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*Charles Darwin & his sister Catherine.  
From a chalk drawing in the possession of  
Miss Hodgwood of Leith Hill Place.*

FIGURE 1.1 "I was in many ways a naughty boy."

Portrait of young Charles and his sister Catherine. Charles later wrote in his autobiography, "I was much slower in learning than my younger sister Catherine, and I believe that I was in many ways a naughty boy." From *More Letters of Charles Darwin: A Record of His Work in a Series of Hitherto Unpublished Letters* edited by F. Darwin and A. Seward (D. Appleton and Co., New York, 1903).

O N E

## Reverend Darwin's Detour

Every traveller must remember the glowing sense of happiness, from the simple consciousness of breathing in a foreign clime, where the civilized man has seldom or never trod.

—Charles Darwin, *Voyage of the Beagle* (1839)

His nickname was "Gas".

Thirteen-year-old Charles Darwin was, as most younger brothers are, highly susceptible to conspiracy and mischief with his older brother. Erasmus ("Ras"), five years his senior, had developed an interest in chemistry and recruited his little brother into outfitting a makeshift lab in the garden shed of the family home. The two boys pored over chemistry manuals and often stayed up late at night concocting some noxious or explosive mixture.

Sons of a wealthy doctor, Ras and Gas always had plenty of funds available for their hobbies. They bought test tubes, crucibles, dishes, and all sorts of other apparatus. Of course, chemistry wouldn't be as much fun without fire, so the boys invested in an Argand lamp, a type of oil lamp that they used to heat chemicals and gases. Their fledgling laboratory also had fireproof china

dishes, courtesy of their Uncle Josiah Wedgwood II, the leading maker of pottery in England.

Charles enjoyed the prestige his stinky shed earned him among schoolmates. He was also very well-liked for his cheerful and mild-mannered disposition. Some joined him on his expeditions into the countryside collecting insects or bird hunting. The boarding school he attended was only a mile from home, so he knew the surrounding woods and streams very well.

The schoolmaster, however, was not so impressed with either Charles' chemistry or his lackadaisical approach to the classics. Charles was not much of a student. He was bored stiff by the rote learning of ancient geography, history, and poetry demanded by the school. He escaped to the woods and home to visit and play with his dog as often as he could, sometimes risking expulsion should he get locked out before bedtime. Racing back to his dormitory, he prayed out loud for God's help in getting him there in the nick of time, and marveled that his prayers were answered.

Charles' father was increasingly aware of his son's dislike for school. Although Charles adored him, Robert Darwin was a large, imposing figure, and what he said went for the Darwin household. "The Doctor," as Robert Darwin was called, was worried that Charles was frittering away his opportunities. One day, The Doctor's anger erupted, "You care for nothing but shooting, dogs, and rat-catching, and you will be a disgrace to yourself and your family!"

Eventually, The Doctor decided that the best thing would be to take Charles out of school two years early, at the age of sixteen, and send him to Edinburgh where he could stay with his brother and enroll in medical school. The Doctor hoped that Charles would follow in his footsteps, and those of his grandfather, and become a physician.

## Doctor Darwin?

In Edinburgh, Charles did learn many things — taxidermy, natural history, zoology — and that he did not want to be a doctor.

Edinburgh University provided the best medical training in Great Britain, but it was a gruesome ordeal in the 1820s. Charles was repulsed by the professor of anatomy, who showed up for his lectures dirty and bloody, fresh from stints at the dissecting table. Charles also found surgery sickening. After witnessing an operation on a child (before the advent of anesthesia), Charles fled the operating theatre and vowed not to return.

Outside of the horrors of medical school, Edinburgh did offer some attractive excursions. Charles loved to walk the dramatic coastline of the Firth of Forth and to look for sea creatures that washed ashore. In the city, he met a freed slave from Guiana (on the northeast coast of South America), John Edmonstone, who agreed to tutor Charles on how to stuff and mount birds. Charles was an excellent student and reveled in Edmonstone's tales of the Tropics. Edmonstone's vivid descriptions of the South American rainforests were perfect antidotes for the bone-chilling Scottish climate.

After two years of cutting classes, and drifting about Edinburgh, Charles was no closer to being a doctor, or anything else for that matter. He dropped out of medical school without a degree.

The Doctor would have to find something respectable for his aimless son. There was a great risk among the well-to-do that their privileged sons would be content to live off the family fortune. If not a doctor or lawyer, what would benefit Charles? What position would bring him the most respectability for the least ambition?

That would be the Church of England.

It was common practice in Charles' day for parishes to be auctioned off to the highest bidder, who would then install a family member as parson. It was a comfortable lifestyle with ample lodging and some land, along with income from the local parishioners and investments. Charles would have plenty of time to pursue his hobbies.

The only requirement would be to pass his ordination, which required a bachelor's degree from Cambridge or Oxford, and a year's study of divinity. So it was off to Cambridge for Charles, where virtually all of the faculty were ordained members of the clergy.

## The Making of a Country Parson

Having washed out of Edinburgh, Charles was determined to start off on the right foot at Cambridge. Unfortunately, his resolve would soon be challenged by the beetle collecting craze that was then sweeping the nation and Cambridge. The capture of diverse and rare species was becoming a competitive sport. It so appealed to Charles' love for romping about the woods with like-minded comrades and his thirst for recognition that he soon became obsessed.

Charles acquired the best equipment, hired helpers to sift through forest debris, and spent significant sums buying specimens from other collectors. One day, peeling bark off a tree, he eyed two rare beetle forms and quickly grabbed one in each hand, but then spotted another. So he popped one of the two captured beetles into his mouth so that he could snag the third. Unfortunately, the one in his mouth was a bombardier beetle, and it emitted an awful brew that forced Charles to spit it out and to lose the other two!

Charles spent most of his first two years pursuing such beetle trophies, but finally resolved again to buckle down and to prepare for the key exam at year's end. He was to be tested on translation of Latin and Greek, portions of the Gospels, the New Testament, and on the works of Reverend William Paley, who had written several books concerning the evidence for God and the truths of Christianity. Charles, in fact, was lodging in the very rooms Paley had occupied at Cambridge decades earlier and was very impressed and persuaded by Paley's lucid logic.

Charles made it through the exams and resumed his beetling, but he also fell under the very positive influence of his professor of botany, Reverend John Stevens Henslow. On Friday nights, Henslow hosted small gatherings at his home for the discussion of natural history, and a little wine drinking. Other professors would occasionally drop in and share their expertise and passions. Charles had found his place. Henslow took Charles under his wing, and the two were so often seen walking together engrossed in conversation that Gas became instead "the man who walks with Henslow."

Henslow took students on all sorts of botanical excursions around Cambridge. Charles was eager to please, even wading through the muck of the

River Cam to snatch a rare species for his mentor. Charles saw Henslow as the role model of the ordained naturalist. Charles said of Henslow, "[He is] quite the most perfect man I ever met with." Charles thought he would take his year of divinity studies under Henslow.

First, there was the matter of passing his final exam — more Homer, Virgil, and Paley — with some math and physics tossed in. Charles ranked tenth in a class of 178. To get his degree, he also had to pledge his adherence to the "Thirty-Nine Articles" (established in 1563), which outlined the basic doctrine of the Church of England.

Henslow continued grooming Charles. He encouraged Charles to read more and to think about traveling to widen his horizons. He lent Charles his copy of Alexander Von Humboldt's *Personal Narrative*. While the old Charles would have struggled with the seven-volume work, the new Charles gobbled it up and started dreaming of the places Humboldt described in his travels to and throughout South and Central America. The Canary Islands (off the coast of Northwest Africa) offered the closest glimpse of a tropical paradise, so Charles thought, "Why not go there?" Henslow and three of Charles' friends were interested in going along. Charles went to see his father, and The Doctor forked over the money to clear all of Charles' debts and to pay for the expedition.

Henslow knew that Charles would need some geological training to make the most of such a visit, so Henslow set up a "hands-on" tutorial for Charles with Reverend Professor Adam Sedgwick, a leading figure of British geology who would later name the Devonian and Cambrian geological periods. Sedgwick, who had also trained Henslow, took Charles on a field trip to Wales. Sedgwick taught Charles very well. Charles discovered that he had a knack for and love of geology.

While he was in Wales, Charles' mates for the Canary Island trip backed out one by one until just a single companion remained. On his way back to England, Charles received a message that this friend had died suddenly. He was shocked over the loss, and deeply disappointed that his planned expedition had dissolved.

When he reached home, exhausted and uncertain of what he was going to do, there was mail waiting for him. It was a letter from Henslow with stunning news. Charles was being offered a voyage around the world.

## Permission to Board

Asked to recommend a naturalist for an upcoming voyage to South America, Henslow had written to his young protégé Charles, "I think you are the very man they are in search of."

Charles was elated. The Doctor was not.

Charles' father knew that British ships were sailed by some very rough characters. He also knew that the ships were dangerous and often wound up being sailors' coffins. The Doctor thought the voyage too risky an adventure and yet another delay on Charles' path to settling down in a respectable position. Charles glumly wrote to Henslow that he would not go over the objections of his father.

To distract himself from his disappointment, Charles headed off to his Uncle Josiah's house. His father, however, handed him a letter for his uncle. The Doctor explained that he objected to the voyage on many grounds but told his brother-in-law, "If you think differently from me I shall wish him [Charles] to follow your advice."

Uncle Josiah was indeed much more supportive of the adventure. So that he could offer an informed response to The Doctor, Uncle Josiah asked Charles to write down a list of his father's objections. (The list still exists today, Figure 1.2.) His father's words still fresh in his mind, Charles recited the objections:

1. Disreputable to my character as a Clergyman hereafter
2. A wild scheme
3. That they must have offered to many others before me, the place of Naturalist
4. And from its not being accepted there must be some serious objection to the vessel or expedition
5. That I should never settle down to a steady life hereafter
6. That my accommodations would be most uncomfortable
7. That you should consider it as again changing my profession
8. That it would be a useless undertaking

Uncle Josiah did see it all very differently, and he wrote his response to The Doctor, who quickly changed his mind about the South American voyage. The Doctor declared he would give Charles' journey all the assistance in his power.

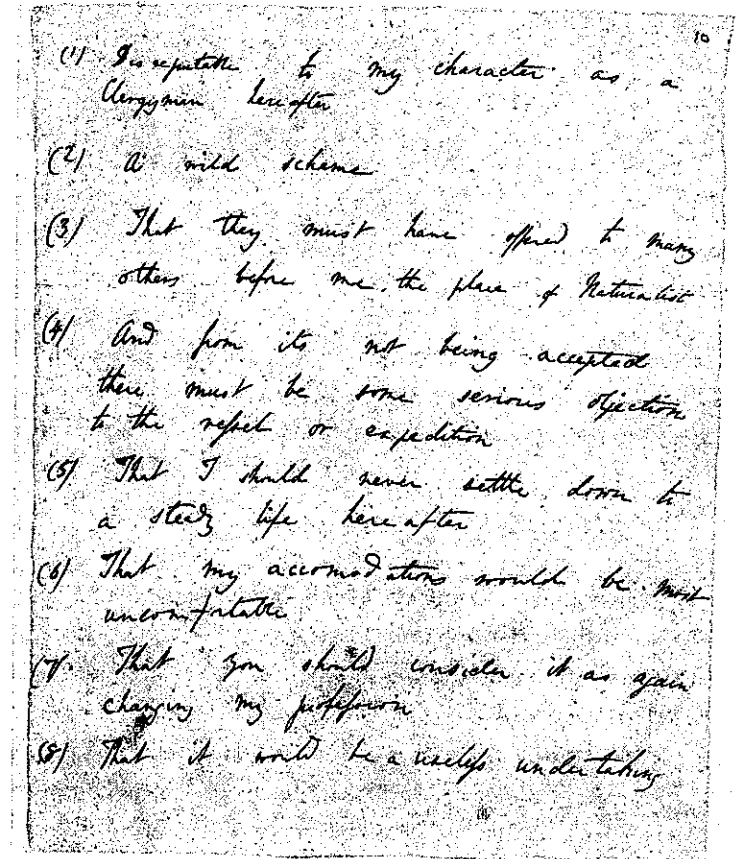


FIGURE 1.2 Charles' list of his father's objections to the Beagle voyage. Reproduced by kind permission of the Syndics of Cambridge University Library.

Overjoyed, and short on time to prepare, Charles set about buying instruments and a new pistol and rifle, getting packed, and meeting with Captain Robert FitzRoy, who would command the ship. The ship was a bit of a shock. The HMS *Beagle* was *small* — only ninety feet long and twenty-four feet wide at the most. It had just two tiny cabins (Figure 1.3). Charles, at six feet tall, had to stoop to enter what for years would be his quarters, and he would share the space with a large chart table, a nineteen-year-old officer,

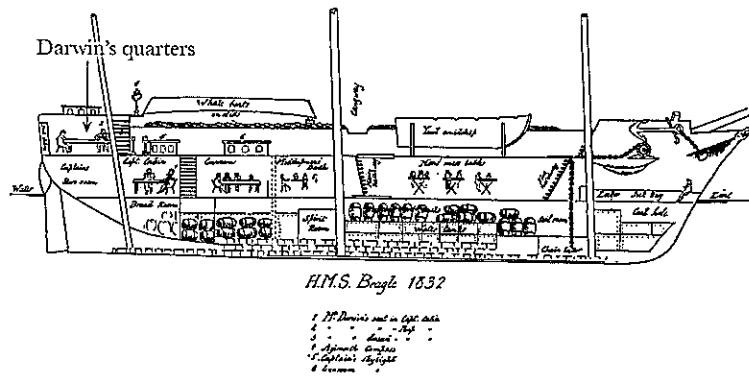


FIGURE 1.3 The HMS Beagle and Darwin's quarters.

Based on a drawing by shipmate Philip King, with whom Darwin shared his quarters. From *Journal of Researches into Geology and Natural History of the Various Countries Visited by H.M.S. Beagle by Charles Darwin (facsimile edition of 1839 First Edition, Hafner Publishing Company, New York, 1952).*

and a fourteen-year-old midshipman. Charles was to sleep in a hammock that was slung over the chart table and just two feet below a skylight.

Charles made his rounds saying goodbye to friends and family, and seeking out last minute advice from naturalists. Henslow, who had made the voyage possible, gave Charles a parting gift — a copy of Humboldt's *Personal Narrative* — and suggested that he take along Charles Lyell's new *Principles of Geology* to help him decipher the landscapes he would see. These books, and a copy of the Bible, would be the young divinity student's close companions.

Saying goodbye to his father was the hardest. Charles would be away for so long. (Little did he know how long it would be. The voyage was supposed to take just two years, but it ended up lasting almost five years.) There was also the very real risk that he might not return. Charles tried to put these thoughts out of his mind as Ras saw him off from Plymouth.

The *Beagle* made what turned out to be three attempts to start its voyage. The initial launch, on December 10, 1831, was thwarted when the ship hit a strong gale. Captain FitzRoy then set out again at low tide on December 21, only to run the ship aground, and even though he was able to free the ship, another gale turned it back to shore. These were not good omens for the long

voyage ahead. Finally, on December 27, 1831, the *Beagle* left England and set out for the Canary Islands and South America.

## Voyaging

It did not take very long for Charles to be miserable. As the *Beagle* tossed in the waves, Charles tossed everything he tried to eat. Retreating to his hammock, he wondered if the voyage was a huge mistake. He pulled out Humboldt for a little encouragement and tried to look forward to setting foot on land again.

After ten days of torment, the ship finally reached Tenerife in the Canary Islands. From the ship, Charles finally saw the great mountain of which Humboldt wrote, but his excitement was short-lived. The *Beagle* was to be quarantined for fear of its sailors spreading the cholera that had erupted in England just before the *Beagle* set sail. Captain FitzRoy wasn't going to wait, he ordered the sails up, and without anyone stepping on the shores of Tenerife, the ship left for the Cape Verde Islands further south off the west coast of Africa.

St. Jago (San Thiago) would provide Charles relief from his desperate seasickness. Although a volcanic island, Charles was thrilled to see for the first time a tropical landscape. The birds, palms, and massive baobab trees made deep impressions. He also enjoyed the island geology and was intrigued by a band of shells and corals that lay about thirty feet above sea level. Charles, fresh from Sedgwick's training and reading Lyell, began to wonder, had the sea level fallen or the island risen? He would ponder the same questions many more times in the coming years.

After a few weeks of respite, it was back on board the *Beagle* for the crossing to Brazil. The nausea returned and was compounded by the oppressive heat as the ship crossed the equator. Charles was laid up in his cabin, feeling as though he was being "stewed in . . . warm melted butter."

Having retched his way across the Atlantic, he was understandably eager to get off the boat as soon as it made landfall at Bahia, on the coast of Brazil. Charles headed for the forest, and it did not disappoint. His senses were flooded with the colors of the flowers, fruits, and insects, the scents of the plants and trees, and the chorus of all the animal sounds. He wrote to

Henslow, "I formerly admired Humboldt, I now almost adore him; he alone gives any notion of the feelings that are raised in the mind upon entering the Tropics." Charles began to collect everything he could.

After a couple of weeks in Bahia, the *Beagle* sailed on down the coast of Brazil to Rio de Janeiro, from where Charles would again venture out. This was to be a repeating pattern of the voyage. The *Beagle* would sail from port to port conducting its surveys and mapmaking, while Charles would head inland to collect. Captain FitzRoy was obsessive about his work, which bought Charles a lot of time for his land excursions.

Onboard ship, there was also a routine. In a letter to his sister Charles explained:

We breakfast at eight o'clock. The invariable maxim is to throw away all politeness — that is, never to wait for each other, and bolt off the minute one has done eating, &c. At sea, when the weather is calm, I work at marine animals, with which the whole ocean abounds. If there is any sea up I am either sick or contrive to read some voyage or travels. At one we dine. You shore-going people are lamentably mistaken about the matter of living on board. We have never yet (nor shall we) dined off salt meat . . . At five we have tea.

Charles himself would procure a good portion of the meat his shipmates would consume in the course of the voyage. He was, thanks to his boyhood, a good shot. His skills put him in good stead with the crew of the *Beagle*.

Charles also used the port stops to find a vessel heading home that could carry his specimens. Eight months into the voyage, he shipped his first box to Henslow, for safe-keeping.

## Gauchos and Bones

Forays into the interior of a region required some local knowledge, and Charles was usually able to find various native characters willing to accompany him. At Bahia Blanca, a settlement on the coast of Argentina at the edge of the great Patagonian plains or "Pampas," he found himself in the company of "gauchos," the local type of cowboy that Charles found "by far the most savage picturesque group [he] had ever beheld." Amused by their colorful dress and ponchos, Charles also noted the sabers and muskets they carried. They were in constant

conflict with local tribes, but as they were also "well known as perfect riders" and knew where to find the few sources of fresh water, Charles and the officers of the *Beagle* accepted their assistance. This included introduction to the local cuisine of rhea eggs (a flightless bird Charles referred to as an "ostrich") and armadillos, which Charles declared "taste & look like a duck."

While exploring the coast just a bit further south near Punta Alta, Charles found some rocks containing shells and the bones of large animals. He used his pick axe to free what he guessed were parts of a "rhinoceros." The next day he found a large head embedded in soft rock and spent so many hours removing it he returned to the ship after dark. Two weeks later, he found a jaw bone and a tooth that he thought belonged to the *Megatherium*, or giant ground sloth. He was not sure of what he had, but crated the bones ("cargoes of apparent rubbish," Captain FitzRoy teased) for shipment so that the experts back in England could decipher their identities.

Eventually, it would be determined that Charles had found remnants of several species, including: a giant armadillo-like creature called a *Glyptodon*; *Toxodon*, an extinct relative of the capybara; and three types of ground sloth — *Megatherium*, *Myiodon* (Figure 1.4), and *Glossotherium*.

It would be a long wait before Charles would even hear that his fossils arrived safely. Safe passage of either parcels or passengers was far from guaranteed in those days, as Charles was about to find out firsthand.

## Land of Savages

The *Beagle* continued to sail south along the eastern coast of South America, making its way toward Tierra del Fuego and Charles' first encounter with humans in their most primitive state.

He had been looking forward to the experience. On the previous voyage Captain FitzRoy had taken several native Fuegians back to England where they were clothed and taught in the British fashion. Now, on the return, three of these former "savages" were to be returned to their people in the hope that they might spread some civilization to this part of the world.

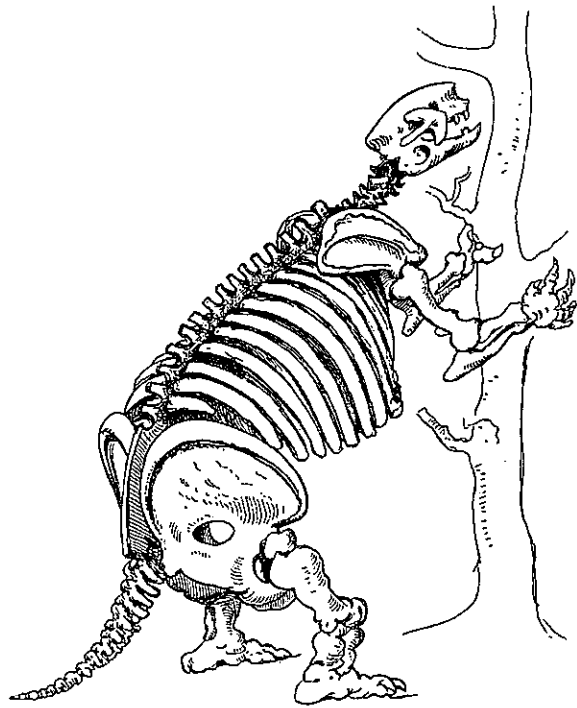


FIGURE 1.4 A mylodon.

Drawing of a giant ground sloth. From *A Naturalist's Voyage Around the World: The Voyage of the H.M.S. Beagle* by Charles Darwin (D. Appleton and Co., New York, 1890).

Charles rowed ashore with Captain FitzRoy to meet the native Fuegians. He was shocked by their appearance and behavior, and could not believe that the three missionaries they were about to deliver were only recently just as untamed (Figure 1.5). The contrast set in motion much thought about the differences, or lack thereof, between savage and civilized humans.

The *Beagle* forged on to round the notorious Cape Horn. Hugging the coast, the going was rough and the ship often tucked into coves to escape the weather. Charles tried to enjoy the scenery and wildlife, but two weeks of the cold, wind, and waves took their toll. He noted in his diary, "I have scarcely for an hour been quite free from seasickness: How long the bad weather may

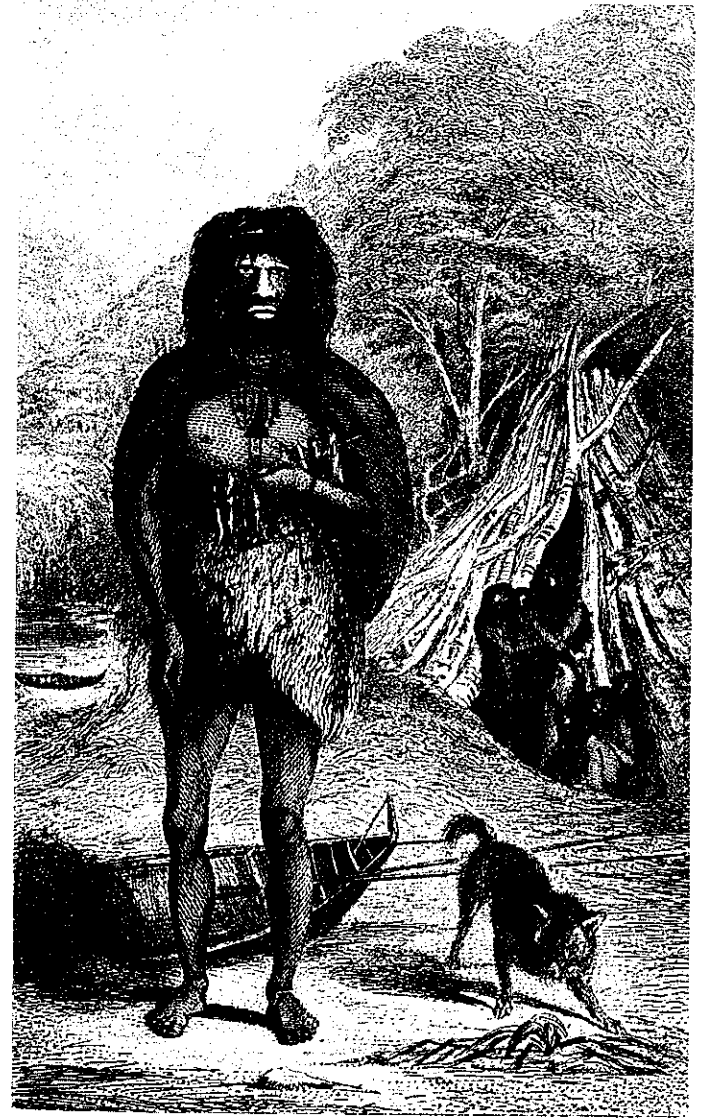


FIGURE 1.5 A Fuegian.

Drawing of a native of Tierra del Fuego at Portrait Cove. From *Journal of Researches into Geology and Natural History of the Various Countries Visited by H.M.S. Beagle* by Charles Darwin (facsimile edition of 1839 First Edition, Hafner Publishing Company, New York, 1952).

last, I know not; but my spirits, temper, and stomach, I am well assured, will not hold out much longer.”

But the weather worsened, the *Beagle* lost track of its position, and took a pounding. A great wave struck the ship, and the crew had to cut away one of the whale boats. The sea poured onto the decks and started to fill the cabins. Fortunately, once the portholes were opened, the little ship righted herself and water was drained away. One more wave, Charles knew, and that would have been the end. It was the worst gale Captain FitzRoy had ever experienced. Terrified, Charles wrote in his diary, “May Providence keep the *Beagle* out of them.”

The *Beagle* inched up the coast, the crew looking for a place to establish a settlement for their Fuegian missionaries. Afterwards, they entered the Beagle Channel. The scenery was magnificent. Glaciers extended from the mountains down to the water, where they calved small icebergs — creating the effect of a small “arctic ocean.” But the tranquility of the scene was deceiving. While dining on shore near a glacier, a large ice mass broke off and hit the water, sending a great wave toward the landing party boats on the shore. Charles acted quickly as he and several sailors grabbed the boat lines before the waves could steal the boats away. Had they lost the boats, they would have been in a dire situation, stranded with no supplies in hostile country.

Captain FitzRoy was impressed by Charles’ actions and the next day named a large body of water “Darwin’s Sound” after “my messmate, who so willingly encountered the discomfort and risk of a long cruise in a small loaded boat.” Captain FitzRoy also named a mountain peak in Charles’ honor. Charles certainly appreciated the captain’s gestures. It was flattering, as a then just twenty-four-year-old geologist, to have features named for him, even if they were at the remote tip of the continent.

But, as the second year of the voyage unfolded and Charles continued his expeditions and collecting, he was increasingly concerned with how his efforts were being received back home in England. He had shipped barrels of specimens and more fossils, including a nearly complete *Megatherium*. With the long wait between the sending of a shipment or letter, and the receipt of a reply, Charles was worried. Had his shipments even reached Henslow? Was he collecting anything of interest? His constant seasickness and bouts of homesickness were

also wearing on him. He confessed in one of his letters to Henslow his anxiety about the length of the voyage, “I know not, how I shall be able to endure it.”

When the *Beagle* arrived in the Falkland Islands in March 1834, there was mail waiting, and Charles finally got his answer. In a letter he had composed six months earlier on August 31, 1833, Henslow reported that Charles’ fossil *Megatherium* “turned out to be most interesting” and had been shown at the meeting of the British Association for the Advancement of Science that summer. The mentor then gently encouraged his pupil, “If you propose returning before the whole period of the voyage expires, don’t make up your mind in a hurry . . . I suspect you will always find something to keep up your courage.” Then he added, “Send home every scrap of *Megatherium* skull you can set your eyes upon — *all fossils* . . . I foresee that your minute insects will nearly all turn out new.”

Henslow’s news and encouragement were just what Charles needed. He returned to his geology and collecting with zeal, and he looked forward to the next sights on the voyage — the west coast of South America and the Andes.

## Shaky Ground

The price for every new adventure was yet another confrontation with the sea. To get to the west coast of the continent, the *Beagle* sailed through the Strait of Magellan — a “shortcut” that avoided the treacherous Cape Horn (Figure 1.6). But, in late May and early June, nearly winter in the southern hemisphere, it was no leisurely cruise. Charles watched the ice form on his skylight while he clung to his hammock.

There were many reminders of the peril of each leg of the voyage. On the way north to Chile, a shipmate died and was buried in a solemn service at sea. Later, as the *Beagle* scouted islands off the Chilean coast, the crew caught a glimpse of a man waving a shirt and a party was sent ashore to investigate. They found five American crew members who had run away from a whaling ship in a small boat and wrecked before they could reach the mainland. Charles saw the men were in desperate shape, having survived for over a year on nothing but shellfish and seal meat.



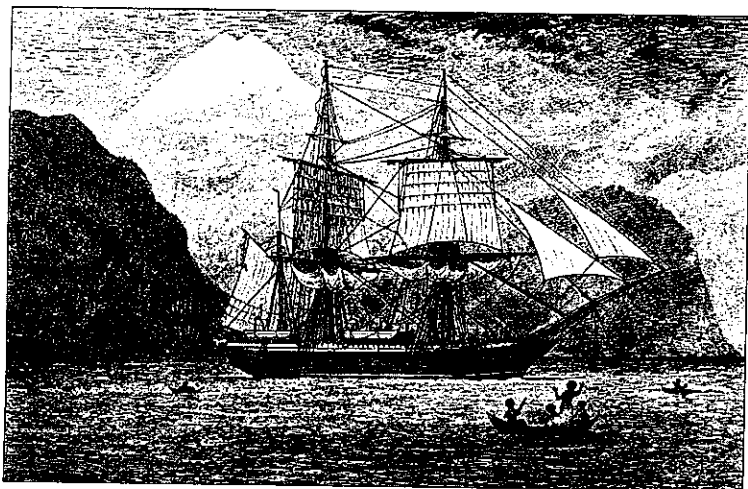


FIGURE 1.6 *HMS Beagle in the Strait of Magellan.*  
Drawing from *A Naturalist's Voyage Around the World: The Voyage of the H.M.S. Beagle* by Charles Darwin (D. Appleton and Co., New York, 1890).

Back on the mainland, Charles enjoyed more geological excursions. He found beds of modern shells at an elevation of thirteen hundred feet, and in the Andes he found fossil shells at thirteen thousand feet. How could the marine creatures wind up so high above the sea?

In a forest near Valdivia, he got part of his answer. While resting on a morning walk, he felt the earth tremble, and then shake so violently he could not stand. He went back into town and found chaos. Houses were tilting and the citizens were in shock.

As the *Beagle* sailed north, the devastation was everywhere. The city of Concepción was pummeled to rubble. The inhabitants described the earthquake as the worst ever; it had also triggered a tsunami and widespread fires. Many people were still buried.

At the shore, Charles observed that *the mussel beds were now positioned several feet above the water*. The new position of the mussels was it — proof that the land had been uplifted. The great mountains were built in small steps, just as Lyell had written, and now Charles was an eyewitness to the process.

On a slope in the Andes, he found even more stunning testimony. At seven thousand feet there was a grove of fossilized trees. How could trees be sitting this high up, embedded in sandstone? Charles deciphered the geological explanation for this astonishing sight:

I saw the spot where a cluster of fine trees had once waved their branches on the shores of the Atlantic, when that ocean (now driven back 700 miles) approached the base of the Andes . . . upright trees, had subsequently been let down to the depths of the ocean. There it was covered by sedimentary matter . . . but again the subterranean forces exerted their power, and I now beheld the bed of that sea forming a chain of mountains more than seven thousand feet in altitude.

These mountains were bearing trees that had once been buried in the sea bed.

Land sinking, mountains rising — Charles began to think about everything he saw in a dynamic geological perspective. On the island of San Lorenzo off the coast of Peru, he examined the shell beds which rose above the level of the sea. In a terrace at the eighty-five-foot level, he was very curious to find, together with the shells, cotton thread, plaited rush (braided seagrass), and the head of a stalk of Indian corn — signs of earlier human inhabitants. Charles deduced that the island had risen eighty-five feet since humans last lived there.

Geology dominated Charles' thoughts. Off the coast of Peru he began to think about the Pacific islands he was about to visit. One of the *Beagle's* assignments was to take measurements around the picturesque coral islands and to see whether the rings of coral that encircled them sat upon the rims of rising volcanic craters, as then believed. Though he had not yet seen a coral island with his own eyes, Charles rethought the situation and came to the opposite conclusion. What if the mountains were actually sinking? Then the corals, which required the light of shallow water, would encircle and grow upward around the sinking masses. If so, the beautiful rings of coral atolls were not sitting on crater rims, but encircling sinking land forms. This was the first theory he could call his own.

Charles wrote to Henslow that he was looking forward to his next stop for two reasons: it would bring him that much nearer to England, and it would give him a chance to see an active volcano. But this time it would be the animals and not the landscape that set his mind in motion. The *Beagle* sailed for the Galapagos Islands some six hundred miles off the coast (Figure 1.7).

## Reptile Paradise

Charles arrived in the Galapagos on September 15, 1835, well into the fourth year of the voyage. One might think that with these islands now inextricably linked with Darwin's name, they were the young naturalist's Eden. Far from it. In his diary of the first days there he wrote:

The stunted trees show little signs of life. The black rocks heated by the rays of the vertical sun like a stove, give to the air a close & sultry feeling. The plants also smell unpleasantly. The country was compared to what we might imagine the uncultivated parts of the infernal regions to be.

But he did find a bay swimming with fish, sharks, and turtles, and described the islands as:

... paradise for the whole family of Reptiles ... The black lava rocks on the beach are frequented by large (2-3ft.) most disgusting, clumsy lizards ... They assuredly well become the land they inhabit.

On a stroll, Charles encountered:

... two very large Tortoises (circumference of shell about 7ft.). One was eating a Cactus & then quietly walked away ... 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 antediluvian animals; or rather inhabitants of some other planet (Figure 1.8).

He found great numbers of tortoises near the freshwater springs and was amused by the lines of animals marching to and fro.

On James Island, Charles collected all of the animals and plants he could. He was curious to decipher whether the plants were the same as those on the South American continent or if they were peculiar to the Galapagos Islands. He also paid attention to the birds. The species of mockingbird on James Island looked different from those on other islands. Moving from island to island, the primary challenge was collection; identification would come later.

Charles did resolve a mystery of the marine iguanas and what they ate. An earlier visitor had concluded that the lizards went out to sea to fish. But Charles opened the stomachs of several of the animals and found that they

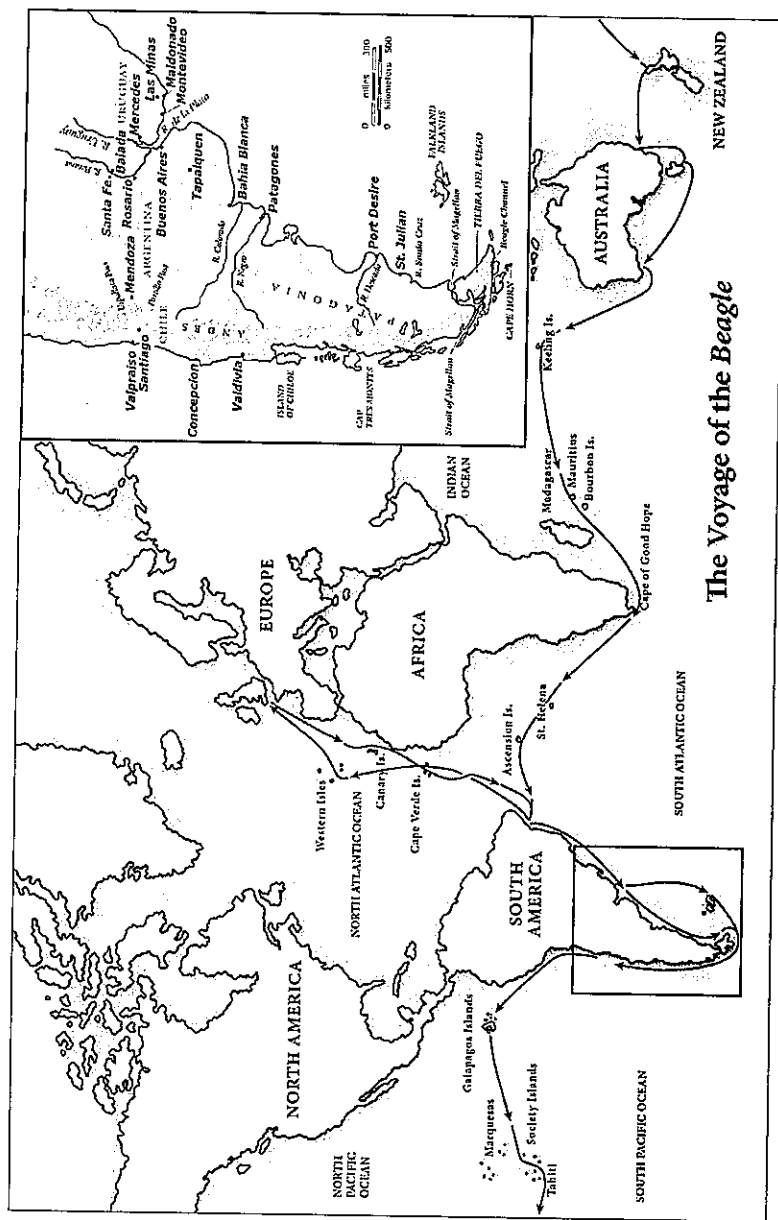


FIGURE 1.7 Map of the Voyage of the HMS Beagle, 1831-1836.  
Drawn by Leanne Olds.

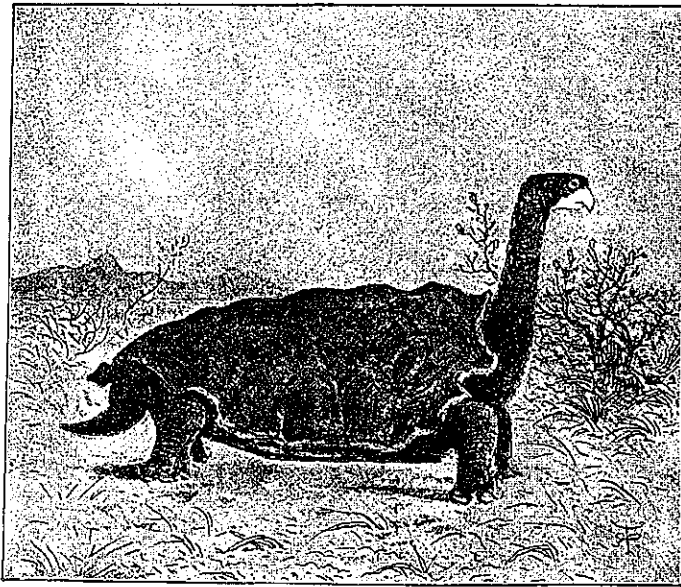


FIGURE 1.8 A Galapagos tortoise.

Drawing from *A Naturalist's Voyage Around the World: The Voyage of the H.M.S. Beagle* by Charles Darwin (D. Appleton and Co., New York, 1890).

were packed with the seaweed that grew in thin layers on the submerged rock. Though hideous to his eye, Charles did admire the animals' great swimming ability and diving endurance. He noted that he believed these habits were unique to marine iguanas — not seen in any other lizard — and strikingly different than those of the Galapagos Islands' land iguanas.

After five weeks of hiking across sand that reached 137°F, Charles and the *Beagle* departed for points west.

## Centers of Creation and the Mystery of Mysteries

Charles, for once, enjoyed the long sail through tropical seas to Tahiti. One of his cabin mates, Midshipman King, would later recall the pleasure Charles took, “in pointing out to me as a youngster the delights of the tropical nights,

with their balmy breezes eddying out of the sails above us, and the sea lighted up by the passage of the ship through the never-ending streams of phosphorescent animalculae.”

The *Beagle* went on to New Zealand, Australia, and then to the Cocos Islands, where Charles saw his first coral atolls, with their reefs encircling gorgeous blue lagoons. Wading among the corals, he immersed himself in the wonders of the reef and confirmed his suspicions about how such beautiful structures were built.

The *Beagle* then sailed on toward Africa and reached it at the end of May, 1836. At the Cape of Good Hope, Charles went ashore with the captain to call upon the great astronomer, Sir John Herschel, whose book Charles had read while studying at Cambridge. Herschel was keenly interested in geology and was also a close follower of and correspondent with Lyell. But Herschel thought Lyell had missed the mark with his second volume of the *Principles of Geology*.

The second volume, a copy of which Charles received at sea in a shipment from home, focused on questions surrounding the appearance of species. Lyell refuted the then circulating ideas of evolution and proposed instead that species were created “in succession at such times and in such places as to enable them to multiply and endure for an appointed period, and occupy an appointed space on the globe.” Lyell proposed that the congregations of species peculiar to any area marked “centres or foci of creation . . . as if there were favorite points where the creative energy has been in greater action than others . . .” Lyell was adhering to the conventional view of species as unchanging — with each kind specially created — while explaining the succession of species he knew so well from the fossil record as a succession of creations.

But Herschel thought otherwise. If landscapes evolved, as Lyell had amply demonstrated, why not their inhabitants? Herschel saw a connection to the “mystery of mysteries” — the origin of new species. Whether Herschel fully disclosed his thoughts on the matter is not clear. But it is clear that on the journey home, and thereafter, the mystery of mysteries gripped Charles.

Charles had much to look forward to on the way back to England. Henslow had collected and published ten of his letters in a pamphlet, and

Charles' sister wrote that his name was gaining much attention in England. Charles began to plot his return and to prioritize his work. Surrounded by reams of geological, zoological, and botanical notes, he began organizing them for publication. The final leg of the voyage, thanks to Captain FitzRoy's obsessive chartmaking, was going to be longer than expected. Instead of heading up the west coast of Africa to Europe, the ship headed back to Brazil for one last check of measurements. Charles, who never overcame his seasickness, wrote home: "I loathe, I abhor the sea."

But Charles reconciled to make good use of the extra time. He began to gather and to flesh out his ornithological notes, and returned to the puzzle of the Galapagos birds. He concluded that the mockingbirds of the Galapagos were closely allied in appearance to those of Chile. But there was more to the story. Charles wrote in his notes:

I have specimens from four of the larger islands; the specimens from Chatham & Albemarle Isd. appear to be the same, but the other two different. *In each Isd. each kind is exclusively found* [emph. added]; habits of all are indistinguishable. When I recollect, the fact that from the form of the body, shape of scales & general size, the Spaniards can at once pronounce from which Isd. any tortoise may have been brought: — when I see these Islands in sight of each other and possessed of but a scanty stock of animals, tenanted by these birds but slightly differing in structure filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware is the constant asserted difference between the wolf-like fox of East & West Falkland Isds. — *If there is the slightest foundation for these remarks, the zoology of Archipelagoes — will be well worth examining; for such facts would undermine the stability of species.*

By the end of the voyage Charles was already pondering that mystery of mysteries in a fresh light.

## The Mariner Returns

It was a joyous and triumphant homecoming.

For five years Charles had been away from his friends, family, and mentors. His sisters were so relieved to see him home safe. And The Doctor, well, he was very proud. His son had left a directionless bug-catcher, but had returned

to the toasts of the cream of British scientific circles. Charles was most anxious to see Henslow again — and to get his advice on what to do with the specimens he had collected.

The great Lyell wanted to meet him, and Charles soon was invited to a dinner at the London home of his geological hero. Lyell was transfixed by Charles' tale of the Chilean earthquake, and introduced him to the people who could help with the scientific analysis of his collections. The fossils, the birds, the plants, and even the iguanas found eager takers.

Charles was pondering writing a book about his long voyage. He loaned his Wedgwood cousins his diaries to read and was very encouraged by his cousins' reactions to his adventures. Captain FitzRoy developed plans for a three-volume "narrative" of the *Beagle's* voyages, written by himself, another previous captain of the ship, and Charles.

As Charles set to work writing his account of the *Beagle* voyages, the experts were poring over his collections. Ornithologist John Gould, an accomplished naturalist and illustrator, quickly perceived that Charles' Galapagos birds were closely related. What Charles thought were "gross-beaks" and "blackbirds" were actually finches. In just a few days' examination, Gould had identified twelve (later revised to thirteen) species of ground finches — all entirely new species (Figure 1.9). And the "varieties" of Galapagos mockingbirds? They included three distinct species. They were related to those in Chile, as Charles surmised, but they were not identical to them.

So here was the crucial puzzle. How could Charles explain all of these new species, each specific to an island? The conditions on each island were not significantly different, so if each bird had been created to suit each island, then why were the birds different? It was inescapable. The original birds that immigrated to the islands had changed somehow and produced new species.

Charles knew this was difficult to explain, even more difficult to persuade others of, and as it violated the doctrine of the immutability of species and challenged creation-based explanations, very dangerous territory. He was torn. He was eager for recognition and to climb the ranks of the scientific elite, but he knew that the "transmutation" of species was professional suicide. Neither his new boosters in the scientific community nor his Cambridge mentors would stand for such heresy.

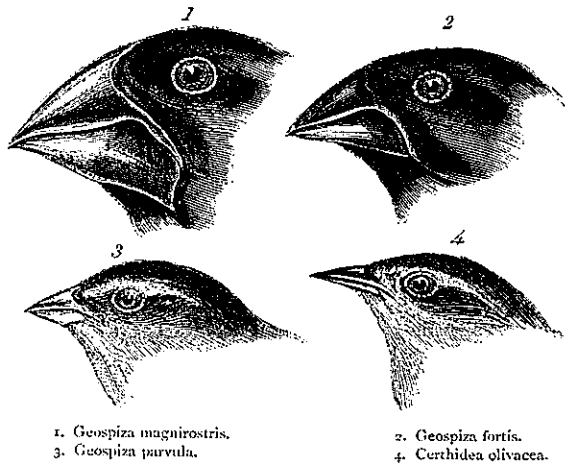


FIGURE 1.9 Galapagos finches.

Drawing from *A Naturalist's Voyage Around the World: The Voyage of the H.M.S. Beagle* by Charles Darwin (D. Appleton and Co., New York, 1890).

He worked furiously on his journal and tried to finesse the issues raised by the Galapagos animals:

It never occurred to me, that the productions of islands only a few miles apart, and placed under the same physical conditions, would be dissimilar. I therefore did not attempt to make a series of specimens from the separate islands. It is the fate of every voyager when he has just discovered what object in any place is more particularly worth of his attention, to be hurried from it . . . It is clear, that if several islands have their peculiar species of the same genera, when these are placed together, they will have a wide range of character. *But there is not space in this work, to enter on this curious subject.*

And so began the dodging game he would play for the next twenty years. When he wrote these lines, he was already convinced that species change, but he did not tip his hand. Indeed, when a young Alfred Russel Wallace read this passage he saw the mystery of mysteries as a still-open question that the great Darwin had overlooked, and this spurred Wallace to make his own voyages (as will be seen in Chapter 2).

Charles finished his *Journal of Researches into the Geology and Natural History of the Various Countries Visited by the H.M.S. Beagle Under the*

*Command of Captain FitzRoy, R.N. from 1832 to 1836* (what became known as *The Voyage of the Beagle*) in seven months. (It would not appear for two years due to Captain FitzRoy's delays in finishing his part.)

## Secret Notebooks and a Species Theory

Publicly, Charles would only go so far. Privately, he threw himself into the study of the transmutation of species.

He recalled the "ostriches" of South America. Early in the voyage, he had heard of a second, smaller form of the bird that lived in southern parts of Patagonia beyond the Rio Negro. The *Petise* form was rare, and Charles wanted very badly to collect one but had no luck, as the bird was difficult to spot and very wary. While dining one night on what he casually thought was a juvenile ostrich, it dawned on him that he was actually consuming the elusive *Petise* species. Panicked, he rescued some parts that had not been cooked or eaten. Years later, after Charles returned, John Gould named the reassembled bird *Rhea darwini*.

Now Charles began puzzling over the fact that the large and small rheas overlapped in their territories near the Rio Negro. Unlike the Galapagos birds, there was no physical boundary to separate them. The two species made Charles note, "One is urged to look to common parent?" Charles opened up a new notebook (called simply "B") and jotted his thoughts down as they streamed out. On page fifteen, he recalled the animals of Australia and scrawled:

Countries longest separated greatest differences — if separated from immens [*sic*] ages possibly two distinct type, but each having its representatives — as in Australia. This presupposes time when no Mammalia existed; Australia Mamm. were produced from propagation from different set, as the rest of the world.

On page twenty:

We may look at Megatherium, armadillos, and sloths as all offsprings of some still older type some of the branches dying out . . .

On page twenty-one:

Organized beings represent a tree *irregularly branched* some branches far more branched — Hence Genera. As many terminal buds dying as new ones generated . . .

On page thirty-five:

If we grant similarity of animals in one country owing to springing from one branch . . .

And then on page thirty-six, following the declaration "I think," he drew a little diagram that represented a new system of Natural History, a tree of life with ancestors at the bottom and their descendants at the top (Figure 1.10).

His jottings raced from topic to topic in zoology, geology, and anthropology. Each entry was a fragment of a much larger picture that was slowly taking form.

Life was a tree, with the branches and twigs connecting species, like relatives in a family pedigree. But what made the tree branch? Why were new forms arising and others dying out?

Through the next year, he read all sorts of books for hints toward the questions burning in his mind. On September 28, 1838, he opened Thomas Malthus' *Essay on the Principle of Populations*. Malthus proposed that there were checks — disease, famine, and death — upon the growth of populations that prevented them from increasing at an exponential rate. Malthus explained that there was great overproduction of offspring in nature because of these checks. And what would sort out the survivors from the others? It was clear to Charles, the stronger, better adapted ones.

The result, Charles realized, would be the formation of new species.

His "species theory" was thus born, and would grow and develop over the next few years. He quickly made an analogy between the role of nature in shaping her species and the role of humans in shaping their animal breeds: "It is a beautiful part of my theory that domesticated races of organisms are made by precisely the same means as species — but latter far more perfectly & infinitely slower." That natural process was to be called "natural selection."

Charles was also recalibrating the clock of life. Influenced by astronomer Herschel, who suggested that "the days of Creation" may correspond to "many thousand millions of years," Charles felt confident that the earth and life were much older than geologists had grasped.

But even as Charles' certainty increased, all of these ideas remained private. He kept his notebooks and his ideas secret because they were heretical to the

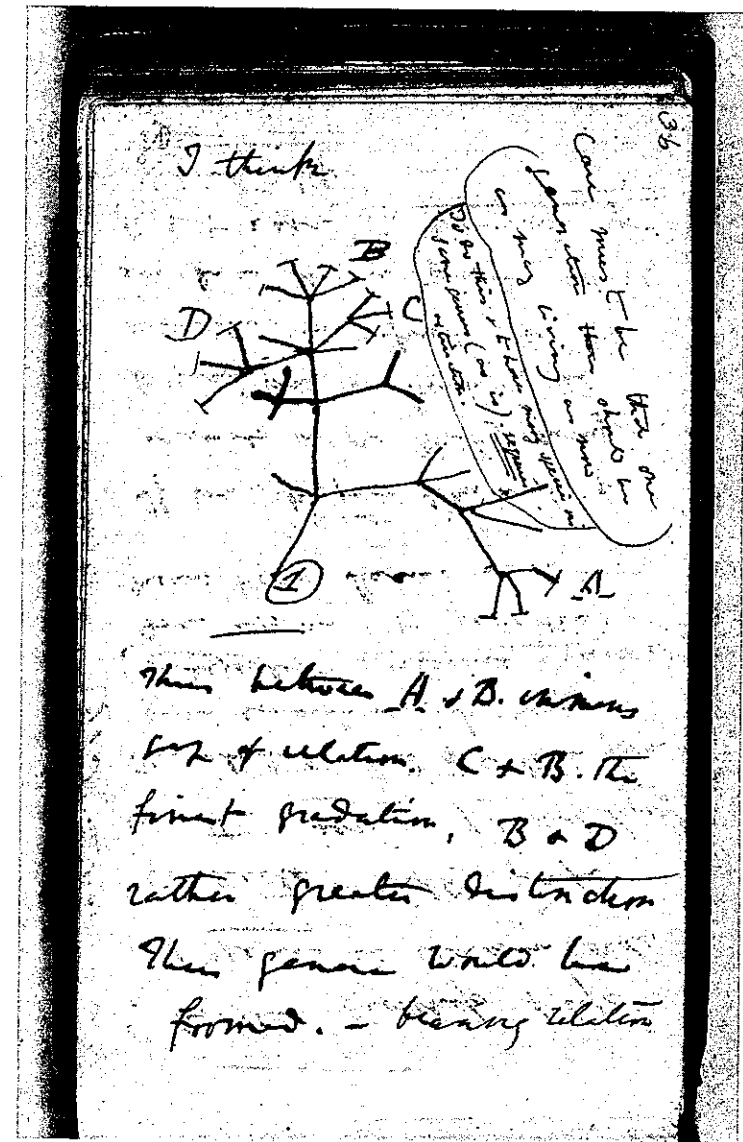


FIGURE 1.10 *The tree of life.* Page from notebook "B," where Darwin recorded his idea that life is connected like the branches of a tree, with ancestors at the bottom. Reproduced by kind permission of the Syndics of Cambridge University Library.

doctrine of special creation, which was held sacred by those in power in Britain — the government, the Church, and fellow scientists, including those who trained and supported Charles. It would be professional suicide to go public. He was young and not established. Charles was getting plenty of recognition without having to make public such radical thoughts.

In 1839, *The Voyage of the Beagle* appeared to great acclaim. Charles was becoming famous. One day, a letter arrived from Potsdam. It was from the great Humboldt himself. Gushing with praise, Humboldt declared that his influence on Charles was “the greatest success that my humble work could bring.”

Charles was thrilled and moved. He answered his hero thanking him for the great pleasure his letter had given. Charles wrote, “That the author of those passages in the Personal Narrative, which I have read over and over again, & have copied out, that they might ever be present in my mind, should have so honoured me, is a gratification of a kind, which can but seldom happen to anyone.” It was too much of a risk to gamble his soaring reputation on his species theory.

## The Dear Old Philosopher

There was neither the time nor the inclination to return to his divinity studies. Charles was fully consumed by his science and felt that if he did not work very hard on the fruits of his voyage in the first few years home, he would be overwhelmed. While his heart was no longer there for his parsonage, he was eager to settle down and start a family. Just before he turned thirty, he married his first cousin Emma Wedgwood.

They had known each other all of their lives. Charles confided to Emma where his thoughts were leading. Emma, a devout Christian, worried that Charles’ heresies might preclude their eternal life together. It was a delicate balance. Emma knew that Charles was working on great ideas, but Charles was very mindful of Emma’s concerns. Charles had yet another reason to keep his theory private.

In 1842, Charles distilled his notes and several years’ thinking into a thirty-five-page sketch of his species theory. Two years later, he expanded the

sketch into a work of 230 pages. The table of contents is strikingly similar to that of *The Origin of Species*, which would not appear for seventeen years, in 1859. Many of the well-known arguments and prose from his great book appear in both of these early manuscripts.

But Charles still thought it was unwise to publish. He would, in time, share the long essays only with a few trusted intimates — Lyell; botanist Joseph Hooker; biologist Thomas Huxley; and Emma. On July 5, 1844 Charles wrote his wife a note:

I have just finished my sketch of my species theory. If, as I believe, my theory in time [will] be accepted even by one competent judge, it will be a considerable step for science . . . I therefore write this in case of my sudden death, as my most solemn and last request . . . that you will devote £400 to its publication, and further will yourself, or through Hensleigh [Emma’s brother], take trouble in promoting it.

More evidence was what Charles decided would be needed to bolster his theory. He then went to work on all sorts of topics in botany, zoology, and geology. Independently wealthy, thanks to his father and his father-in-law, and ensconced at his manor in the village of Down, his life revolved around his work, Emma, and their ten children (seven of whom lived to adulthood). He was a doting father and often regaled his children with tales of his adventures and stories about his shipmates on the *Beagle*.

Charles’ demeanor as a father and a husband was the same as his disposition at sea. His *Beagle* shipmates could not recall ever seeing Charles out of temper or hearing him say an unkind word about or to anyone in the course of their long journey. It was in admiration of these qualities and his abilities that Charles’ shipmates had given him perhaps his most apt nickname, “the dear old Philosopher.”

*The Voyage of the Beagle* would in turn inspire another wave of naturalists, for whom Charles would play the same role as Humboldt had in his day. And a letter from one of this new group of voyagers would finally, after twenty years, make him break his silence about the origin of species and finally publish his greatest work.

CHAPTER QUESTIONS

1. What experiences of his youth helped to prepare Darwin for the voyage on the *Beagle*?
2. What geological phenomena and formations did Darwin witness? How did these shape his thinking about the age of the earth or how life changed?
3. What zoological evidence led Darwin to think that species evolved?
4. What were Thomas Malthus' ideas, and how did Darwin react to them?
5. Why did Darwin delay publishing his species theory?

For more on this story, go to the *Into The Jungle* companion website at [www.aw-bc.com/carroll](http://www.aw-bc.com/carroll).

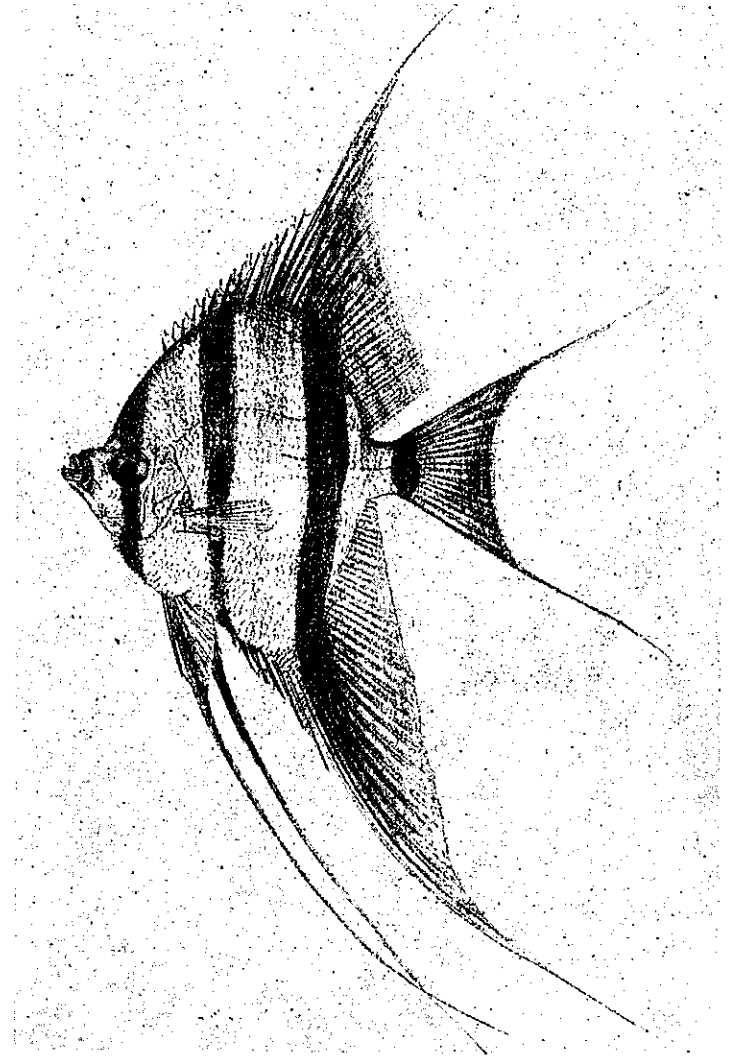


FIGURE 2.1 Sketch salvaged from fire and shipwreck of the *Helen*.

This drawing of an Amazonian angelfish was one of the few sketches Wallace managed to save out of all of his notes and specimens on his doomed voyage home. It displays one of the important talents for naturalists before the age of photography — that of being a good artist. Drawing from the autobiography of Alfred Russel Wallace, *My Life* (New York: Dodd, Mead, and Co., 1905).