FEATURE ARTICLE

The Power and Place of Stories in Biology Class

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Abstract

The universal appeal and pedagogical power of stories are well established, yet they are underutilized in biology classrooms. I suggest that stories have an important role in helping students understand how science is made, and in offering glimpses into the hearts and lives of scientists.

Key Words: *science teaching; story telling; creativity.*

> Tell me a fact and I'll learn. Tell me the truth and I'll believe. But tell me a story and it will live in my heart forever.
>
> — Native American Proverb

"All children, except one, grow up."

"In a hole in the ground there lived a hobbit."

"A long time ago, in a galaxy far, far away . . ."

Do I even need to say where these opening lines are from?

These phrases have been etched into our memories from the moment we first heard or read them. And how we love the stories they begin. The third quote is, of course, the first line of the first *Star Wars* movie in 1977, the start of what has turned out to be the largest grossing movie franchise of all time: thirteen films have earned more than 9 billion dollars and been seen by about 40 percent of American adults.

From Dr. Seuss to Disney, Harry Potter to Game of Thrones, we grow up and live in a world teeming with stories. In all forms of media—books, films, television, radio, and the internet—stories are the currency of everyday life.

Yet they are strangely absent from most science classrooms.

Despite a universal appreciation and thirst for stories, and considerable evidence for their pedagogical power, stories are underutilized in formal education, and in learning science in particular. One of my main goals as a scientist, educator, and storyteller is to encourage the use of stories in science education. Here, I will focus on two main questions: Why do stories have an important place in the science classroom? And, what makes for a good science story?

Mark Twain said famously that the truth is stranger than fiction. One could add that the truth is stronger than fiction.

Homo Narrans

Rudyard Kipling once said, "If history were taught in the form of stories, it would never be forgotten" (1970). The author of *The Jungle Book* and the youngest writer ever to win the Nobel Prize for Literature (in 1907) certainly knew how to tell memorable stories. But he could not have known that in the ensuing century, a new branch of psychology would emerge that has amply confirmed his instinct about the power of stories.

One of the central tenets of "narrative theory" is that human thought is fundamentally structured around stories. People record and recall life experiences—their own as well as others' experiences—in the form of stories. This has been true since or before the dawn of civilization. Before the advent of writing, some reliable means was needed to transmit lore and information faithfully from generation to generation (Egan, 1989). All oral cultures, including those that survive to the present day, use storytelling. Stories typically embed content into vivid imagery and characters that inspire our imagination and arouse our emotions. No doubt our ancestors discovered that knowledge embedded in story form was more memorable. It has been claimed, and reasonably so, that story is one of the most important human inventions (Egan, 1989). Indeed, we are such storytelling and story-seeking creatures that numerous experts have dubbed our species *Homo narrans* (the storytelling person).

One important thrust of current research in this area is to understand why and how narrative plays such a crucial role in human

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thought. There are two universal aspects of story structure that combine to give it power. No matter whom the storyteller, narratives are usually structured in ways that connect *cause and effect* (X happened, so Y happened). And stories are always comprised of a sequence of events that are connected over time (first X happened, then Y, then Z). Thus, stories enable us to *understand* cause and effect, and to connect events. Because narratives are constructed of causal links and temporal order between events, stories carry the powers of both instruction and persuasion. People learn from stories because they present a coherent argument in favor of some conclusion (Herman et al., 2010).

This fundamental, longstanding place of story in human culture has prompted scores of educators and psychologists to study the role of story in learning. They have found that narratives are associated with increased recall, greater comprehension, and shorter reading times than expository texts (reviewed in Dahlstrom, 2014). Narratives also appear to offer advantages in several aspects of information processing, particularly with respect to motivation and interest, the allocation of cognitive resources, and transfer into long-term memory (Dahlstrom, 2014). With respect to science content in particular, audiences find narratives easier to comprehend and more engaging than traditional logical-scientific communication. But this is not because narratives simplify content, but rather because narratives embed content within a story's plot in a way that satisfies audience expectations. Educational content that is more integral to the plotline requires less cognitive resources for comprehension and enhances learning (Dahlstrom, 2014).

The increased cognitive engagement and more durable learning that a well-crafted narrative enables is the very objective of active learning. Like other forms of active learning, narrative offers learners the opportunity to actively construct their own understanding of content. It is especially conducive to introducing the scientific process and fostering a deeper grasp of scientific inquiry. Jerome Bruner, one of the leading figures of narrative theory notes:

> The process of science is narrative. It consists of spinning hypotheses about nature, testing them, correcting the hypotheses, and getting one's head straight. . . The history of science. . .can be dramatically recounted as a set of almost heroic narratives in problem solving. (1996, pp. 126–127)

Just think how many discoveries in biology have been the reward of some long quest, fraught with obstacles or danger, with no guarantee of success. Darwin's and Wallace's epic voyages (the latter interrupted by shipwreck), and the phenomena they encountered and deciphered, certainly qualify as heroic. A century later, the question of human origins was still wide open when Mary Leakey went combing an African hillside one morning for scraps of hominid bone, as she and her husband Louis had been doing without success for twenty-four years. She later told the tale in her own words:

> Louis got an attack of the 'flu and retired to bed, and so it came about that on the morning of 17 July I went out by myself, with the two Dalmatians Sally and Victoria, to see what I could find of interest at nearby Bed I exposures. I turned my steps towards a site not far west of the junction of two gorges. . . There was indeed plenty of material lying on the eroded surface. . .some no doubt as a result of the rains earlier that year. But one scrap of bone that caught and held my eye was not lying loose on the surface but projecting from beneath. It seemed to be part of a skull. . . I carefully brushed away a little bit of the deposit, and then I could see parts of two two large teeth in place in the upper jaw. They were hominid. It was a hominid skull, apparently in situ, and there was a lot of it there.
>
> I rushed back to camp shouting out "I've got him! I've got him! I've got him!"
>
> "Got what? Are you hurt?" Louis asked.
>
> "Him, the man! Our man." I said. "The one we've been looking for. Come quick."
>
> **(Leakey, 1984, pp. 120–121; Morell, 1995, p. 181)**

The fragmented skull was indisputable evidence that Africa was the cradle of humanity, and the reward for the indefatigable efforts of these two brave pioneers who were willing to live most of their lives in the bush in the hope of finding something that would upend not only the scientific world, but society at large. But is any of that *story*—the long quest, the many setbacks, or the moment of triumph—the elements that make any kind of tale more exciting, engaging, and memorable, conveyed in a textbook? Nope. Take a glance at leading high school and college biology texts, and the story of human origins is all about species names and dates (shrug). Bruner advocated more than twenty years ago that "our instruction in science from the start to the finish should be mindful of the lively processes of science making, rather than an account only of 'finished' science as represented in the textbook" (1996, p. 127). Thomas Newkirk, author of *Minds Made for Stories*, has noted how the structure of narrative can mirror the act of a scientist coming to an understanding so that as readers, "we are able to follow a mind at work" (2014, p. 49).

However, although the pedagogical importance of narrative is undisputed (Hadzigeorgiou, 2016, p. 91), its value is not widely recognized and it remains underutilized. "Stories are an underused medium for learning. Pushed to the margins of the curriculum to stimulate art and drama activities, but forgotten or neglected when the study of more 'serious' subjects begins" (Egan in Hadzigeorgiou, 2016, p. 83). This state of affairs is more than a missed opportunity—it is a shame.

Without narrative to illuminate the making of science, students are left to study the finished science, with little context as to what questions inspired an investigation or how a mystery was solved. And they get the wrong impression, or perhaps no impression at all, about who scientists are, what they do, and why they do it.

○ Science is Their Superpower

Good stories make for good pedagogy. But what makes a good story? Or more to the point, what makes a good science story—one that is worth precious time in the classroom, or at home?

There are two key ingredients to any story: plot and characters. One might think that factual science stories would be at some disadvantage to fictional stories about boys who can fly or a ring with magic powers. Not true!

Adam Gopnik, a brilliant writer for *The New Yorker* (and interestingly not a scientist himself), has made a very persuasive case that science stories offer something special. He argues that both good science stories and good scientific theories are *startling*; they *astonish* us with their claims. For example, he cites this premise for a story from

physics: "locked inside the nucleus of each little invisible atom is a force so vast it can destroy an entire city!" (2012).

Of course, biology has its own astonishing tales to tell: Inside the nucleus of every cell are invisible molecules, the precise positions of atoms within which determines the characteristics of every living thing on earth! Or, 66 million years ago a space rock the size of Mt. Everest slammed into the earth at 50,000 miles per hour, and wiped out the dinosaurs along with nearly three-quarters of all species on the planet!

Indeed, some claims are so astonishing they are initially disbelieved by scientists, and may remain disbelieved by non-scientists for decades, or centuries.

Gopnik notes that good science stories "startle us with their strangeness, but they intrigue us by their originality, and end up rewarding us with the truth, after an effort" (2012).

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Plot and a central idea are only half of a story. Science is done by people—real people. One might think that real-life scientists could not hold a candle to fictional heroines and heroes endowed with various superpowers. Think again. Contrary to the stereotype of dispassionate nerds in white lab coats, science has a good share of explorers, rebels, and detectives in its ranks. Such characters are the bread-and-butter of novels, television, and movies.

Indeed, I would put Roy Chapman Andrews, who first discovered dinosaur eggs in Mongolia, up against Indiana Jones (Andrews partly inspired the fictional character); Svante Pääbo (Neanderthal genetics) against Sherlock Holmes; and Lynn Margulis (endosymbiotic origins of organelles) against any movie rebel. Heck, Carl Woese not long ago discovered a *real* ancient kingdom living right under our noses. Take that, Narnia and Middle-earth!

And what do all of these people have in common? Science is their superpower.

○ The Gift of Inspiration

People are drawn to stories for more than entertainment. Robert McKee, a master storyteller and guru to legions of Hollywood screenwriters, points out that stories fulfill "the profound human need to grasp the patterns of living—not merely as an intellectual exercise, but within a very personal, emotional experience" (1997, p. 12). That emotional experience is very much a part of scientists' lives. Take Mary and Louis Leakey's discovery of human origins: an epic quest, for sure, but also a love story that encompasses ambition, desire, conflict, frustration, betrayal, and ultimately, the thrill of discovery. These feelings and human qualities such as courage, persistence, sacrifice, and resilience, surface often in stories of scientific exploration and discovery.

By offering students glimpses into the hearts and lives of scientists—their passions, aspirations, struggles, setbacks, and the price many willingly pay to do what they love—stories offer one of the most precious gifts any student may receive—inspiration. Students get Jefferson and Lincoln in history class, Shakespeare and Twain in English class, Beethoven and The Beatles in music class. Shouldn't they also get to know the stories of some of the people who have shaped our understanding of the natural world?

Surely, we don't want generations of biology students to grow up like Peter Pan and the Lost Boys:

WENDY: Peter, why did you come to our window?

PETER: To hear a story. None of us know any stories.

WENDY: How perfectly awful!

Perfectly awful indeed!

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