Manchester, Steve Brusatte, an American paleontologist and evolutionary biologist who specializes in the anatomy and evolution of dinosaurs. This project by Colossal aims to revive these extinct creatures to combat arctic permafrost melting, slow global warming, and advance genetic engineering knowledge. Despite the concerns about the technology's maturity, I want to emphasize the rapid progress in genetic engineering, reminding the readers of CRISPR-CAS9 technology and how that revolutionized genetic engineering. While I acknowledge the skepticism surrounding this *colossal* endeavor, I aim to persuade readers of its necessity for environmental, scientific, and ethical reasons, urging maximum funding support.

Before I go on further, I would like to introduce what an arctic permafrost is, and what consequences we might face if it continues to melt. Arctic permafrost is defined as rock or soil with ice that stays frozen for two or more years. It usually lies below an “active layer” of soil that freezes and thaws every year (“Climate Change Indicators"). There are numerous risks associated with the degradation of arctic permafrost. If more than two percent of permafrost thaws, twenty-eight billion tons of CO2 will be released into the environment which would increase global warming (“The Mammoth”). Also, trapped in the Arctic are hundreds of thousands of unknown species of microbes. A recent study recovered one thousand nine hundred and seven uncharacterized virus populations in one ninety seven samples across a permafrost thaw gradient in Sweden (Miner et al 809). If the arctic permafrost continues to degrade, it could break out and lead to another pandemic like COVID-19. This is further complicated by the presence of radioactive materials due to the Cold War nuclear testing (Miner et al 813). If these were to be released into the environment, approximately three million lives would be endangered. They could also be carried over to other continents over time through ocean currents, causing severe health risks. One of the best ways to avoid arctic permafrost degradation would be to rely on the beasts that roamed our planet three thousand seven hundred years ago, the wooly mammoth.

While Love Dalen believes that the resurrection of the wooly mammoth wouldn’t impact the environment in any considerable way, there is a very sound theory behind why that is not the case (Neuman). The resurrection of the wooly mammoths would help decelerate the melting of the arctic permafrost, lowering the overall effect of Global Warming. Mammoths were large beasts that walked the planet in herds. They compact snow in winter as they graze, removing a layer of insulation and exposing permafrost to extreme cold, keeping the chances of further degradation at a minimum. Even though I know Love Dalen, and other critics like him, believe

that this is just a theory, there is a study underway that is trying to prove this theory. Pleistocene Park is an Arctic tundra grassland restoration by Russian geophysicist Sergei Zimov project that has been successfully operating for the last forty years. The twenty square-kilometer park is filled with around hundred animals roaming free including bison, musk ox, and reindeer. The park is designed to determine if the animals can disturb and fertilize the current ecosystem where little grows into highly productive pastures, as well as slowing or even reversing permafrost thaw ("Pleistocene Park Foundation"). Considering we still are years behind in bringing back the wooly mammoth, the research would yield useful results by then. If it worked on bison, horses, and musk oxen which are much smaller than a wooly mammoth, then it would surely work on the mammoths. I believe we must continue to fund and work on bringing back the mammoth so that when Pleistocene Park shows positive results, we won't waste any time.

Another environmental benefit of bringing back the mammoths would be how they could also provide a new food source for predators such as polar bears in the Arctic region which are having trouble finding food due to shrinking arctic boundaries. This could help to support healthy populations of these predators. Henry Fountain in an article in the *New York Times* mentioned how, "By century's end, polar bears worldwide could become nearly extinct" given that, "There's not enough food on land to sustain a polar bear population." Polar bears rely on seals and other smaller animals for food since there aren't a lot of other land options available to them (Fountain). Due to the shrinkage of arctic sea walls, it's getting harder for them to find food. Mammoths would not only slow down the melting of the Arctic region but also give animals like Polar bears a new food source. I believe this makes it even more important to resurrect mammoths since they would not only help save the environment but also directly

impact the survival of polar bears and other endangered animals that are on the verge of extinction.

Even though the resurrection of mammoths has many ecological benefits, like providing food as a new food source for predators, Joseph Frederickson has expressed concern that the introduction of wooly mammoths into a new habitat might disturb the ecological balance. While this concern is reasonable, he overlooks the fact that three thousand seven hundred years isn't enough time for the environment to change in a way that would reject their formal species (Neuman). Lasting evolution, amongst the species and the environment, takes millions of years (“Lasting Evolutionary Change”). Four thousand years isn't enough for the Arctic species to evolve so significantly that they can no longer deal with the mammoths. One of the most famous species of the Arctic, the polar bear, evolved approximately seventy thousand to over one million years ago (Harmon). They co-existed with the mammoths for a hundred thousand years. Four thousand years is too small in the grand scheme of evolution to be of any significant harm. In fact, it will benefit the environment. Wooly mammoths are not an invasive species. Frederickson also pointed out that, "There were plants and animals that were living alongside the mammoth that are now long gone or have drastically shrunk in their range, and just bringing back the mammoth won't bring those back” (Neuman). According to Colossal, the point of resurrection is not to bring them all back, but to increase the biodiversity of the arctic ecosystem (“The Mammoth”). It has been seen countless times how biodiversity leads to a healthier environment (Grace). Researchers from the Wetland and Aquatic Research Center have found clear evidence that biological communities rich in species are substantially healthier and more productive than those depleted of species, making it favorable for us to bring the mammoths back.

Similar to Frederickson's concern, Paul Knoepfler believes that mammoths could easily be contaminated with microbes in the lab and then pass it on to other animals like elephants, indirectly disturbing the ecological balance, but it is possible for us to completely avoid that problem through genetic engineering (Knoepfler). While it is true that mammoths could carry diseases that are common in elephants, such as elephant endotheliotropic herpesvirus, it would not be as large a problem as it might appear. Colossal has mentioned how the mammoths resurrected would be genetically modified ("The Mammoth"). It is possible for us to genetically modify them in a way that gives them resistance to diseases of those types, like endotheliotropic herpesvirus. Studies have pointed out that through gene editing "The researcher can then influence how the DNA is repaired, introducing very precise genetic changes at a target locus in their species of interest. This technology has been revolutionary and provides exciting possibilities for the production of livestock resistant to viral diseases" (Li et al 1) This technology has so far only been used for pigs and cows, i.e. livestock, but the same technique can be used to give mammoths immunity as well. When the mammoths themselves are immune to such diseases, they won't spread it to other species.

The resurrection of mammoths also has other benefits. Even though saving the environment should always be our priority, that doesn't mean we can't use this opportunity to expand our knowledge about genetic engineering through experimentation. If we manage to resurrect a wooly mammoth and genetically modify it to handle the warmer temperatures we have today, we could in theory do that with all the mammals, including humans. As it was said on the website of the National Heart, Lung, and Blood Institute, "In the future, genetic therapies may be used to prevent, treat, or cure certain inherited disorders, such as cystic fibrosis, alpha-1 antitrypsin deficiency, hemophilia, beta thalassemia, and sickle cell disease. They also may be

used to treat cancers or infections, including HIV" ("Genetic Therapies"). This would be a game changer since diseases like cancer require treatment methods that can be harmful to the human body. Using genetic engineering we could cure cancer without ever having to force the body through high amounts of radiation. Therefore, resurrecting the wooly mammoth would not only help the environment but also advance our knowledge of genetic engineering.

Genetic engineering is indeed a sensitive topic, especially when dealing with complex organisms like mammoths and humans. The general public has always expressed its concerns regarding the safety of genetic engineering, but this isn't true in the slightest. A recent survey published said, "54 percent of the population believes that gene editing could jeopardize moral and ethical principles in scientific practice and give rise to unacceptable experiments" (Mandal). I would like to assure the reader that as long as companies undertaking genetic engineering do so with proper safety protocols, the risks associated with genetic engineering are minimal. Genetically modified organisms are already being used in large-scale industrial settings to produce pharmaceuticals (Morris 1). Studies have already been done to ensure its proper regulation and safety by the FDA. This would save us from creating whole new guidelines from scratch. We could simply modify the preexisting ones. However, the addition of species to communities where they did not exist can have undesirable effects that one needs to be aware of while dealing with genetic engineering. One of the biggest unforeseen side effects could be a transfer of genetic alteration from one species to another (Sharples 23). Hypothetically, mammoths with resistance to heat to survive the current day temperature could get transferred to polar bears over a long period, allowing them to survive in places they wouldn't have been able to, which would lead to their population growing and infiltrating the habitats of other species and ruining the ecological balance. However, these alteration transfers have only been seen in

microorganisms (Sharples 23). Mammoths on the other hand are extremely complex. It is close to impossible for them to transfer the trait over to polar bear which has a completely different body physiology. In conclusion, ecologists and environmental scientists do not believe that the products of biotechnology, like genetically engineered organisms, will generally be harmful (Sharples 29).

Now, I realize how sensitive the resurrection of mammoths is for the general public. That's why I decided to talk to my friend[1] about this project and discuss her concerns regarding it. While the arguments I mentioned so far convinced her, she did have one doubt. She pointed out to me how the problem of poaching and hunting the mammoths might lead to their extinction again. Even though she is right, this isn't a big issue. Humans out of their greed have led animals like the Dodo bird and Golden Toad to extinction ("Extinction Over Time"). There is no guarantee that we wouldn't do the same with mammoths. Even though this is a real threat, poaching of mammoths would be hard to do due to multiple reasons. Mammoths have very thick and wooly skin, which makes them hard to kill with conventional firearms ("Mammoth"). Furthermore, mammoths will roam the Arctic region, which is one of the most scientifically guarded places on earth. Organizations are working in the Arctic trying to stop climate change and save native Arctic species making the monitoring of mammoths an easy task. Lastly, other elephant species we have on earth are usually in the region which is easy to access. That's not the case with the Arctic. It will be nearly impossible for poachers to reach the Arctic with proper hunting equipment, avoid the patrolling organization, and manage to survive in the harsh Arctic climate. Still, precaution has to be taken. We need to conduct in-depth research about possible mammoth habitat locations and how safe it is there before releasing them into the wild.

[1] Special thanks to my friend Maham for mentioning her concerns about the project

Before concluding my essay, I would like to touch upon one of the biggest criticisms of the resurrection project as mentioned by Matthew Cobb: the resurrection of mammoths is unethical and we are "playing god" by bringing back the mammoths. However, he is neglecting the fact that we might have been the main reason for the wooly mammoth's extinction (Naraharisetty). Between one twenty six thousand to six thousand years ago, the climate oscillated between cool and dry to wet and warm. These climate oscillations forced the mammoths to slowly concentrate in smaller areas with climates suitable enough for them, which led to their population size dropping (Nogues-Bravo et al). At the same time, the human population grew rapidly during this time and we started to hunt other animals en masse for food and game. Models published in the research by Nogues-Bravo suggest that humans likely had a major role in the extinction of wooly mammoths. According to him "one wooly mammoth killed every three years by each human being inhabiting its distribution range would be sufficient to lead the species to extinction." Wiping out entire species, like the wooly mammoths and more recently the dodo bird, is highly unethical. Keeping that in mind, I believe it is in our best interest – and that it is ethical – to resurrect them to restore the natural balance in the Arctic that was lost 3700 years ago. Steve Brusatte also argues that mammoths were adapted to Ice Age climates with average temperatures up to 10 degrees Fahrenheit colder than today (Martindale). If they return, they would be facing temperatures "much warmer than any mammoth ever experienced," but Colossal has already said they would be modifying the DNA of the wooly mammoth to make sure they can survive in the new environment using CRISPR-CAS9 technology, making the fact that they wouldn't survive in today's climate and would suffer irrelevant.

Despite our differences, Love Dalen, I, and the other scientists I mentioned throughout the essay are all scientists in our respective fields and share a common goal: safeguarding the planet and its species. This essay aims to determine what is right, not who is right. Love Dalen emphasized the importance of preserving existing species over resurrecting mammoths (Scott), a viewpoint I partially agree with. Our reckless exploitation of Earth's resources and wildlife has driven many species to extinction. Millions of animals turned to dust in a matter of a few hundred years. Earth is a delicate biosphere, where every living organism plays a crucial role. Damaging these components will ultimately stop the planet's clock and our time on it. To prevent further environmental harm, we must support conservation projects. Instead of fighting over which projects to fund, why can't we find common ground on such issues and work together? Why can't we save the species we have today and bring back the older ones? In 1987, during a triple planetary crisis, the Montreal Protocol successfully restored the ozone layer ("Rebuilding the ozone layer"). This international effort demonstrated the power of unity. We are once again at a turning point in our history. Preserving current species and resurrecting mammoths are both equally vital. I urge scientists all around the globe to not fight with each other, trying to prove the other scientists wrong. We are now at a point where we need to take action fast or it will be too late. Debate is no longer an option. Wooly mammoth research can benefit the environment and provide genetic engineering insights for saving endangered species, such as the African elephants. For the sake of our only home, the Earth, we need to put aside our differences and support this project.

Sincerely

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