The Flawed Genetics of Jurassic Park

By James P. Zaworski

"***The lysine contingency - it's intended to prevent the spread of the animals is case they ever got off the island. Dr. Wu inserted a gene that makes a single faulty enzyme in protein metabolism. The animals can't manufacture the amino acid lysine. Unless they're continually supplied with lysine by us, they'll slip into a coma and die.***" (**JURASSIC PARK,** Michael Crichton, 1990)

The movie Jurassic Park, based on the book of the same name penned by Michael Crichton, is one of the most successful science fiction films of recent memory. The theme of the movie is that an eccentric billionaire, named John Hammond, has invested his vast fortune in a theme park of unusual and very unique qualities: he has hired the best in the scientific fields of genetics and paleontology, as well as paleobotany, to resurrect real living and breathing dinosaurs, some 65 million years since they have gone extinct! The Jurassic Park is situated on an island, Isla Nublar, off the Pacific coast of Costa Rica, and will draw visitors from around the world to see dinosaurs in the flesh. Hammond has spared no expense, to use his favorite line in the film. However, he has run into some legal trouble, due to some lawsuits surrounding the accidental deaths of some employees that work in the park, and he needs to reassure his investors back in the United States that the park is indeed safe and a fully sound investment, with guarantees of huge returns on their initial investments. To do this, he has hired Ian Grant, a top dinosaur paleontologist, and his girlfriend, a top paleobotanist, as well as a chaos mathematician, to help determine that the island park is safe for tourists, and this determination is to be made by a lawyer representing the investors. Throughout the course of the film, the park proves to be a disaster in the making, as a disgruntled employee, a hurricane, and the dinosaurs themselves, wreak havoc throughout the park, killing and eating people, each other, and setting up shop in the late 20th century. This paper will seek to identify three genetic themes from the movie Jurassic Park, to explain these themes, and to show how the film has incorrectly used these genetic themes.

The first genetic theme involved in the movie is cloning of dinosaurs. The film has a section in which the audience is hand held, and condescended quite a bit, through the process of how they did it, that is, cloning the dinosaurs, which have been extinct for 65 million years. Well, where do you get dinosaur cells that retain DNA? Certainly not from fossilized bone, as the original material has become hard as stone and has been mineralized as well. The answer lies in the fact that very similar annoying biting insects surely lived and pestered the dinosaurs, much as they do us on a muggy afternoon in the shade on an August day. These insects occasionally get stuck in the natural oozing sap of the gymnosperm plant species that dominated the Jurassic and Cretaceous landscapes, pine trees. Covered over by sap, an insect who has just feasted on the blood of a Tyrannosaurus rex, for example, would have consumed both kinds of blood cells, red and white blood cells. The red blood cells or erythrocytes are not nucleated in their mature form, but the white blood cells, or leucocytes, have a nucleus present. In this nucleus, as in the nuclei of other cells, there is a nuclear membrane that surrounds the nucleus, and within is the genetic material, with a full complement of chromosomes, with genes attached at certain loci, made up of DNA. So, the argument goes in the film that this blood, preserved inside the gut of an archaic mosquito, and not yet digested, would be perfectly preserved inside the now tree resin covered, and dead, mosquito. This substance would then harden, and eventually fossilize itself, in the form of amber. 65 million years in the far distant future, in the amber trade say, in the Baltic region or on the island of Hispaniola, these amber globules containing the treasure of a trapped insect are purchased by agents of John Hammond, who spared no expense, who then bring these gems back to a special laboratory, and extract the blood, which contains DNA ready to be cloned. The movie presents this blood as a fully liquid blood, as the camera shows a hole drilled into the amber, and a syringe inserted into the abdomen of the mosquito, and actually drawing liquid blood from it! If that were not ridiculous enough, the movie tries to halfheartedly talk about DNA gaps that need to be filled if successful cloning were to take place. DNA begins to break down when an organism dies, and this degradation continues over time, starting with the cession of cellular activity. This would eventually result in the total annihilation of

the DNA, if it had not been for the preservation in amber. DNA, or deoxyribonucleic acid, is the blueprint as it were, for, and the instructions to make you what you are. Self replicating in mitosis, DNA is the stuff of life. To make a complete organism, one would need a complete DNA sequence. This sequence is made up of the four nucleotides which make up DNA, that is, adenine, thyamine, cytosine and guanine. Adenine bonds only to thyamine, and cytosine only to guanine. Thus, a sequence like G-A-T-C-A-G-C-C might code for one gene, which is responsible for a particular physical trait, or expression of that gene. There are thousands upon thousands of genes in the genetic compliment of even a fruit fly, much less the complex multicellular creature that is a vertebrate dinosaur, or human for that matter. So, in other words, a full gene sequence would be needed of a human in order to make a human or of a dinosaur to make a dinosaur. Any gaps in the sequence would result in something that would be omitted in the development later on, or that no development would take place, and thus, no dinosaur. Well, to make up for the gaps in the DNA sequences, the author and film makers decided that they use frog DNA to fill in the gaps! One huge problem here is that number one, though a frog may be fully karyotyped as to numbers of chromosomes, how many genome projects have been completed on frogs? A genome project is the full genetic mapping of each and every gene in the DNA of an organism. OK, let us say that this is true of the frog in question whose DNA we are hypothetically using. The next problem beyond mapping of genes and sequences is to find out their function! We might know the function of a couple of dozen genes, and what traits they are responsible for, but certainly we do not know the function of all genes, much less the ones that would be inserted into the gaps of sequences in a dinosaurs gene sequence! Another gigantic problem is that the DNA sequence of a dinosaur has never been mapped, and even if it were, we would not know the function of even a single gene or gene sequence, since no one has a live animal to experiment with! So, the film fails miserably to convince a scientifically savvy individual that you can just stick in some frog DNA and that will fix the gaps in dinosaur DNA. Theoretically, it is possible, but extremely remote in possibility, and not right now. Perhaps in the distant future, something like this may be possible, with a computer that can sequence genes lickety split, together with deciphering the respective codes for function for each and every gene sequence of both frog and dinosaur! The film continues from here, fully reassuring the audience that frog DNA fully fixes the gaps, and that now we can go ahead and clone a dinosaur. Well, to clone an organism, one has to take a relatively undifferentiated cell, stick a tiny syringe in the nucleus and extract the genetic material of this host cell, and then take the dinosaur DNA, and inject this into the nucleus, where it will suddenly start replicating through the actions of mitosis. If this cell works, so to speak, it is best to put this nucleus into an egg, which presents another problem. Into what species do you put dinosaur DNA, so that the ontogenetic development will continue, from single cell to blastula, and on and on until the embryo develops until it is time to hatch? Well, the film uses crocodile eggs, which seem to work nicely (although if it were a Brachiosaurus, one would think you would need a bigger egg, unless they hatched out as tiny as 8 inch long baby crocodiles!). Cloning of vertebrates is also a very tricky business, with a high rate of failure. To successfully clone sheep, like Dolly, the geneticists had something like a 98% failure rate! This, using live cells with their nuclei being implanted into live cells. Here, we have DNA from an extinct animal, doctored up with frog DNA, and I think it just would not work. Scientists have extracted DNA from the extinct zebra called the quagga, from hides preserved in museums, but I know of no credible attempt to clone them to get them back, and if it is even possible. There is talk of trying to clone the Thylacine, or Tasmanian Marsupial wolf, from a pup preserved in alcohol, but it is a long shot to be sure. The same goes with the mammoth, frozen in ice. The further you go back in time, the less likely it is to get a successful clone.

The second theme relating to genetics in the movie is the act of genetic engineering. Genetic engineering is a science that is less than thirty years old, and is still really in its infancy. Gene splicing, and genetic manipulation have been successful in bacteria, and are routine these days. Genetic modification of plants is commonplace, and there is even now a designer glowing zebra fish that is all the rage, and there was even a glowing bunny created recently. However, the movie

Jurassic Park, made in the early 1990s, puts genetic engineering ahead even of what it is at the current date. Perhaps the incentive of big cash bonuses to the scientists would make them more brilliant, and more apt to advance way ahead of their time? I think that the presentation of genetic engineers as far beyond their time, and that they are people without a conscious, is incorrectly portrayed by the film. I also think that the film tends to feed the general public's mystique of the mad scientist, whose almost god-like ability to modify the material of life itself, and without concern for consequence, makes for a kind of Orwellian future that is bleak for us all. The third theme relating to genetics that I am using from the film is the selecting for desired traits in animals. Again, this is another unlikely scenario, at the present time, due to the fact that even if we had a living and breathing dinosaur, and its genome all mapped out nicely, that we still would not be able to know what each and every gene does, and not in the nifty time period laid out in the movie. In the film Jurassic Park, the main traits that are selected for are for a lysine deficiency in the dinosaurs, so that the lysine contingency can be implemented if anything goes wrong, as the dinosaurs are dependent on the human benefactors in terms of being supplemented with this essential amino acid, or the dinosaurs would die. By implementing the lysine contingency, denying them this amino acid would result in their deaths. The other trait that is selected for is that all of the dinosaurs in the Jurassic Park were to be genetically female. However, this all goes wrong, as the dinosaurs end up finding their own sources of lysine on the island, and the dinosaurs end up reproducing! In terms of selection of particular traits, the genetic engineers would again, have to have complete working knowledge of what genes or gene sequences were responsible for what traits that are later manifested in the dinosaurs themselves, and this would be no small task as there are dozens and dozens of species of dinosaurs represented in the film, from all three major eras of dinosaur existence, from the Triassic, Jurassic and Cretaceous Periods. Still, it is possible for this gigantic task to be achieved, especially due to the super advanced genetic engineering displayed in the film! I say this is pretty unlikely to say the least! The selection for all female dinosaurs is more plausible, as genetically, all vertebrates begin life as female, and it is the introduction of a key hormone during embryonic development usually that will change a sex chromosome to be male. So, to select for this would be much easier than to select for another, more vague trait. However, in the film, the pesky frog DNA raises its ugly head once again. The dinosaurs end up reproducing like crazy, indicating that this trait selection, because life will find a way. Well, the premise here is that in times of stress, certain species of frogs can change their sex from female to male, and that this quality was selected for unwittingly by the geneticists, who had stuck in frog DNA into those dreaded dinosaur DNA gaps! Sure, it is possible, but is it likely? Is it likely that the same frog DNA sequences that would code for this trait would be inserted into the right gap for each different species of dinosaur, which have different DNA from one another, and different sequences of genes, and different gaps of DNA? Still, the movie uses this, as implausible as it may seem. Why would not, if you were selecting for particular traits, would not you select for a toothless Tyrannosaurus rex? Or how about one that does not eat meat, and is as tame as a puppy? Sure, it is possible to genetically modify an organism to achieve a particular trait, but we are not there yet in terms of the kinds of gene sequencing and genetic mapping made apparent in the film. Why would not the world be a better place, with such technology, as if we had the power of the genetic engineering in the film Jurassic Park to select for certain desired traits, so that we could select for, say, a perennial corn that produces one thousand full ears of corn, never has to be replanted, and is completely disease and pest resistant, and drought resistant, and has a full daily allowance of recommended nutrients to keep a human being alive, in just one kernel of corn from one of its one thousand ears One thing that they did not take into account in the film is that the natural reproductive state of dinosaurs could be that they were all female, and reproduced via parthenogenetically. Parthenogenesis is a kind of asexual form of reproduction, and it is present in certain species of lizards, and some fish as well. I do think that the movie Jurassic Park is flawed when it comes to the realistic expectations of how it relates to the state of genetics, genetic engineering, cloning, and bioengineering especially at the time it was released in the early 1990s.