

Introducing Students to Darwin via the Voyage of HMS Beagle

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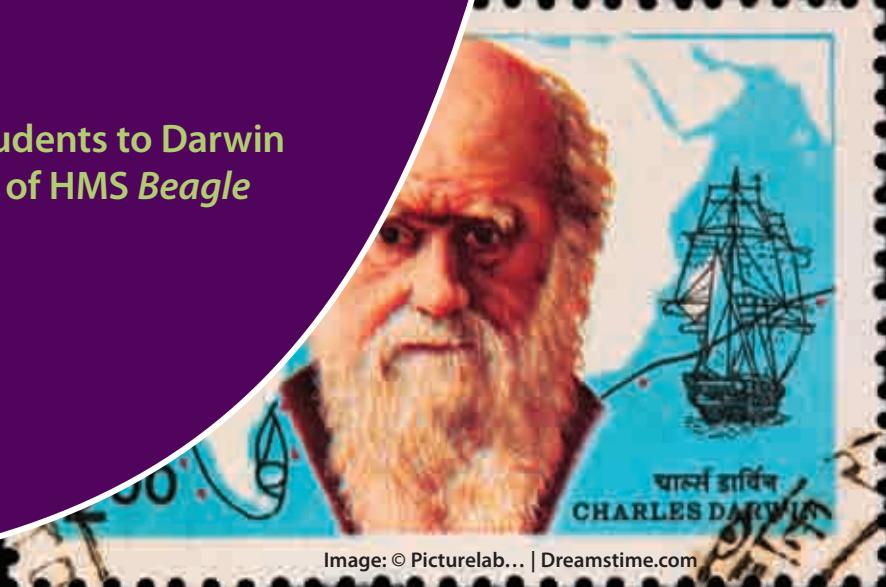


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ABSTRACT

I use the diary that Darwin wrote during the voyage of HMS Beagle and recent images of a few of the places he visited to illustrate some comparisons between Darwin's world and ours. For today's students, increasingly committed to environmental issues, this may be an especially promising way to introduce Darwin.

Key Words: Charles Darwin; voyage of HMS Beagle; teaching about evolution.

Beginning biology students usually think of Charles Darwin (if they think of him at all) as an old man with a beard, a large nose, and an extended brow who introduced an idea that somehow endangers their religious beliefs with an atheistic view of nature and, especially, of humans. Most will never have considered the process of thinking that led him to his ideas, or thought of him as a young man avidly undertaking an adventure so fraught with danger that it was quite possible he would not return. This was a voyage of discovery for young Charles, who had no idea what wonders the world held. At 22, just months after completing his studies at Cambridge, he boarded the 10-gun brig, unaware that his presence would make this possibly the most famous scientific voyage of the 19th century.

Darwin's most famous volume, *On the Origin of Species by means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life*, will engage few students. Yet they respond well to the diary writings that chronicle Darwin's voyage and provide what he called the "exact record of all my first impressions" (Keynes, 2001: p. 61). In a seminar entitled "Around the World with Darwin," my students read Charles Darwin's Beagle Diary, edited by descendent Richard Darwin Keynes and published in 1988. I supplement the text with slides and digital photography of my own travels, which over the years have sought to cover all the places Darwin visited. Combined, Darwin's writings and my more recent images help students appreciate not only the people, landforms, and organisms he encountered but also the nature of scientific process, the value of observation, and the changes that have occurred between Darwin's day and ours. Here, I will use a few statements from the *Diary*, coupled with a few of my photographs, to illustrate some of the comparisons between Darwin's world and ours. For today's students, increasingly committed to environmental issues, this may be an especially promising way to introduce Darwin.

Even as a young man, Darwin was one of the most acute observers and interpreters of nature who ever lived. The *Diary* affords glimpses of this young man at work in a largely unknown world, depending only on his powers of observation and discernment to answer his persistent questions about the world around him. He observed relationships in nature and surmised much that he was unable to see firsthand on a few brief stopovers. Darwin's writings are filled with expressions of excitement about the natural world that students rarely see in current writings. Placing themselves in this historical period takes some doing, but students can and will do so if they are led by a skillful guide – an interested teacher. Perhaps students will be enticed to dip into some of Darwin's other accounts of his scientific work and resulting thoughts after this kind of introduction.

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○ HMS Beagle

The *Beagle*, a Navy vessel, 90 feet long and 24 feet wide, was carrying 75 people. This, the *Beagle*'s second voyage, under the command of Robert FitzRoy, only 4 years older than Darwin, was given two missions: (1) to complete an earlier survey of the southern coasts of South America, especially as much of the Pacific coast as possible; and (2) to obtain more accurate fixes of longitudes by using new instruments that had recently become available. (These instruments can be seen at Greenwich, England, today.) The required readings determined the *Beagle*'s destinations. Also, this

was the first time that the Beaufort wind scale was used, giving a consistent and accurate comparison of wind speeds as it sailed.

Knowing these things, students understand that neither biological nor geological exploration was the purpose of this voyage. They also should know that all such ships that sailed from England had amateur or professional naturalists aboard who reported their discoveries to an interested public.

○ Beginnings

Darwin's botany professor, John S. Henslow, asked by FitzRoy to recommend a suitable companion for him during a planned two-to-three-year

voyage to "Terra del Fuego and home by the East Indies" (Burkhardt et al., 1983–1994), suggested Darwin. Students continue to be surprised that Darwin had no official position on the ship and that his father paid his way. The official naturalist on ship was Robert McCormick, surgeon, who left the ship while it was docked in Rio de Janeiro in April 1832, less than 4 months after leaving England. Darwin became the de facto naturalist after this. Because he paid his way, the collections he made belonged to him, to do with as he pleased. Darwin joined the voyage because this teacher had confidence that he would benefit from the experience. Henslow consequently received thousands of collections Darwin sent back, wrote to him with suggestions of how to improve packing, distributed specimens to experts for study, and even made Darwin's work known to the scientific world while Darwin was still away. Earlier, Henslow had introduced Darwin to a geology professor, Adam Sedgwick, who took him on field trips and an extended trip to Wales. Sedgwick evidently taught him much not only about geology but also about field work and scientific methodology. That these teachers took an interest in the young, inexperienced Darwin helped to change the course of biological thinking.

What Darwin took onto the ship and the conditions under which he lived cannot help but interest students. The meticulous records of his expenditures that he kept for his father and the constant complaining about expenses throughout the voyage certainly resonate with them. Among Darwin's possessions on board were a small (6×4 inch) microscope, a compass, a book on taxidermy, a geological hammer, Milton's *Paradise Lost*, a Bible, Lyell's first volume of *Principles of Geology* (the second and third volumes reached him along the way), a magnifying glass, jars of alcohol for preserving specimens, and the *Personal Narrative* of the great German naturalist Humboldt, which had greatly inspired Darwin when he read it as a student at Cambridge.

That Darwin suffered from seasickness throughout the voyage, sometimes eating nothing but raisins (believed to help the condition), certainly makes those of us prone to this malady sympathetic to him. He left the ship whenever he could and spent much more time on land than on board. He was clearly homesick much of the time and terribly missed his loving family, as we all would.

O Voyaging

The voyage lasted 4 years, 9 months, and 2 days; of this time, he spent more than 3 years on and around the South American continent. Sixty-three days out of Devonport, England, after his 23rd birthday, having encountered various Atlantic islands, the *Beagle* anchored at Bahia (El Salvador), Brazil. Darwin had tasted a banana "but did not like it, being maukish and sweet with little flavor" (Keynes, 2001: p. 23). Unfortunately, his first opinion of St. Jago, an island of the Cape Verdes and his first landing place, was written as he viewed it from the ship at some distance: "St Jago is so miserable a place that my first landing in a Tropical country will not make that lasting impression of beauty which so many have described" (p. 22). Many of us feel some relief that even Darwin would let premature opinion color his expectation of a place. Yet, upon seeing a deep valley a few days later, he recalled Humboldt's descriptions and wrote, "Here I first saw the glory of tropical vegetation" and "It has been for me a glorious day, like giving to a blind man eyes – he is overwhelmed with what he sees and cannot justly comprehend it. – Such are my feelings, and such may they remain" (p. 23). Considering the geological wonders of these islands, Darwin consulted his volume of Lyell. It is clear that upon seeing the geological formations here he began to think his own thoughts, and they were at odds with prevailing ideas of the day. Now near Bahia, Darwin writes of tropical luxuriance that

delight is a weak term for such transports of pleasure: I have been wandering by myself in a Brazilian forest.... To a person fond of

Natural history such a day as this brings with it pleasure more acute than he ever may again experience. (Keynes, 2001: p. 42)

This coastal Atlantic forest in which he wandered is now one of the most endangered forests on earth; less than 3% of the original forest remains, and it is under constant threat.

Nothing escapes his notice:

For the first time in my life I saw the sun at noon to the North: yesterday it was very near over our heads and therefore of course we are a little to the South of it. (Keynes, 2001: p. 41)

Around Bahia, Darwin first encountered slavery, against which he railed unceasingly. His uncompromising stance on this issue is made clear on several other occasions during the voyage.

As a map of the voyage shows, FitzRoy did not follow a steady course around the coastline but sailed back and forth to verify earlier measurements, to gather supplies and repair the ship, to escape harm from political uprisings and various lawless groups, and sometimes to meet up with incoming or outgoing English ships. Because of this, the order in which Darwin visited and described these areas is rather confusing, and students learn a lot of geography as they follow the ship's movements.

Traveling with Gauchos for weeks, he reported a dinner of ostrich, although it would have been a rhea, a large flightless bird; there are no ostriches in South America. He also sampled armadillos, comparing their taste and appearance to duck: "Both of them are very good" (Keynes, 2001: p. 105).

He wrote about the killing of indigenous peoples: "I think there will not, in another half-century, be a wild Indian northward of the Rio Negro." He was only partly wrong – there are no indigenous Indians living in the wild now, either south or north of the river.

The *Beagle* sailed to the Falkland Islands, 300 miles to the southeast of the South American continent in the Southern Ocean, in 1833 and again in 1834. Darwin's descriptions of these remote islands fit much of what can be seen today. "The island (East Falkland) is abundantly stocked with animals. – there are about 5000 wild oxen, many horses, & pigs. – Wild fowl, rabbits, & fish in the greatest plenty. – European vegetables will grow" (Keynes, 2001: p. 145). Actually, these "wild" cattle and horses had been introduced by the French in 1764 and the introduced rabbits were natives of North Africa. On the second trip it rained and sleeted, horses fell in swampy areas, and travel was generally miserable – today's students will hardly believe how Darwin carried on with his observations under such conditions. I can attest that his descriptions of the difficulties of making one's way through the tussock grass are accurate (Figure 1).

Returning to the continent, Darwin spent weeks in Patagonia, working his way north over the great plain to meet the ship. He described 27 species of mice from this rodent-rich area and observed pumas and condors. Today a visitor thrills to see a single one of these increasingly rare birds. While in Patagonia he described at great length the habits of the guanaco, or "wild llama," one of four camel-like animals of South America. (The other three are the alpaca, llama, and vicuña.) The guanaco is the characteristic large mammal of the plains of Patagonia, ranging through the entire temperate region. Darwin writes that "there were many herds of 50 to 100, & I saw one, with, I should think 500" (Keynes, 2001: p. 235). Today, no such numbers are encountered (Figure 2).

At Punta Alta, Brazil, Darwin first made some of his most important finds: fossils of giant extinct mammals. He wrote extensively about the fossils of gigantic quadrupeds that he found, some correctly identified, some not, until later when they were examined by experts in England.



Figure 1. Area with tussock grass on East Falkland (2001).



Figure 2. Guanacos (*Lama guanaco*) in Patagonia (2001).

They included the giant sloth, elephant-like fossils, and others that led him to think about what they must have eaten and to write long discourses about the vegetation of earlier times (Figure 3).

What had caused the extermination of so many species, since they were obviously no longer living in South America? He increasingly mused about how the earth had changed and admonished Henslow to be especially careful lest the numbers inked onto the bones be lost.

Tierra del Fuego and the Fuegians, now extinct, fascinated Darwin and clearly impressed him deeply. Sailing in the raging seas of the southern winter was yet another adventure that impressed the now more seasoned, but ever seasick, traveler. His descriptions of this southernmost region of South America during the weeks spent under fierce weather are wide ranging, from his physical condition – “How long the bad weather may last, I know not; but my spirits, temper, & stomach, I am well assured, will not hold out much longer” (Keynes, 2001: p. 131) – to the wildlife: “So that there are three sorts of birds which use their wings for more purposes than flying; the Steamer as paddles, the penguin as fins, & the Ostrich spreads its plumes like sails to the breeze” (p. 130) – to the vegetation: “The country on each side of the channel continues much the same, slate hills thickly clothed by the beech woods run nearly parallel to the water...” (p. 135) (Figure 4).

On the island of Chiloé, off the west coast of Chile, Darwin describes the native vegetation, and although today we can see much of what



Figure 3. Cave in southern Chile where giant sloth fossils have been found (2001).

Darwin saw, the invasive, exotic plants in some places have crowded out the natives. He describes the “gloomy, damp nature of the climate” and of a single road that goes directly through the interior of the country, “entirely formed of trunks of trees squared & placed side by side” (Keynes, 2001: p. 247) (Figure 5). From this island he saw the eruption of a volcano, Osorno, and beautifully described the spectacle (Figure 6). He attempted explanations for everything he observed, from why different landscapes are treeless to the reasons why geological formations had their particular characteristics.

Darwin never shied away from vivid observation. After an arduous crossing of the Andes, he stayed in a village near Mendoza, Argentina, where he reported:

At night I experienced an attack...of the Benchuca, the great black bug of the Pampas. It is most disgusting to feel soft wingless insects, about an inch long crawling over ones body; before sucking they are quite thin, but afterwards round and bloated with blood, & in this state they are easily squashed. (Keynes, 2001: p. 315)

While crossing the Andes he saw red snow, and on the Galápagos Islands and elsewhere he saw flamingos and other life forms in brine lakes. He ventured to say “Well may we affirm that every part of the world is habitable!” (Keynes, 2001: p. 60).

The *Beagle* sailed for the Galápagos on 7 September 1835, having traveled north as far as Lima, Peru. Students are often surprised, and some hardly believe, that he was on these islands only from 15 September to 20 October 1835. His descriptions of what he saw are vivid and compelling, ranging far beyond the finches for which his travels – and the islands themselves – are often known. He described his encounters with several animals, among them the well-known tortoise:

In my walk I met two very large Tortoises (circumference of shell about 7 ft). One was eating a Cactus & then quietly walked away. – The other gave a deep & loud hiss & then drew back his head. They were so heavy, I could scarcely lift them off the ground. – Surrounded by the black Lava, the leafless shrubs & large Cacti, they appeared most old-fashioned



Figure 4. Beech woods in National Park, Tierra del Fuego (2001).



Figure 5. Trail made of *alerce* logs, Chiloé (2001).



Figure 6. Darwin witnessed an eruption of volcano Osorno (2001).

antediluvian animals; or rather inhabitants of some other planet. (Keynes, 2001: p. 354)

Already he reports that their

numbers have been much reduced; not many years since the Ship's company of a Frigate brought down to the Beach in one day more than 200.... These immense creatures must be very old, in the year 1830 one was caught (which required 6 men to lift it into the boat) which had various dates carved on its shells; one was 1786. (Keynes, 2001: p. 356)

He reports collecting "many new plants, birds, shells & insects" (p. 354). "The main evil under which these islands suffer is the scarcity of water," he noted (p. 55). Today these islands are under great pressure for development, and indeed the lack of fresh water helps protect them from absolute ruin. Marine life is in peril, and the work of various environmental organizations is critical. Nearly 1,500 invasive species are currently recognized, including plants, animals, insects, and diseases (Anonymous, 2008) (Figures 7 and 8).

Sailing on to Tahiti, he saw entirely different vegetation; today the many species of exotic plants give a different character to the forests that Darwin described (Figure 9). Here, Darwin saw the coral reef, recalled what he had read, and ventured that "little is yet known, in spite of the much which has been written, of the structure & origin of the Coral Islands & reefs" (Keynes, 2001: p. 378). Before the end of the voyage, and having seen other reefs, he was the first person to accurately describe their formation. Darwin thought at the time that this might be the highest scientific accomplishment for which he would be remembered.

The brief days that Darwin spent in New Zealand introduced him to the Maori people and to unexpected vegetation where ferns gave the dominant aspect. Here he visited a mission where the missionaries had changed their surroundings to resemble the English countryside, with extensive pastures, well-mended fences, and productive gardens and orchard. He walked in a forest of kauri trees. Today, only a few protected mature individuals remain (Figure 10).

In Australia, Darwin was fascinated to realize the importance of fire to the life cycles of many plant species, and most of all he reflected

on the strange character of the Animals of this country as compared to the rest of the



Figure 7. Small pools of water collect in lava depressions, Galápagos (1976).



Figure 8. Lava cactus (*Brachycereus nesioticus*) grows on the nearly bare lava, Galápagos (1976).

World. An unbeliever in everything beyond his own reason might exclaim ‘Surely two distinct Creators must have been [at] work; their object however has been the same & certainly the end in each case is complete.’
(Keynes, 2001: p. 402)

He commented on the *Eucalyptus* forests that he saw everywhere he went (Figure 11).

In Mauritius he saw the effects of the sugarcane crop on the most unusual natural vegetation. Today, the destruction is even greater. I did not see the famous Dodo and neither did Darwin; it was already extinct in his day. After brief stops in the Cape region of southern Africa, final longitude determinations in Brazil, and a final stop on St. Michael’s Island, he writes that “getting a good offing from the land, we steered, thanks to God, a direct course for England” (Keynes, 2001: p. 441).

○ Teaching about Darwin & His Ideas

I teach the one-credit biology seminar in a “read, write, and discuss” format. The course outline for the 15 weekly meetings is divided roughly as follows, with appropriate reading assignments: (1) course



Figure 9. Darwin climbed along these heavily forested volcanic slopes, Tahiti (2007).



Figure 10. As Darwin hiked to this waterfall in New Zealand, he commented on the unusual flora (2007).

introduction and Darwin’s life before the voyage; (2) introduction to the *Diary* and overview and beginning of the voyage; (3–10) South America (3+ years of the voyage); (11) Galápagos Islands; (12) Pacific Ocean crossing, including Tahiti and New Zealand; (13) Australia, Mauritius, South Africa, and Atlantic crossing to Brazil; (14) final months and home at last; and (15) Darwin’s life after the voyage and associated sites to visit today. Each week, both world maps and maps



Figure 11. *Eucalyptus* forest in Blue Mountains, New South Wales (2007).

appropriate to the current week are available and are consulted. Images are usually shown at the beginning to get the discussion going. Before coming to class, the students have written about their reactions to the reading, what they learned, what puzzles them, what inspires them – essentially anything they wish, in one or two (maximum) typed pages. They add notes, other questions, or whatever they wish to these pages during class discussions. The readings, rich with Darwin's observations, carry the class along so quickly that students forget to look at the clock. I never know exactly what the discussion will entail; student interest dictates what takes place. Before leaving class, the students must turn in their papers. I read and return all papers each week and give feedback. They are given a score from 0 (absent, no paper) to 10 (evidence of real engagement with the entire reading assignment), and the final grade is a simple average. Certainly I have my points to make each week, but the students know that whatever they are interested in will be addressed. The discussions are often timely. For example, one semester as we were studying the Galápagos, the Sierra Negra volcano on Isabela was erupting and we looked at the news stories during class.

Some ideas in science are of such importance that it is impossible to teach them with assurance without having read the original work; such is the case with Darwin. Even excellent biology teachers, with the best instructional methods, will improve their teaching by reading the 1859 edition of the *Origin*, as it is commonly called. I maintain that without an

acquaintance with the young, voyaging Darwin, his greatest work cannot be fully appreciated.

"What did he know, and when did he know it?" is an exciting thread to follow through the *Diary*. For too long we have taught Darwin's ideas without consulting Darwin's voice. The place to begin is the edited *Diary* of the voyage. Perhaps students could be encouraged to dip into a section that seems interesting. Later, they could be encouraged to read a chapter from the fuller account, *The Voyage of the Beagle*. In 1959, a paper, "One Hundred Years without Darwinism are Enough," lamented the paucity of evolutionary biology in biology teaching and its consequences (Muller, 1959). Fifty years later, I suggest that an updated statement remains appropriate. One hundred and fifty years is too long, surely; however, might we begin with greater attention to Darwin himself during the voyage and see what happens?

A further note: Darwin's writings are wonderful for their simply stated observations and thoughts. Of all his writings, the pages that end the *Diary* are in many ways the most meaningful to me. How can any student (helped along by the teacher with the sometimes archaic-sounding language) not be drawn to the young man who writes, "Our voyage having come to an end, I will take a short retrospect of the advantages and disadvantages the pain & pleasure of our five years' wandering" (Keynes, 2001: p. 441). The next five pages contain a description of travel that everyone should read, for there will be something for each to savor. I end with my favorite words: "Hence a traveller should be a botanist, for in all views plants form the chief embellishment" (p. 443).

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