Third Place: Academic

"Speculative Biology in Popular Culture and Educating a New Generation"

By Ava McCall

In 1933, the Loch Ness Monster was spotted once again. The Loch had been plagued with reports of strange goings-on since the sixth century AD, but the Spicer family were the first to report the Nessie that we know today. Reports predating this sighting were all over the board- from a "whale-like creature" seen by Aldie Mackay earlier in 1933 to a creature seen in 1888 that looked like a salamander. The Spicers, however, saw a long-necked creature that was, as George Spicer described, similar to a "…dragon or prehistoric animal", with, "...web feet", and an arched back (Tikkanen, 2023). Following the Spicer sighting, though, tourists agreed- the Loch Ness monster had a long neck, an arched back, and a small head, reminiscent of contemporary depictions of the Plesiosaur, like the one in *King Kong*, which conveniently came out in April 1933. Featured in *King Kong* was a scene in which an aquatic dinosaur with a long, arched neck and a humped back attacked explorers on Kong's Island.

Today, conspiracy theorists maintain that Nessie is real, and is a late-surviving plesiosaur or population of plesiosaurs that were isolated in the Loch due to continental drift millions of years ago. *The New York Times* even published an article touching on why a recent discovery that plesiosaurs may have lived in fresh water brought hope to Nessie hunters worldwide (Gross, 2022). This, of course, is false, and one of the biggest points against this line of reasoning is that plesiosaurs could not arch their necks in the Loch Ness Monster's classic manner. In fact, it is recently hypothesized that they could barely lift them at all- modern-day depictions of plesiosaurs have very long necks and small heads, but these extend in front of their bodies almost completely

straight out, and are thought to have been used to be able to get their mouths close to fish without startling them with their large bodies. It's thought that they could turn their necks side to side, but were much more limited in vertical mobility (Gross, 2018). The *King Kong* depiction was completely inaccurate. There is no way Nessie is a late-surviving plesiosaur, because if she was, she would not have the classic Loch Ness arched neck.

This dissonance is because the plesiosaur behavior in *Kong* was a work of speculative biology. The writers of the movie took the skeletons of long-dead creatures and, seeing the long necks, speculated that these necks could be used to attack prey on land. This speculative behavior was shown to millions because the 1933 action movie was wildly popular. Just months after its release, the Spicers conveniently saw a creature ripped right off the screen and ignited a national wave of misinformation about plesiosaur biology and the fossil record that has lasted to this day. Speculative biology is a field in which experts and laymen alike will take biological concepts and apply it to speculative scenarios. Speculative biology, despite being relatively little known, has widespread impacts on the general public's knowledge of real biological concepts. Like the late-surviving plesiosaur theory from *Kong*, it can have negative impacts on the public's knowledge. However, there are a multitude of examples where speculative biology can inform the public about biology or incite inspiration in the topic because of its creative format.

Speculative biology has many different facets. It is based on real-life biological concepts of evolution, classification, and zoology (Naish, 2015). It is also known as speculative evolution, and speculative zoology, but the term speculative biology will be used to refer to any work that features creatures or evolution that did not happen on Earth, but is rather speculative, and at least loosely based on real-life biological concepts. The *Kong* plesiosaur, and *Kong* as a whole, is speculative biology, because it took knowledge of prehistoric animals of the time and imagined a

world where these creatures survived to the present day. King Kong himself is a product of the idea that a gorilla-like primate could grow to massive size, possibly inspired by the real-life prehistoric animal *Gigantopithecus.* Many forms of media feature speculative biology based on real-life evolution, from movies (*Jurassic Park*) to literature (think the scientific and biological approach of the *How To Train Your Dragon* books). This paper will focus on the different ways speculative biology has influenced the general population's views on biology, good and bad, and how people have taken advantage of its creative and inspirational success in teaching biology.

Jurassic Park came out in 1993. Steven Spielberg's popular culture juggernaut imagined a world where scientists found dinosaur DNA in prehistoric amber and cloned these creatures in a lab. The result- prehistoric creatures, from T-rex to Mosasaurus, walking (or swimming) the Earth alongside modern animals. The writers of *Jurassic Park* naturally had to speculate on what these dinosaurs would look and act like. All paleontologists face this issue as well.

World's writers decided that the Velociraptor was a huge, fierce dinosaur with intelligence to match modern-day primates who are closest to humans in ancestry (Naish, 2015). In reality, the velociraptor was the size of a large bird, and we have no idea how intelligent it was. However, the common person will probably tell you that the Velociraptor was the size of a horse and was highly intelligent. The Velociraptor has been described as, "…one of the best known yet little understood dinosaurs that ever lived" (Taylor, 2021). In fact, this is a misconception that British paleontologist Dave Hone at the University of London complains he is constantly subjected to educating about, as he mentioned in his article, "Everything People Ask Me About Dinosaurs, They Learned from *Jurassic Park*" (Hone, 2008). This effect is common among pieces of media that contain speculative biology, which is very commonly dinosaur media. Even documentaries made about dinosaurs contain inaccuracies that are discovered mere months after their creation.

The issue of recreating dinosaurs is incredibly complex, as sometimes all we know these creatures from are a few teeth or a vertebral column. When dinosaurs were first discovered, they were recreated as creatures out of a fairytale. Lumbering, scaled behemoths that would have trouble fitting into any ecological niche were described, as well as wildly inaccurate dragon-like creatures with bony faces and sharp, exposed teeth. As more scientific work is done, largely based on what we know about biology from today's animals and DNA testing, we learn more and more about where dinosaurs came from, what adaptations they needed to survive that caused them to become so alien-looking, and also that they might not look as frightening as we describe them to be.

Many books have been written and illustrated on the topic of speculative biology, most famous of which being *After Man* by Dougal Dixon. This book prompted the release of *All Yesterdays,* written to use speculative biology to depict how outdated and inaccurate dinosaur depictions can be by reimagining them in new ways that challenge the cultural norm. In this book, the issue of 'shrink wrapping' is explored. Shrink wrapping is the term used when creatures are speculatively recreated with their skin much too tight to their bones, when in reality there would be fat tissue, lips, and eye protection on the faces of these creatures. In *All Yesterdays*, the skeletons of modern-day animals - including humans and swans - were used to speculate on how civilizations of the future might inaccurately recreate them. The result was usually horrifying, as illustrated in Figure 1. These depictions bring to light how inaccurately many dinosaurs may be recreated, and how these recreations can be influenced by modern beliefs about dinosaurs' intimidation factor and outlandishness.

Shrink wrapping is common in paleontological recreations. Recently, a controversial study explored whether or not T. Rex had lips. Many people were upset when this study concluded that it was very likely (Bouabdellah, 2021). When people grow up seeing these inaccurately created dinosaurs, it can be hard to see them changed in ways that make them 'less cool' (As seen in the introduction of feathers and more fat tissue in dinosaurs). It is the responsibility of those within the biological field to find and report the truth about these concepts, despite how much nostalgia people may have for inaccurate depictions of dinosaurs.

When speculative biology is used irresponsibly, people are given false information about the biology of our world. When it is used more strategically, it can ignite inspiration in young people and those not involved in biology to explore the topic and possibly find a passion there.

The video game *Spore* came out in 2008. Many children in Generation Z played it as they grew up in the era where the internet transferred from being a futuristic commodity to a tool used mostly daily by everyone. As this transition occurred, experts began to realize that the internet could also be used for education. Prior to its release, *Spore* creator Will Wright did an interview with *NPR* and a Yale Biology professor, discussing primarily how his game could be used as a tool to teach biology. He begins by saying *Spore* is based on the general tenets of evolutionary biology, but focused more on the macro-level story of life rather than focusing on specific topics like population genetics and alleles. The children playing *Spore* were engaging with speculative biology on their own terms- when they played, they took an organism from a single-celled creature that fell out of a meteor to the master race of a planet. They chose which adaptations their creature would use and faced benefits and drawbacks from that. Wright believed that his game, with its own entertainment value, could also be used in the classroom as a tool to help get kids excited about biology.

Speculative biology is, unsurprisingly, much more fun than real biology. This fact has been taken advantage of over the years, specifically in development of activities done in the biology classroom. One in particular, focusing on dragons using information from the popular game *Dungeons and Dragons* and real-life phylogeny and evolution concepts, was written and tested in a classroom to be reviewed by the students (Palca, 2008).

Notably, phylogenies from fictional animals will engage students further than with real-life animals. Additionally, this was a simple way to apply the skills of phylogeny, because the creatures had consistent and easy-to-classify traits. The undergraduate students were informed of the traits each species of dragon had, focusing on the color of the dragon, their "breath weapon" (i.e. fire) and their morphology. The students created a character matrix and a cladogram, focusing on real-world evolution concepts, such as convergent and divergent evolution, descent from a common ancestor, and parsimony. When surveyed, students generally reported that they enjoyed the material. The author noted that a lack of a 'correct answer' for this project made it more realistic and forced the students to genuinely apply the concepts they had learned about biology and phylogenies in class (Cruz, 2017).

Vertebrate paleontologist Darren Naish (an author of *All Yesterdays)* claims that despite the "seemingly pointless" and frivolous appearance of speculative biology, the field is important because it acts as an exploration of real-life biological and evolutionary information (Naish, 2015). Speculative biology has had a large impact on the biological knowledge of recent generations. Children come across speculative biology more than anyone. From *How to Train Your Dragon* to *Spore*, whether on purpose or not, works of media put ideas into children's heads about how the natural world works. Sometimes, it is clear that these pieces of media are purely for entertainment, and other times, creators work hard to include depictions as realistic as possible within their media.

Occasionally, creators are irresponsible about their depiction of biology and can misinform the public. Any media about dinosaurs is more likely than not speculative, but speculation is also present in many children's novels featuring magical creatures or creatures not of this world. In the past, speculative biology has helped and hindered the effort to raise an accurately informed new generation. It is a niche, young field that is rapidly growing, with many places to go in the future.

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