

ReVista

HARVARD REVIEW OF LATIN AMERICA • SPRING 2009

The Sky Above, The Earth Below

Exploring the Universe



EDITOR'S LETTER

Professor Don Pfister came to my office the other day to discuss this issue of *ReVista*. I was wearing one of my favorite pieces of jewelry, a black-and-white speckled necklace from Colombia. "Oh, that's from a tropical tree," he said with interest, identifying the species. For me, my necklace is a lovely handicraft, a splendid ornament, a sentimental memory. Pfister, who is Curator of the Farlow Herbarium, noticed something I didn't, the botanical origin of my beads.

It made me realize that even though lately I've been focusing on the theme of the sky above and the earth below, I remain an urban creature. Geology was the only class I ever got a "D" on in college. I took it to fulfill my science requirement. Yet I remember vividly how the professor took us across the Hudson River to New Jersey with its wind-swept views of Manhattan. There, he showed us Manhattan schist, a very hard rock on which Manhattan is built (I have no idea why we went to New Jersey). Despite that grade, I learned to see rocks in a different way.

It's not that I don't like nature, dear reader (seeing that much of this issue deals with the 19th century, that feels like an appropriate way to address you). I love to look at "the sky above" and "the earth below," but usually just as a poetic big picture—the amazing sunset, the towering mountains, the welcome sound of birds in the early spring. I still like to feed pigeons and sparrows, urban memories of exploring the universe.

Obviously, with my track record, the idea for this issue therefore did not arise from any particular knowledge about science or nature, but rather with a historical awareness of two important dates. This year, 2009, has been designated the International Year of Astronomy. It also marks the 200th anniversary of Charles Darwin's birth. Even I know that Darwin looked at the earth below, developing the theory of natural selection in the 19th century. Three hundred years before, Nicolaus Copernicus observed that planets' motions across the sky could be explained much more simply by assuming the Earth and other planets revolved around the Sun in perfect circle.

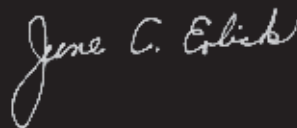
So I wanted to investigate the links of both men to Latin America. Darwin had traveled throughout the region, exploring such far-off places as the Galápagos Islands in Ecuador and Tierra del Fuego in Chile. Copernicus, a contemporary of Christopher Columbus, never traveled to Latin America, but he might be considered the spiritual godfather of all the astronomers looking out at the starry nights from observatories in Mexico, Costa Rica, Chile, Mexico and throughout the region.

I wanted to make this *ReVista* an issue that would be interesting to those of you who know all the names and species—and to those of us who write songs about butterflies and don't know a swallow from a seagull. And yet I wasn't quite sure exactly why I was so fascinated by the explorations of Copernicus and Darwin.

That is, not until I walked into Harvard's Bio Labs to see Professor N. Michelle Holbrook, "Missy," to discuss the upcoming *ReVista*. She pointed out to me that both Darwin and Galileo were rebels whose theories shifted the center of the world. With Darwin, she observed, humans ceased to be the center of the earth, and with Copernicus, the earth ceased to be the center of the universe.

The Catholic church even placed Copernicus' book *De Revolutionibus* with his new scientific theory on the index of prohibited books in 1616 because it contradicted religious beliefs. Darwin's theory of natural selection still remains controversial among some fundamentalists today.

The natural sciences—like the social sciences and the arts—have their own particular way of challenging our premises and transforming the world around us. This *ReVista* thus is not just a celebration of Darwin and Copernicus, but of all the scientists working today and yesterday—and who will be working in the future—to explore the mysteries of the universe, even if they are as simple as the origin of a necklace.



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The Moon, planet Venus, the bright
star Spica and planet Jupiter are seen
(in descending order) over Cerro
Tololo Inter-American Observatory in
Chile in September 2005.



The Sky Above, The Earth Below

The Art of Good Seeing

AN INTRODUCTION BY N. MICHELE HOLBROOK

"We had gone a few miles upriver and now were standing on the riverbank, and in front of us, on the other side, the forest was rising like a wall. We looked in silence and then Schultes said, as if speaking to himself, 'I know every tree, every single tree one can see from here.'"

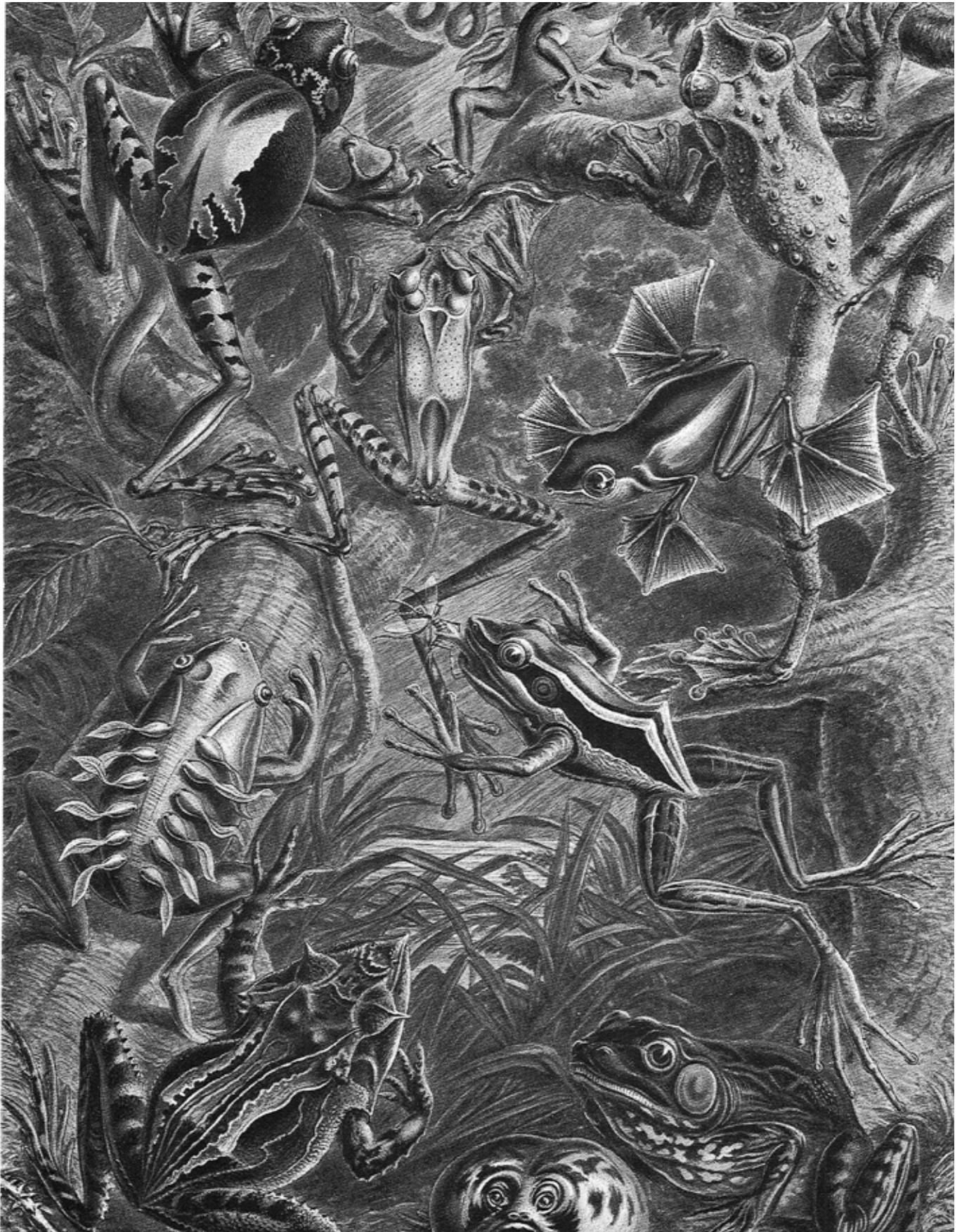
— Anthropologist Gerardo Reichel-Dolmatoff of his 1952 encounter with Richard Evans Schultes, Harvard College class of 1938*

AT THE HEART OF SCIENTIFIC EXPLORATION AND DISCOVERY IS AN ability to see deeply into the unknown. Whether through a telescope or across a river, the scientific gaze transforms these depths into shapes and patterns that shed both meaning and light. When Schultes, one of the greatest botanical explorers and ethnobotanists ever to have lived, says "I know every tree," it is not of ownership or possession that he speaks, but of

his ability to see so much more than the non-botanical mortals who stand beside him.

I first experienced this widening gaze when, as a Harvard undergraduate, I spent a year working as a research assistant at the Smithsonian Tropical Research Institute in Panama. At first all was green. Only with study, with time, did the forest come into focus. Only then did I see the feathery, grey-green branches of *Xylopia*, the unequal petioles that signaled *Capparis*, the ribbed trunks of *Quararibea*. Not surprisingly, the ability to distinguish these "endless forms most beautiful," to quote from the final sentence in *The Origin of Species*, was like a drug, bringing with it the desire to claim, with knowledge and name, more territory. And yet the more my eyes became accustomed to the 'green,' the more visible became all that I had yet to see.

*SCHULTES WAS LATER PROFESSOR OF BOTANY AT HARVARD. QUOTED IN *ONE RIVER, EXPLORATIONS AND DISCOVERIES IN THE AMAZON RAIN FOREST*, BY WADE DAVIS (SIMON & SCHUSTER, 1996)



Previous page, View of Punta Arenas, Chile; above, various species of frogs, including tree frogs (from Ernst Haeckel's *Art Forms in Nature*); right, Southern Astrophysical Research Telescope (SOAR) and Gemini South telescopes on Cerro Pachón as seen from Cerro Tololo in June 2006.



I suspect that the young Charles Darwin had a similar experience when, in 1832, he arrived in Brazil. Although he later described his earliest forays in fairly general terms: "Delight itself, however, is a weak term to express the feelings of a naturalist who, for the first time, has wandered by himself in a Brazilian forest," his notes and journals are filled with data, numbers, details — all of which speak to his increasing ability to see and claim the world around him. For the young Darwin, it was a world replete with capybaras and musical frogs, icebergs and Indians, volcanoes and red snow, flycatchers and finches. But for all his enormous powers of observation, the heavens — both astronomical and metaphorical — seem to fall outside of Darwin's realm. Indeed the lack of interest in astronomical phenomena is striking in Darwin's *Voyage of the Beagle*.

The irony of this is that Darwin's theory of the mutability of species was seen by many as treading exactly on the "heavens" through its displacement of humans from the centrality conferred by special creation. Moreover, his theory undermined the prevailing metaphysical idealism in which truth lies not in the day-to-day details and variation, but in some purer, unchanging realm. Writing on the 100th anniversary of the publication of *The Origin*, Ernst Mayr, Professor of Biology at Harvard from 1953 to 1975, states that "The ultimate conclusions of the population thinker and of the typologist are precisely the opposite. For the typologist, the type (*eidos*) is real and the variation an illusion, while for the populationist, the type (average) is an abstraction and only the variation is real. No two ways of looking at nature could be more different."

The practice of science is deeply connected to how one sees the natural world. Thus, when astronomer Robert Kirshner (p. 55) describes northern Chile as a place of "good seeing," I think of this as referring to more than the clarity of the air and the absence of artificial light. Good seeing is also a state of mind. Good seeing involves a delight in the appearance of new things and the clarity that comes from stepping outside of one's daily routine. Therein lies the value of exploration for the scientist, whether it be traveling by sail around the world or by plane to Chile. For Darwin, the Galápagos Islands proved to be a place of "good seeing," although even this was a near-miss. Darwin writes that despite the Vice-Governor "declaring that the tortoises differed from the different islands, and that he could with certainty tell from which island any one was brought, I did not for some time pay sufficient attention to this statement, and I had already partially mingled together the collections from two of the islands."

As a young, not-yet scientist in Panama, I found that the tropical rainforest was my place of "good seeing." It was there that I learned to see and to inquire. *The Sky Above, the Earth Below* celebrates good seeing by bringing together articles of and inspired by scientific exploration. The theme that unites them is learning how both the journey and the place, whether large or small, bring the world increasingly into focus, and how this sharpening gaze generates a widening sense of wonder.

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Charles Darwin made six major expeditions in South America, and in doing so, changed the way human beings think about their world. In this section, historians, educators and scientists examine Darwin's legacy on the 200th anniversary of his birth.

The Voyages of Charles Darwin

Travels in South America

BY JANET BROWNE

WE OFTEN FORGET THAT THE MOST CREATIVE YEARS OF CHARLES Darwin's life were passed in South America. For three years in the early 1830s, Darwin traveled extensively in Uruguay, Argentina and Chile, and made important shorter visits to the Galápagos Islands and coastal Brazil. The ship that brought him to the continent was HMS *Beagle*, captained by Robert FitzRoy, and commissioned by the British Admiralty to survey the South American coastline for peaceable naval purposes. Those years afloat have become part of history.

Yet Darwin's voyage was mostly on land. Wherever it was convenient FitzRoy arranged to leave Darwin ashore so that he could pursue his scientific observations. The two men would rendezvous several weeks later and move onwards to another area. This method of traveling allowed Darwin to make six major expeditions in South America and on occasion even to rent a small house as a base for his natural history explorations. By the time the ship struck out into the Pacific to continue its voyage around the world, Darwin had come to understand a great deal about the geology and natural history of this enormous landmass.



THE LEGACY OF CHARLES DARWIN

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Previous page: Painting by Gordon Chancellor of HMS *Beagle* in the Galápagos from *Evolution, The First Four Billion Years*, edited by Michael Ruse and Joseph Travis, foreword by E. O. Wilson (Belknap Press/Harvard University Press, 2009); above: Beagle Channel looking westwards.

Darwin's voyage on the *Beagle* is, of course, famous for turning his mind towards evolutionary theory. For us, it is also a story full of symbolic resonance. On that voyage he began an intellectual journey, a quest, if you will, at the same time as he assembled the wide variety of information about the natural world that would help provide an answer. Darwin himself appreciated the lasting impact of the voyage on his subsequent work. The voyage opened the door to exceptional sights and opportunities—the impressive landscapes of South America, the fecundity of tropical Brazil, the brilliance of the stars over the Andes, dramatic encounters with other cultures and other ways of life, hazardous travels off the beaten track, and countless moments when his imagination was powerfully stirred. On his return, his *Beagle* successes enabled him to join the world of natural history experts and inspired the evolutionary views later expressed in the 1859 *On the Origin of Species by Means of Natural Selection*. The voyage made him what he eventually became. Long afterwards he declared in his *Autobiography*, “The voyage of the *Beagle* has been by far the most important event in my life and has determined my whole career.”

All these endeavors and more can be found in the book that Darwin published in 1839. Originally issued under the title *Journal of Researches*, it is now known more usually as *Voyage of the Beagle*. Based on the extensive diaries that he kept during the five years at sea, and drawing on the help of professional naturalists after his

return, this book of travels has charmed readers ever since. Here we can follow his lengthy inland expeditions and what he called his gallops across the pampas; his remarkable encounters with indigenous peoples, and the excitement he felt at recognizing that he could make new and valuable contributions to science. The book also tells us a great deal about the way that natural history got done during the 19th century, from the moment that a rock or fossil, an iguana or a beetle, was picked up by Darwin and put into his collecting bag, to its arrival in a wooden Admiralty box or barrel at Cambridge University, where his friend and former professor John Stevens Henslow was storing material in an unused lecture room, ready to be classified and distributed to British experts. At the same time, an extensive series of letters Darwin wrote to older scientific colleagues show him working extremely hard on living specimens, always reading, writing, cataloguing, and using his microscope to make preliminary dissections. He also made careful field notes that were intended to remind him about key characteristics of the living organisms or important geological features.

Darwin was in fact learning how to process information. Just like us, but without the benefit of computer data bases, he needed to record his information in a retrievable form. He anticipated a lifetime of further study of the fascinating material he brought home. These notes and letters are a truly extraordinary record of a young man's personal development. And in letters to his sisters at home



Observing a fossil outcrop near Montevideo, Uruguay.

in Shrewsbury, he described his deep emotional engagement with the lands and people he encountered. Inexhaustible good humor and energy sing out from every one of these pages—here is a young man who loves what he is doing, who is having fun, who is full of intellectual vigor—an attractive combination of qualities that has captivated generations of readers.

Looking beyond the personal, Darwin's account of his time in South America also has much to tell us about the role that 'travel' held in a rapidly changing political world. Even without Charles Darwin at its center, the *Beagle* voyage provides a significant account of the adventures and dangers of a voyage carried out at a key point in political history. The British Admiralty's desire to chart the South American coast was to enable informed decisions to be made on naval and commercial operations along the stretch from Bahia (now Salvador) in Brazil to Bahía Blanca in Argentina and into the relatively unexplored coastline of Tierra del Fuego, and to enable Britain to establish a stronger foothold in these areas, so recently released from their commitment to trade only with Spain and Portugal. Like the other developed nations of the world, Britain had commercial expansion in mind. Exercises such as these were not always peaceful. As far as the *Beagle* was concerned, FitzRoy was a government representative engaged on official business.

But that was not necessarily how other nations might see it. The *Beagle* was involved in several neo-colonial incidents, includ-

ing military action in Montevideo and being caught in a naval blockade off Buenos Aires. When Darwin rode out into the pampas around Buenos Aires he arrived in the middle of General Juan Manuel de Rosas' fiercest guerilla campaigns. Rosas had succeeded in concentrating all public authority in his own hands during that period, and had assumed the position of a popular savior and dictator. Rosas' troops were at that time relentlessly hunting down and exterminating the Indians. Darwin had to obtain a passport from Rosas and travel with a number of gauchos, who knew the terrain, in order to secure his safety. He describes several occasions when he and his travelling party had to talk their way out of trouble. The passport was granted to 'El Naturalista Don Carlos,' which was widely understood to mean a man who knows everything. Darwin told some amusing stories about the way this inspired great respect from people who probably did not know what it meant. Natural history investigations and coastal surveys could nevertheless be seen by others as politicized, even dangerously nationalistic, pursuits. To ensure his men's safety, Captain FitzRoy insisted that no one should travel on shore alone —Darwin included.

Nevertheless, Darwin made new friends abroad. The gentry in the large towns of South America pursued activities appropriate to their social standing. Darwin stayed in a number of very great *estancias*, often carrying a letter of introduction from some civic dignitary. Many cities had libraries, theatres, and opera houses. There

were local newspapers at every port, but what is perhaps not quite so well known is that FitzRoy and his crew received regular parcels of English newspapers and journals, along with personal letters sent onwards by the British Admiralty. Although Darwin naturally complained about being out of touch, the reality was that he and FitzRoy were remarkably well informed about home activities.

Darwin collected natural history specimens widely and carefully. Several other European naturalists had covered some of the same territory beforehand, including the talented French naturalist Alcide d'Orbigny, collecting for the Paris Museum of Natural History during the 1830s. Darwin chose to concentrate on the less well known organisms. In South America he collected complete suites of insects, small invertebrates, birds, spiders, corals, mollusks, mammals, and fossils when he could get hold of them, having no scruples about buying specimens if he had the opportunity. He knew he would never be able to visit again and that

In South America, Darwin first began to believe that he might be able to do something in natural history and found that his zest for geology started to lead him towards some of his major theoretical achievements.

he should not miss any chance to gather as much information as possible. Many members of the *Beagle's* crew were also interested in natural history and were able to make small, sometimes significant, collections of animals and plants. After the voyage, this unexpectedly became important. In March 1837, a few months after the *Beagle* returned home, it became apparent that Darwin had not sufficiently recorded the geographic location of bird specimens from the Galápagos Islands. He needed the records made by other members of the crew, including those of the surgeon Benjamin Bynoe and Captain FitzRoy. These records helped him pinpoint the locations for his specimens—the vital information that allowed Darwin to see that each form of finch was restricted to an individual island.

During Darwin's intensely active days on shore, he also pursued his fascination with geology, fostered so recently at Cambridge University and on a short field excursion in Wales with his professor Adam Sedgwick. It was in South America that he first began to believe that he might be able to do something worthwhile in natural history and where his zest for geology started to lead him towards some of the major theoretical achievements of the voyage.

The role of Charles Lyell and his *Principles of Geology* in this enthusiastic commitment to geology in Darwin's early work is perhaps now so well known that there is very little to add to the various accounts given by historians. Darwin read Lyell's famous book as soon as it was published, and was delighted by the grand theoretical scheme he found there. Lyell's theory of the gradual elevation of land out of the sea, for instance, could be used by Darwin to explain many of the things he saw. The thick alluvial deposit of the pampas was consequently interpreted by him as an elevated estuary, and Darwin thought that the fossil mammalian bones he found there must have been swept into the sea by tertiary rivers, only to be covered with sediment and eventually raised above the

surface. Rounding Cape Horn, he thought the islands looked like a row of submerged mountains. He was particularly gratified to find that the high double ranges of the west coast seemed to have been uplifted, step by step, from a state similar to that now exhibited by Tierra del Fuego. Cross-country traverses and coastal surveys in Chile left no doubt in Darwin's mind that the elevation of the Andes had taken place exactly as Lyell had surmised. As he later declared, Darwin was here seeing the origin of landscapes as if he had the eyes of Lyell.

This special vision was also plainly to the fore during Darwin's visit to the Galápagos archipelago in Ecuador. The *Beagle* arrived in the archipelago in September 1835, staying for five weeks. Darwin visited four of the islands. His interest in the archipelago was intense because it promised a new kind of geological experience. He hoped to see active volcanoes (in this he was disappointed) and evidence of recent volcanic activity. Countless lava rocks of various ages

and numerous volcanic cones convinced him that the islands had only recently, in geological terms, emerged from the sea bed. Darwin also relished the chance to investigate the animal and plant life of the archipelago. Insular populations were fascinating objects at any time, and the Galápagos Islands were known to possess a rich variety of endemic species. Here again it would be possible to

see how animals and plants colonized new lands, how bare rock was clothed and colonized with living beings. He enjoyed the tortoises, collected nearly all the land bird, and studied the two species of iguana very closely, even dissecting a marine iguana to confirm his suspicion that the animals were entirely vegetarian and took their meals in the sea.

The other topic that should finally be mentioned is Darwin's discussion of the Fuegians. The *Beagle* carried three individuals from Tierra del Fuego who had been Christianized and given an elementary education in Britain, and were now being returned to their original land in order to establish an Anglican missionary station. The three on board fascinated Darwin and he recounted his naïve amazement that after so few years in English company they were now almost another "species of man" from their literal relatives. Darwin felt the indigenous inhabitants of Tierra del Fuego were primitives existing on the edge of savagery, and the comparison between these peoples and their Anglicized relatives on board the ship struck him hard. This encounter with primitive humans in fact destabilized his ideas about the fixity of species just as much as the Galápagos species did. Both Darwin and FitzRoy were saddened by the eventual collapse of the mission. Of all of Darwin's varied experiences, this example of the temporary nature of civilization and the contrast of human habits and lifestyles moved him the most. "I could not have believed," he wrote, "how wide was the difference, between savage and civilized man. It is greater than between a wild and domesticated animal, in as much as in man there is a greater power of improvement."

*Janet Browne is Aramont Professor in the History of Science, Harvard University. She is the author of a two-volume biography of Darwin, *Voyaging* (1995) and *The Power of Place* (2002). In January she visited Tierra del Fuego for the first time.*



Darwin, Lizards, and Evolution

The Latin American Connection

BY JONATHAN LOSOS

MUCH HAS BEEN SAID ABOUT THE LIFE OF CHARLES DARWIN on the occasion of the 200th anniversary of his birth and 150th anniversary of publication of his magnum opus, *On the Origin of Species by Means of Natural Selection*. A point that has not received much attention, however, is the significance of Darwin's years in Latin America, which helped shape his views about the diversity of the natural world and how it came to be.

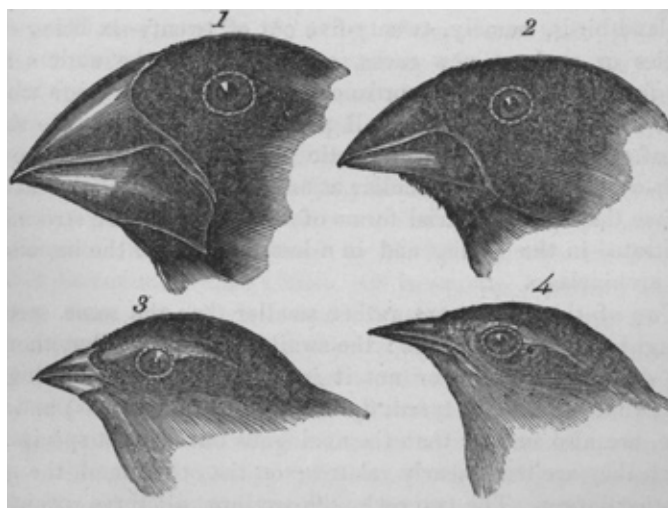
Without question, the most significant event in shaping Darwin's thinking was his five-year voyage on the British royal naval ship, the H.M.S. *Beagle*. A primary purpose of the expedition was to survey the coast of South America. As a result, the ship spent a large portion of its time in and near that continent, allowing Darwin to disembark and spend considerable periods of time exploring (and avoiding the seasickness that plagued him throughout the trip). The biological and geological observations that he made during this time were crucial in sculpting his idea that living forms had not remained static through time, but rather had changed, evolved. For example, he discovered a new species of rhea, a flightless bird similar to, but slightly smaller than, an ostrich, and marveled that

there should be two species of rhea occurring in different parts of the continent, similar, but noticeably different.

In addition, his paleontological explorations uncovered fossils of species different from those currently found on the continent, yet clearly related to them. These observations made a strong impression on Darwin, as he recounted in the *Origin*: "When on board H.M.S. 'Beagle,' as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species—that mystery of mysteries."

And, as is well known, Darwin's five weeks in the Galápagos Islands, a volcanic archipelago 600 miles due west of Ecuador, offered rich material for his discoveries. As the *Beagle* progressed through the islands, Darwin noted that populations of species differed slightly from one island to the next. The mockingbirds differed in plumage pattern and bill size, the tortoises in shell shape. Again, why should this be? All of Darwin's observations suggested the same possibility: populations and species across time and space are connected by descent; species are not immutable, but, rather, change through time, with the result that related species in different

A trunk-crown anole from Jamaica



Darwin's Finches: (1) *Geospiza Magnirostris*, (2) *Geospiza Fortis*, (3) *Geospiza Parvula*, (4) *Certhidea Olivacea*

places or times will be similar, but not identical.

Probably the most famous subject of Darwin's interest are the eponymous finches of the Galápagos, a group of 15 species that have diversified into many ecological niches, including seed-eaters, insect catchers, fruit and flower bud specialists, and even a tool-user that employs twigs to probe crevices for tasty grubs. Paradoxically, Darwin failed to see the significance of these birds at first, misidentifying them as members of different bird families. It was only when the *Beagle* returned to England in 1836 and Darwin sent his specimens to the famed ornithologist John Gould that he learned that all of the birds were members of a single, extraordinarily diverse family. At this point, Darwin recognized their significance, noting in his best-selling travelogue: "Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago, one species has been taken and modified for different ends" (*Voyage of the Beagle*, p. 380). These observations set the stage for Darwin to develop his radical theory. Through careful observation, analysis, and painstaking data accumulation, he slowly (slowly!) honed his ideas, finally publishing them in his masterpiece over two decades later.

The situation illustrated by Darwin's finches is now termed "adaptive radiation," the phenomenon in which a single ancestral species diversifies, producing descendants adapted to a wide variety of ecological niches. Many biologists consider adaptive radiations to be responsible for a large part of the diversity in life we see around us. What causes one type of plant or animal to radiate and not another continues to be a question of intense scientific investigation. One factor that appears important is ecological opportunity — when a species finds itself in a setting with ample resources and few other species, adaptive radiation often results.

Such ecological opportunity can arise for many reasons, but perhaps the most common is colonization of a distant island. Many islands are formed by volcanic eruptions that create a new landmass where none previously existed. This is true for the Galápagos, as well as the Hawaiian Islands and many others. The result is that the early arrivals to these islands have an open playing field, often free of competitors and predators. As ecosystems develop, resources

become available, and the early colonists can diversify in ways not possible on species-packed mainlands. This is exactly what happened with Darwin's finches, and it turns out that similar phenomena have occurred in other archipelagos around the world.

My own research, and that of many students and colleagues, has been focused elsewhere in Latin America, in Central America and the islands of the Caribbean. Anyone who has visited the Caribbean and managed to travel inland from the beach has probably noticed a small lizard with an odd appendage — its throat sports a brightly colored flap of skin, which it flashes as a form of lizard communication. These lizards are members of the genus *Anolis*, commonly called "anoles," and they belong to one of the most diverse groups of vertebrates (back-boned animals), with nearly 400 recognized species.

Anoles have adaptively radiated across the islands of the Greater Antilles. What is most remarkable about these lizards is that they have not radiated once, but four times independently, on Cuba, Hispaniola, Puerto Rico, and Jamaica. On each of these islands, diversification has occurred, producing a suite of species, each adapted to its own part of the environment. What is particularly amazing is that the same set of habitat specialists has evolved independently on each island. Thus, each island has a species that specialized to use narrow surfaces such as twigs. These lizards have very short legs, an elongated body, and they creep slowly along narrow branches, counting on their gray-color camouflage to avoid detection by both predator and prey. Similarly, each island has a robust, long-legged species that lives low on tree trunks and dashes quickly to the ground to capture prey and find its mates; and a slender green lizard with large toepads that give it the sticking ability to climb over slick leafy surfaces high in the canopy. Laboratory studies have confirmed that each type of habitat specialist is modified to function best in the environment it occupies: twig anoles have the best agility to navigate their narrow and irregular surfaces without falling off, long-legged trunk species have the greatest sprinting and jumping abilities, and the canopy species have the best clinging capabilities. In other words, each type is well adapted to the environment it uses.

And, it must be emphasized, these types have evolved repeatedly (and independently) on each island. DNA sequencing confirms that twig specialists on different islands are not each other's closest relatives; rather, each twig specialist is more closely related to other types of specialists on its own island, and the same is true for the other specialist types. Adaptive radiation has occurred independently on each island, producing, for the most part, the same set of habitat specialists.

Convergence—the evolution of similar body features in species adapting to the same environment—has long been taken as evidence of adaptation driven by natural selection. However, convergence of entire communities is a much less common phenomenon, one that is probably best documented in Greater Antillean anoles. Why anole evolution has produced the same outcome on each island is not clear. Most likely, the environments on the different islands are very similar, so that the same best ways for anoles to make a living recur from one island to the next.

But the story does not end there. Although most scientific research on these lizards has been conducted on Caribbean islands, there are even more species of anoles in mainland Central and



Clockwise, from top left: a twig anole from Cuba, trunk ground anoles from Jamaica and Hispaniola, the former displaying its dewlap; a trunk-crown anole from Hispaniola.

northern South America than on the Caribbean islands (approximately 220 vs. 150, with more being discovered every year, primarily on the mainland). The discrepancy in research efforts has to do with abundance; whereas anoles are abundant on the islands, they can be quite hard to find on the continent (one of the curses of studying island anoles is that working anywhere else, on any other type of organism, just seems like too much trouble).

One might well ask: does the same set of habitat specialists that occurs in the Greater Antilles also occur on the mainland? A few mainland species do, indeed, conform to the island specialist types. Most mainland anoles, however, clearly are not at all like the island species: they differ in body proportions, habitat use, or behavior (and sometimes all three). For example, the two most common species found at the Organization for Tropical Studies' (a consortium to which Harvard belongs) La Selva field station in Costa Rica are anoles that use the leaf litter and narrow saplings near the ground. In both ecology and behavior, these species are not like any of the Greater Antillean habitat specialists.

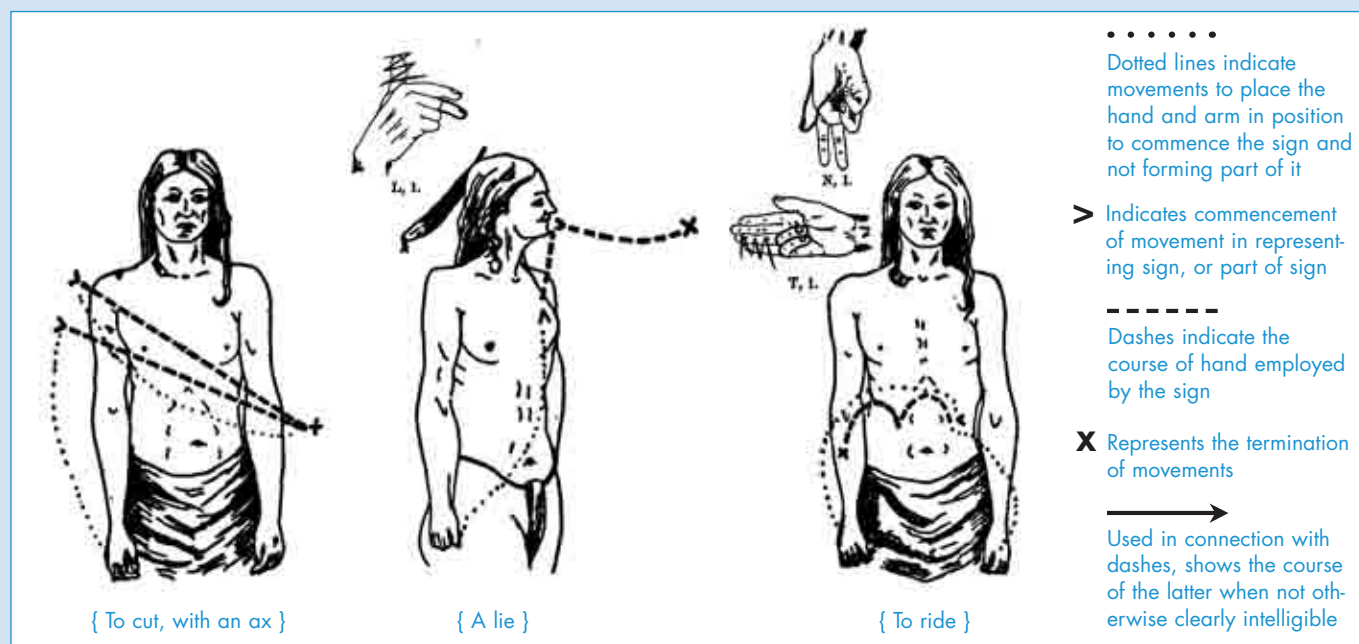
Why has evolution on the mainland taken a different route? At this point the answer is unclear, but the most likely explanation involves differences in levels of predation. On the mainland, a huge variety of predators occurs—not only many types of birds and snakes, but also monkeys, pig-like peccaries, cats and other carnivorous mammals, larger lizards and many more. By contrast, the predator fauna on the islands is much more limited. Thus, while island lizards are probably most concerned with competing with members of their own species for food and mates, the main priority for mainland species may well be avoiding being eaten. In other words, even if they used exactly the same habitat (e.g., the tree canopy), two species—one in the islands, the other on the

mainland—might have to adapt differently because of the contrasting demands posed by their environmental settings. The greater abundance and longer lifespan of island species would seem to support this idea, but more work is needed.

A second question is whether replicated adaptive radiations occur on the mainland, as they do in the islands. As yet we don't have enough information on the biology of the mainland species that occur in different places. In addition, our DNA sequence data are not yet sufficient to resolve the evolutionary relationships of these species. Anole work in Central and South America is just getting started in my laboratory, as well as in other labs, so we hope to be able to answer these questions before too long.

I have often wondered what would have happened if the *Beagle's* charge had been to survey the Caribbean islands, rather than South America. Darwin was an astute observer and naturalist; he surely would have noted the anoles, and probably would have picked up on their similarity from one island to the next. Perhaps, in fact, the lessons they teach might have been so clear that Darwin wouldn't have needed another 20-plus years to write his grand synthesis! And the lizards would have had a catchier, more marketable name—Darwin's lizards, surely. Alas, the *Beagle* didn't chart that course, but anoles are still allowing us to learn much about the evolutionary process and to test the ideas Darwin laid out 150 years ago.

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Darwin and Digital Code

From the Origin of Species to the Origin of Speeches

BY MARA MILLS

DURING WORLD WAR II, BELL TELEPHONE LABORATORIES worked on the problem of secure voice communications for the United States Army. In 1943, they launched the SIGSALY system, also known as “Project X.” SIGSALY (a fake acronym) enabled thousands of secret telephone calls between Winston Churchill, Franklin Roosevelt, General Douglas MacArthur and other military leaders. Today, the encryption system is hailed as a starting point for digital communication, the first successful demonstration of pulse code modulated speech. With PCM, patterns of electrical pulses or numbers “describe” the amplitudes of samples from a speech wave. Instead of carrying speech itself (or an analogous electrical wave), telephone wires and radio wireless transmit only the parameters of the speech signal.

A central component of the SIGSALY system was the vocoder, or “VOice-CODER,” a device best known for generating “robotic” voices in electronic music. Bell engineer Homer Dudley originally designed the vocoder in the 1920s as a tool for speech compression—to reduce the bandwidth, and hence the expense, of telephone transmission. The vocoder “analyzed” or separated telephone speech into frequency bands, sampled and quantized each band, and then remade the speech at the receiver. “In ordinary telephony,” Dudley explained to the readers of *Bell Laboratories Record* in 1936, “we move a sound wave electrically from one point to another by direct transmission but in the synthesizing process, only the specifications for reconstructing the sound wave are directly transmitted.”

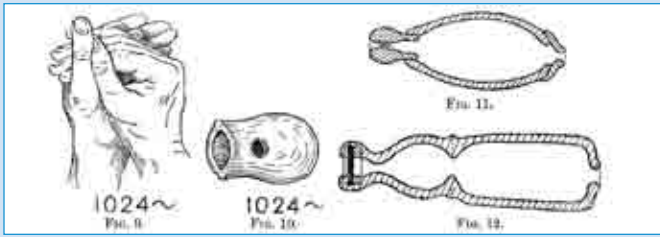
Dudley based the vocoder’s sampling mechanism on the theory that concrete and quantifiable “gestures” lay beneath speech. His publications often referred to lip-reading, artificial larynges, and

speaking automata as evidence for the viability of speech compression. Each of these fields had already demonstrated that speech could be divided into a sound stream and a “message,” imprinted onto the breath by the movements of the lips, tongue, teeth and other vocal organs. These speech “codes,” or their numerical descriptions, might be transmitted with great efficiency over a telephone line.

Dudley acknowledged a debt to one of his contemporaries from England, Sir Richard Arthur Surtees Paget. Baronet and barrister, born in Somersetshire in 1869, Paget was one of the last “gentlemen scientists” to have substantial influence. In childhood and adolescence he met all the unofficial benchmarks for a promising speech researcher—possessing “perfect pitch”; performing “one man duets” (by whistling and singing, or whistling and humming, at the same time); and teaching his black poodle, Pompey, to utter a few words.

His life’s work was given over to debunking venerable notions of orality. In a lecture to the Oxford University Anthropological Society in 1934, Paget explained, “Speech is usually described as a system of significant sounds by which we communicate ideas—but a very little reflection will show that this is a mistake... It is the gestures that we make with our tongue, lips, etc., which carry the meaning of speech. The sounds are only consequences by which we (subconsciously) recognize the gestures.” The role of sound, Paget believed, was to convey emotion, as in the mating calls of birds, the songs of crickets, and the tones of human voices. Speech “gestures,” on the other hand, conveyed information.

Paget marshaled a wide range of evidence to support this gesture theory. For one thing, he knew that many deaf people were able to communicate through lip-reading. For another, he observed



(fig. 9) Clapsed hands resonator 1024; (fig. 10) Model #7, resonator 1024 in plasticine; (fig. 11) Model #8, single resonator with larynx; (fig. 12) Model #9, u (who) 608/362

firsthand the actions of the vocal organs. At the 1932 International Phonetic Conference, he peered down phonetician George Oscar Russell's throat with a "pharyngeal periscope." In a subsequent lecture to the Physiological Society at University College London, he recalled "the extreme activity of his larynx and surrounding parts...during normal speech. There was a different 'attitude' at each change of vowel—there was a different attitude in forming the so-called voiced and unvoiced consonants...even when *all* these consonants were being whispered."

Paget also argued from evolution: articulation must have emerged from a "primitive" sign language. In *The Descent of Man*, Charles Darwin had insisted that complex language distinguished the human species—and was subject to the laws of evolutionary theory. Other animals, of course, communicated through sound, but humans had the "mental faculties" for "connecting definite sounds with definite ideas." Different human languages, like so many behaviors, had a common basis in biology. "I was incessantly struck whilst living with the Fuegians on board the *Beagle*," Darwin reflected, "with the many little traits of character, shewing how similar their minds were to ours." Certain facial expressions, emotional vocalizations, and gestures seemed even to be universal.

Darwin described gesture as a longstanding accompaniment to vocalization, and "gesture-language" as analogous to speech. "I cannot doubt that language owes its origin to the imitation and modification, aided by signs and gestures, of various natural sounds, the voices of other animals, and man's own instinctive cries...As bearing on the subject of imitation, the strong tendency in our nearest allies, the monkeys, in microcephalous idiots, and in the barbarous races of mankind, to imitate whatever they hear deserves notice." Some gestures, such as shrugging, were almost certainly innate. Yet Darwin cited the theory of Edward Burnett Tylor, anthropologist of ancient Mexico, which held that most gestural signs were related to nature through instinctual mimicry, and then condensed, exaggerated, or otherwise altered over time. In *Researches into the Early History of Mankind and the Development of Civilization*, Tylor argued, "The Indian pantomime and the gesture-language of the deaf-and-dumb are but different dialects of the same language of nature." Speech had evolved—somehow—as an improvement upon this "original language of man."

In *The Expression of the Emotions in Man and Animals*, Darwin introduced the concept of "serviceable associated habits," referring to behaviors that become habitual under certain conditions, but then can be triggered in new settings by mood or mental state. In a related phenomenon, Darwin argued, "There are other actions which are commonly performed under certain circumstances, independently of habit, and which seem to be due to imitation or some

sort of sympathy. Thus a person cutting anything with a pair of scissors may be seen to move their jaws simultaneously with the blades of the scissors. Children learning to write often twist about their tongues as their fingers move, in ridiculous fashion." Based on this last model, Paget insisted upon a more central, causal role for gesture in the evolution of language: early humans communicated via "pantomime," unconsciously making the same gestures with their mouths; eventually, they dedicated their hands fully to labor and spoke orally instead. In his lectures on this topic, he often exclaimed, "Darwin has not only given us the origin of species, but also the origin of speeches!"

Paget built a range of "artificial talkers" to test his gesture-theory of speech. His minimalist Cheirophone, for instance, consisted of a vibrating reed held within the resonator of his own clapsed hands, fed by an airstream. With three fingers simulating the tongue, thumb and forefinger as the lips, the Cheirophone was able to create most English sounds. It spoke the sentences "Hullo London, are you there?" and "Oh, Lilah, I love you" to radio audiences in England and America, demonstrating that hand and mouth might perform the same gestures. To identify the fundamental vocal posture for each vowel, Paget built other models from clay and plasticine. In a 1922 article, "The Origin of Speech—A Hypothesis," he further theorized that if hands and clay could "talk," could not electrical circuits be designed with the appropriate patterns of resonance to synthesize speech?

While the gestural origins of speech are now questionable—and the primitiveness of sign language has lost its validity—telephone engineers of the early twentieth century invested heavily in Paget's theory. Harvey Fletcher, who directed the speech and hearing research at Bell Laboratories while Dudley was assembling the vocoder, opened his textbook *Speech and Hearing* with a discussion of the gestural "mechanism of speaking":

It is very probable that such signs, gestures, and expressions of the face were used before the evolution of the spoken language had progressed very far. According to some philologists, the vocal sounds of very primitive people were exclamatory and song-like and used mainly to express emotion. Sound mimicking nature came to designate certain things connected with the thing imitated. As man's power of analysis developed, the sounds gradually developed into spoken words having definite meanings. According to Sir Richard Paget, human speech began by the performance of sequences of simple pantomimic gestures of the tongue, lips, etc., comparable with the natural gestures (of hands, etc.) which are still made by deaf mutes, and that these gestures were made audible by breathing or grunting.

"Signs" were at once symbolic and wonderfully concrete; mouth gestures could be described, quantified, and coded. Speech could be compressed by separating out these gestures from audible sound. Placed at the foundation of oral communication, gesture was at once universal and "primitive." For the engineer, this suggested that communication was inherently amenable to translation between media—and it was perfectible, open to a modern and efficient re-tooling.

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Teaching Evolution

Challenges for Mexican Primary Schools

BY ANA BARAHONA AND ELISA BONILLA

DURING THE 19TH CENTURY, PHILOSOPHERS, DOCTORS, botanists, and zoologists in Mexico engaged in lively debate over Darwin's ideas about evolution of the species. The Catholic Church hierarchy reacted sharply to these ideas and accused Darwinism and all other concepts of evolution as "contrary to Christian doctrine and dangerous to youth." The churchmen firmly opposed the teaching of evolution in Mexican classrooms. Justo Sierra, the illustrious Mexican lawmaker and politician who decisively influenced education in the era, had brought Darwin's ideas to public attention for the first time in 1875, when he published an article on "El espiritismo y el Liceo Hidalgo" (Spiritism and the Hidalgo Lyceum) in the newspaper *El Federalista*.

Sierra invoked the separation of church and state, a principle firmly established in Mexican law, to head off the Catholic Church hierarchy in its attempt to impede the teaching of evolution. He argued that sciences have to be taught even if they contradict common sense or ideological and theological positions.

A fundamental outcome of this debate, which took place in scientific societies and in the press alike, was that it publicized evolutionary ideas throughout many sectors of society, and these ideas were gradually incorporated into classrooms at various levels of education.

In 1902, Alfonso L. Herrera created a professorship in General Biology with an evolutionary focus, in the Normal School for Professors, a teachers' college. Two years later, he published a course textbook, *Nociones de Biología* ("Notions of Biology"). This book, which was a milestone in progressive thinking, was used for years in several Mexican institutions.

Nevertheless, it is important to stress that evolution was merely mentioned as one among other topics in elementary school curricula rather than figuring as the basis of a systematic approach to the study of living beings. This situation lasted even into the 1970s. President Luis Echeverría (1970-1976) carried out an educational reform that implemented the teaching focus adopted in the United States and Europe and made improvements to the textbooks used in the 1960s; however, this educational reform did not adopt an evolutionary focus in teaching natural sciences for grades 1-6.

Twenty years later, in 1993, another curricular reform of the primary school established that natural science subjects from the first to sixth grade be taught from an evolutionary perspective, and that evolution itself be a sixth-grade subject (this last had already been required in the 1970s). This resulted in a fundamental transformation of the curriculum and textbooks, as previous materials had discussed knowledge about the origin of species in a purely descriptive manner. This change constituted a great challenge for the design and elaboration of new third-to-sixth-grade Mexican textbooks on natural sciences.

In the sixth-grade textbook for natural science from the 1970s, evolution was already included, but the discussion was limited to the study of fossils as evidence of life in the past, with illustrations

that showed the gradual evolution of horses as well as the differences between contemporary humans and their ancestors. In this book the reference to Darwin is minimal, although some adaptations of animals and plants are mentioned, and natural selection is discussed as one of the most important processes in regards to the evolution of the species; finally, there is a passing reference to geological eras. Altogether, these themes take up 18 out of a total of 242 pages.

In contrast, the textbook developed for the 1993 curriculum for the same grade (published in 1999 and still used in Mexican primary schools) discusses evolution extensively. It includes the origins of the earth, the transformation of ecosystems (throughout time and due to continental drift), fossils, the extinction of species and geological eras. It talks extensively about Darwin, his *Voyage of the Beagle* and how this trip helped him develop the idea of evolution. The book devotes ample space to the concepts of natural selection and adaptation. It contrasts Darwinism with the ideas of Jean-Baptiste Lamarck (1744-1829), who believed that evolution occurred due to the use and disuse of the organs and the inheritance of acquired characters. Finally, the textbook concludes with a chapter on human evolution. These subjects take up 60 out of 248 pages, three times as much as in the previous book. The difference between the two textbooks is not only in the number of pages dedicated to evolution or the form of presenting the subject, but also in the type of activities and intellectual challenges demanded of the students. For example, while the previous book shows a couple of images describing the adaptation of a snail, a giraffe and an insect, the current text approaches adaptation and natural selection with a proposal for an experiment to be performed in teams and with the elaboration of a conceptual map.

Diverse themes with an evolutionary focus are introduced beginning in the third grade. For example, there is a discussion of plants' capacity to nourish themselves and how one thing relates to another, so that the oxygen that we breathe today comes from photosynthesis of plants that existed thousands of years ago. Likewise, in the third grade, students study the domestication of corn from its wild ancestors to learn about the importance of mutation, breeding, and conservation of the species. Throughout the development of themes regarding the study of plants and animals, there are multiple references to the importance of the adaptations that are a result of the evolution of the species, bringing up questions and assigning activities to stimulate informed reflection by the students on the subject. In fourth grade, the study of evolution is reinforced when, among many examples, students learn about the role of human beings in changing ecosystems. The text explains how life on earth appeared millions of years ago: from the diversification of living forms, the most ancient human beings appeared, whose remains have been found on the African continent, dating back about two and a half million years. From Africa, these human beings spread throughout the earth. Students learn about the birth of the first societies and the



A National Council of Education Promotion (CONAFE) student in rural Chiapas, this teenager studies when not working in the fields. Free textbooks in both public and private schools have been the principal means to carry out education reform in Mexico.

invention of agriculture, and with it the raising and domestication of plants and animals. This explanation appears also in the context of the importance of conservation of ecosystems.

In the same manner, in the fifth grade the subject of “cells, one-cell and multi-celled organisms” is introduced. Students learn that the first living creatures that appeared on the earth were very simple organisms, composed of only one cell, and more complex forms of life developed from these. Fifth-graders also learn about the first grand division between one-celled organisms with a nucleus and one-celled organisms without a nucleus (bacteria). The conclusion is that these first organisms gave rise to all the living forms that we know today. From the 1990s on, the study of cells ceased to be purely descriptive, reduced to the parts that make up a cell and the difference between animal and vegetable cells, and began to be taught with an evolutionary focus.

The 1993 curriculum and textbooks were an important leap forward and indeed an advancement over other educational systems that still question the value of including Darwinian theory in primary school. However, not everything is entirely positive. In particular, we need to strengthen the training of teachers capable of teaching with an evolutionary, rather than descriptive, focus. It wasn't until 1997 that such a curriculum was approved for teachers' colleges; four years later, in 2001, the first group of elementary school teachers graduated with this training. However, there has been no evaluation whether this training truly is enabling teachers to teach natural sciences with an evolutionary focus or, even more important, if the students manage to develop an evolutionary mindset.

It is important to stress that free textbooks have been the principal means of bringing primary education reform to the Mexican educational system as a whole. The universal character of this measure, which provides books to children in both public and private

schools, makes it very influential. Some 2.7 million copies of each title are published, although the exact number varies from grade to grade. This means that a book that has been published for the last 14 years, such as the third-grade natural sciences textbook, has been used by 37.8 million Mexican children, equivalent to 35% of the Mexican population today.

Federal educational authorities recently announced another new reform of primary school education, now in a pilot program phase. In our opinion, in the case of natural sciences, the reform must not only maintain—or even better, improve upon—the standards of quality reached in the current textbooks, but also confront once again the obstacles encountered in the previous reform, especially that of preparing teachers capable of developing an evolutionary mindset in their students, so that 200 years after the birth of Charles Darwin, his ideas—which revolutionized the way of understanding and explaining the development of the Earth—will finally be fully disseminated and understood.

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THE GALAPAGOS

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The Galápagos Islands off the Ecuadoran coast inspired Charles Darwin's theory of evolution more than a hundred years ago. Today, these islands face multiple challenges as they seek to combine conservation with sustainable development and tourism.

Endless Forms Most Beautiful

Saving Galápagos in the 21st Century

BY JOHANNAH BARRY A PHOTOESSAY BY ROGERIO ASSIS

"There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved."

CHARLES DARWIN WROTE THESE WORDS one hundred and fifty years ago. *On the Origin of Species* exploded upon the scientific and academic world in 1859, and its unorthodox conclusions, to which Darwin was at first unwillingly, but then inexorably drawn, challenged the most entrenched scientific dogma of his day. Charles Darwin spent only five weeks in Galápagos, but his time in these isolated islands led to his theory of a dynamic evo-

lutionary process. The young Darwin could not have envisioned what his trip around the world would bring — even he had little idea of what he was gathering, viewing and chronicling. His keen, observant probing left readers of his work captivated by an all too brief introduction to these inelegant islands and "...their old-fashioned antediluvian animals; or rather inhabitants of some other planet."

More than a century later, society still struggles with the conclusions so carefully reached by Darwin. The concept that evolution is a dynamic force unsettles those who hold a less complex view of the natural world. If the origins of our natural world elude some of us, perhaps it is this lack of clarity that leads us, as a world community, to remain at odds with wild places. We act in and upon them with discomfort

and suspicion, as though the natural world were a frontier to be yoked into submission. Cannot nature, in its full and unpredictable beauty, provide the very context in which mankind begins to understand what it is to be human? How should we connect with the natural world, with the myriad species we encounter on land and in our oceans and waterways? What can wild places like Galápagos continue to tell us about the world in which we live?

There is still mystery in the natural world, things which are yet to be learned and discovered. The ocean, the great blue heart of our world, is as little understood now as it was in Charles Darwin's day. Galápagos today remains a vibrant laboratory for learning how the world works. New scientists join those who have been working for decades to uncover the secret

life of finches, the islands under the sea, and the churning geological activity which even today shapes and expands the archipelago. We learn of a new species of land iguana, new species of plants, and new species of corals. There are systems still to be uncovered and understood and daily opportunities to be enlightened.

But while much of the archipelago remains as it was, and in some cases is better preserved than when Darwin experienced it, this natural treasure faces rapid, possibly irreversible change. The resident population in the archipelago grows and with this growth comes pressure on delicate and scarce resources. We bring the world to these remote islands, and leave behind an unfortunate legacy of waste, consumption, and exploitation. Yet we know the path towards protection and sustainable, harmonious living. We are challenged to take it.

The 21st century will give us reason for hope. There is growing awareness among those living in Galápagos about these extraordinary islands and that a balance must be struck between man and nature. Despite considerable economic and social challenges on the mainland, the Ecuadorian government has demonstrated an increased commitment to “getting it right” in Galápagos. An international community of scientists and scholars continue to seek answers to the unknown. We are grateful to the visitors to Galápagos who become its most ardent advocates and defenders. And we are grateful that mankind still has the capacity to be dazzled. Charles Darwin spoke of the “beauty and infinite complexity...between all organic beings.” The Galápagos Islands remain one, tiny, but infinitely complex system in which biological mysteries still abound.

Johannah Barry is the President of the Galapagos Conservancy. She can be reached at <johannah@galapagos.org>.

Rogério Assis, executive editor of the Brazilian magazine *Pororoca*, made these stunning photos of birds and other wildlife in the Galápagos Islands. One of the principal challenges faced by the islands is how to maintain their biodiversity and strike a balance between man and nature.







Are We Loving the Galápagos to Death?

Beyond the Animals

BY CECILIA ALVEAR

WHenever I tell people that I was born in the Galápagos Islands of Ecuador, they always say, “I didn’t know there were any people on the Galápagos. I thought only strange animals lived there.” To which I usually respond that people—strange and not-so—also made their way to the islands over the years.

The islands were unpopulated for centuries, although they were not unknown. There are oral accounts of one Inca ruler who made his way here on a raft. The first written chronicle comes to us from the Bishop of Panamá, whose ship was blown off course in 1535. The misplaced cleric and his party loaded up on water, but the volcanic terrain and the strange creatures reminded them of hell, so he said mass on the beach and promptly left. The islands, also known as “Las Encantadas” or “The Enchanted

Isles,” later became the refuge of pirates and buccaneers. In the 18th and 19th centuries, whalers made the Galápagos a way station to stock up on water and giant tortoises which they carried as a meat supply.

In 1832, the newly independent government of Ecuador took possession of the Archipelago and in 1835, a young Englishman by the name of Charles Darwin came calling.

And the rest is history—or evolution, if you prefer.

Throughout the early years, Ecuador tried all sorts of colonization schemes. When they failed, settlers left behind domestic animals which became feral and to this day threaten the native species.

Among the more colorful human specimens in the Galápagos saga stands the legendary tyrant Manuel Cobos, who planted

sugar cane and ran a sugar mill and a railroad in San Cristóbal Island with convict labor. He was killed during an uprising. A few years later Norwegian immigrants tried to start a fish processing plant. It failed for lack of adequate transportation. In the 1920s, several Europeans arrived searching for a Robison Crusoe experience in this volcanic utopia.

In the 1930s came a woman who called herself a Baroness and lived with two lovers in Floreana Island where she intended to open a hotel. She and her favorite suitor vanished mysteriously—but that is another story. Several Germans came in those years fleeing the impending horrors. Prominent among them were the Wittmers and the Angermeyers whose descendants still live on the islands. Mrs. Margret Wittmer wrote *Post Office Floreana* about her experiences. A



Left: Photo taken by the author's parents in Baquerizo Moreno, San Cristóbal back in 1940–1941. The older girl is her sister, Alexandra; the toddler is the author. Above: Cecilia with tortoises at the Galapagos National Park tortoise preserve in San Cristóbal Island.

couple of “pre-hippies,” Ainslie and Francis Conway, arrived from Berkeley, California. She wrote a book about their adventures, *Las Encantadas*.

Both authors praise my father, Lt. Col. Alejandro Alvear, who was appointed “Jefe Territorial” or Military Governor of the Archipelago in 1939. They call him “enlightened” because he built the first school in San Cristóbal and cared about the settlers. When my father, my mother, Laura Triviño de Alvear, and my older sister Alexandra arrived in 1939, Baquerizo Moreno in San Cristóbal Island was a small village with huts of bamboo, lumber and corrugated iron. There were only 800 people living in the whole Archipelago. My parents lived in a wooden house facing “Shipwreck Bay” (with a front porch view of the site where on January 16, 2001, an old tanker, the “Jessica” ran aground, spilling bunker fuel). That’s where I was born and where I spent the first two years of my life.

Although I was never more than a toddler there, I know that we spent most of the days at the then-pristine beach. Sea-lions and iguanas frolicked on the nearby rocks. We watched the blue-footed boobies as they dove in swarms to catch fish for their dinner.

In the summer of 1996 I returned to Galápagos with a group of friends. As we approached San Cristóbal a school of dolphins rode the bow wave. They are magnificent creatures in their natural habitat: powerful and playful, enjoying an afternoon romp in the turquoise waters. Our squeals of delight seemed to encourage them to do even more elaborate somersaults, to flip over and then to look up at us to check our reactions. I felt they were welcoming me back home.

The Galápagos were declared a national park in 1959, and in the 1960s tourism

to the islands started to grow and produce significant revenues for Ecuador. There are now about 160,000 annual visitors—including myself—and the local population, mainlanders in search of better job opportunities, now numbers 30,000 spread over five populated islands. My birthplace is now a small city of 4,000, with a concrete pier, paved streets, cars, and cement houses. The house where I was born was swallowed by the new Ecuadoran Navy base.

Although the Galápagos National Park and the Darwin Foundation are making efforts to protect the fragile environment from the impact of the human species, it is very hard for us to co-exist with endangered species. One famous story is that of “Lonesome George,” the last one of the species of tortoises that inhabited Santa Cruz Island. George now lives in Santa Cruz island where the Darwin Foundation cares for him. Efforts to find him a suitable mate have failed thus far, but there may be some hope because recently another male tortoise was found with half of the genes of George so now the search is on for a female equivalent to try and save George’s species.

Some of the people who live in the Galápagos are fishermen. It has been difficult for them to accept governmental regulations as to the length of time they can fish and amount of crustaceans and fish they can harvest. In the past they have staged uprisings to protest the end of the lobster season and the constraints on the

harvesting of sea cucumbers.

Tourists come here because they love the animals and the wildness of the several islands that are still uninhabited. Islanders resent what they perceive as a policy that favors animals over people. They also feel that the profits generated by the tourism industry tend to favor well-established mainland operated tour companies. Tourism is the economic lifeline for the islands but it has many downsides.

The islands were given World Heritage site status by UNESCO in 1978 and in 1985 were declared a Biosphere Reserve. This was extended in 2001 to include the 43,500 square miles of ocean surrounding the islands. In 2007, UNESCO joined the government of Ecuador in declaring the islands “at risk.” But despite all these efforts the flood of tourism continues and will be even greater this year, which marks the 200th anniversary of Darwin’s birthday and the 150th anniversary of the publication of his theory of evolution inspired by his visit to the archipelago. Perhaps the time has come to seriously question whether we are loving the Galápagos to death.

Cecilia Alvear, a native of the Galápagos, is an independent journalist. She is a retired NBC Network News producer, a former president of the National Association of Hispanic Journalists and a 1989 Nieman Fellow. Cecilia Alvear can be reached at cecilia.alvear@gmail.com.

CRAVING COMPUTERS

The one-room school my father built in 1939 still exists and bears his name “Escuela Fiscal No. 1 Alejandro Alvear.”

It is now a large concrete building housing 450 students in grades K-8 in Baquerizo Moreno, San Cristóbal Island. These children are the future of Galápagos and they need to understand that they are the guardians of a natural treasure. I go back every year and visit with them. I have brought them computers and they named the room the “Centro de Cómputo Cecilia Alvear.” Unfortunately most of the computers are now out of commission as I ponder ways to bring additional computers, connect them to the Internet, train the school officials to properly maintain the machines and arrange for the proper and safe disposal of the used computers. It is my belief that if I can connect them with children in other parts of the world and they realize how much the islands are loved elsewhere they will grow up to be the proper caretakers of the Galápagos.





Conservation Finance

Capitalizing the “Missing Middle”

BY BRIAN MILDER

IN EARLY 2003, TOURISM IN THE GALÁPAGOS Islands was booming, one of the few bright spots in Ecuador’s sputtering economy. Yet small tour boat operators like Rocio Martínez de Malo and Rolf Wittmer were struggling to compete against larger and better capitalized companies with direct links to customers in North America and Europe. The dramatic growth in visitors and an influx of residents from the mainland were also straining the islands’ star attraction: their extraordinarily rich but highly sensitive biodiversity.

Considered the birthplace of Charles Darwin’s theory of evolution, the islands were declared a national park in 1959 and a United Nations Education, Scientific and

Cultural Organization (UNESCO) World Heritage Site in 1978. The Galápagos National Park Service (GNPS) manages the islands using a combination of regulations and market-oriented approaches. The islands’ inhabitants live in designated areas on three percent of the Galápagos’ landmass, with the remaining 97 percent protected from development. GNPS awards “bed permits” to a fixed number of licensed boat operators to regulate tourism activity and tightly manages resource use by residents.

What was once a pilgrimage destination for scientific researchers and Darwin enthusiasts developed over the last quarter of the 20th century into a popular vaca-

tion spot for North American and European travelers. The islands’ popularity translated into higher occupancy rates for existing bed permits and an overall growth in visitors from 12,000 in 1974 to 25,000 in 1981 to 46,000 in 1994. As occupancy rates reached capacity in the early 1990s, GNPS responded to pressure from tour operators and increased the number of bed permits from 800 to 1,400 beds per day. These changes favored larger boat operators as smaller operators had already maximized bed capacity on their boats, but larger, better-capitalized operators were able to add more beds or replace medium-sized boats with larger ones.

Facing stiff competition in the market



Above: Marine iguanas;
Right: Rolf Wittmer's boat

and mounting environmental pressure, small-boat operators Martínez de Malo and Wittmer worried about the future of the businesses they had toiled for years to build and the islands they called home. One of only a few female boat owners in the Galápagos and the daughter of a fisherman, Martínez de Malo was the owner of Daphne Cruises and a prominent leader in the local community. Wittmer, the son of the islands' earliest settlers, had pioneered tourism on the islands as far back as the 1960s and later founded Rolf Wittmer Turismo Galápagos (Wittmer Turismo) with his three sons. For years, Martínez de Malo and Wittmer had run their businesses as an extension of their personal values and deep roots in the Galápagos community, hiring local residents as crew members and working to minimize their environmental impact.

In 2000, a new certification known as Smart Voyager was designed for tour boat

operators in the Galápagos by the international nongovernmental organization (NGO) Rainforest Alliance and the Ecuadoran NGO Conservación y Desarrollo. Obtaining this certification would enable boat operators like Martínez de Malo and Wittmer to communicate their businesses' social and environmental commitments to consumers and differentiate them from their uncertified competitors.

To qualify for Smart Voyager, however, Daphne and Wittmer Turismo would first need to acquire new equipment to reduce energy use and pollution. Unable to finance these investments from their businesses' cash flows or to access credit from Ecuadorian banks, Martínez de Malo and Wittmer feared they would be excluded from Smart Voyager and the opportunities it might create. Too large for microfinance institutions but considered too small and too risky by commercial banks, businesses like Daphne Cruises and Wittmer Turismo find themselves trapped in the "missing middle" without access to capital that could yield cost savings, make them more competitive in the market, and generate critical social and environmental dividends.

Daphne Cruises and Rolf Wittmer finally obtained certification after accessing credit from Root Capital, a nonprofit social investment fund that lends to unbanked businesses in the missing middle.

Nature-related tourism in the Galápagos Islands offers a microcosm into the opportunities and challenges for leveraging market forces to conserve biodiversity and improve livelihoods throughout the Americas.

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DRCLAS, in conjunction with the Lincoln Institute of Land Policy and the Universidad Austral de Chile (UACH), hosted a hemispheric meeting on conservation finance in January 2009 in Valdivia, Chile. The meeting was co-organized by Levitt and Antonio Lara, Dean of the UACH Faculty of Forest Science.



SUMMARY OF SMART VOYAGER SUSTAINABILITY STANDARDS

INTEGRATED WASTE MANAGEMENT:

- Recycling waste-disposal systems, waste reduction and management plans, and adequate final treatment and disposal of all wastes onboard
- Use of biodegradable cleansers: soaps, detergents, shampoo

STRICT CONTROL OF USE, SUPPLY, AND STORAGE OF MATERIALS

- Careful management of fuel loading and storage to minimize risk of spills or leaks
- Onboard desalinization plants to generate fresh water

REDUCTION OF NEGATIVE ENVIRONMENTAL IMPACTS

- Replacement of 2-stroke motors on dinghies with 4-stroke engines (70% quieter, emit virtually no fumes, use 50% less fuel)
- Use of lead-free and tributyltin-free paint on boat hulls

LOWERING RISK OF INTRODUCTION AND DISPERSAL OF EXOTIC SPECIES

- Strict management of supplies to minimize the transport and/or introduction of foreign plant and animal species to the Islands

TREATMENT OF WORKERS

- Fair wages, good living conditions, and health benefits for crew and guides

EMPLOYEE TRAINING

- Emphasis on environmental education for all personnel

PLANNING, MONITORING, AND EVALUATION

- Consideration for not only technical and economic but also social and economic factors.

Modern Day Problems

A View

BY THEODORE MACDONALD

ON SEPTEMBER 17, 1835, THE HMS BEAGLE swung on her anchor and came to rest off Chatham Island in the Galápagos Islands. Charles Darwin later rowed ashore and, as he walked across the stark basaltic lava landscape,

...met two large tortoises, each of which must have weighed at least two hundred pounds; one was eating a piece of cactus and, as I approached, it stared at me and slowly walked away; the other gave a deep hiss, and drew in its head. These huge reptiles, surrounded by black lava, the leafless scrubs, and large cacti, seemed to my fancy like some anti antediluvian animals.

Such a thrilling “nature moment” is perhaps exceeded only by John Hammond and his fictional band of scientists when they reeled back before a *Brachiosaurus* in Jurassic Park.

Who wouldn't want to be with either group at such a moment? As it turns out, you can approximate it almost any day on a nature cruise in the Archipelago de Colón. But these are hardly the same conditions that Darwin encountered. The Galápagos Islands now contain thousands of people, residents as well as visitors.

Darwin noted that there were “...between two and three hundred, all people of color, who had been banished for political crimes from the Republic of the Equator” on Charles Island. On James Island, he met a few Spanish sailors sent from Charles Island to dry fish and salt tortoise meat. Later, this motley group served as Darwin's guide and took him to an “altogether picturesque and curious” salt pond where “a few years since, the sailors belonging to a sealing vessel murdered their captain; ... we saw his skull lying in the bushes.” Except for mention of a “Mr. Larson, an Englishman and vice-governor of the colony,” no other people inhabitants are noted in this chapter of *The Voyage of the Beagle*.

In light of such limited and unsavory images, it seemed odd that in 1967, I was invited by the governor to be the Galápagos'

first Peace Corps volunteer (other Ecuadorians speculated that I was being exiled to the infamous penal colony there). Nonetheless it was adventurous. When the navy supply boat dropped my wife and me on Chatham Island, about 1,500 people lived there and on the other three inhabitable islands, now hispanicized to Santa Cruz, San Cristobal, Fernandina, and Floreana. The wildlife was everywhere and was everything one now reads about.

We spent three years building new schools, teaching children history, geography, and English, and thus easily avoided the penal colony, which was abandoned in 1959 after rioting inmates nearly escaped. The same year, the Galápagos National Park was created, now encompassing about 97% of the archipelago's land, uninhabitable because it lacks potable water.

Life was simple, punctuated by monthly supply boats and twice-annual tour boats, bearing ornithologists like Roger Tory Peterson. The single most disruptive social action occurred in 1969, when the national government offered electricity to Santa Cruz, where the National Park headquarters and Charles Darwin Research Station are located. Public works to that point consisted of a malfunctioning water pump, a few hundred yards of iron pipe, and a dysfunctional management *junta* made up of the local priest, the navy port captain, and the sheriff/notary public (*teniente político*). The community was reluctant to provide labor for what they argued would quickly deteriorate into an archeological monument without proper maintenance and payment of bills. So they persuaded the *junta* to cede authority to a citizen board for a one-year trial period. Not only did the plant generate light each night, but the project generated a profit. When the board presented its year-end report, they followed it with a demand to take over the water project, and quickly purchased a new water pump and plastic pipe with their profits. This action was to foreshadow local responses to a more serious conservation crisis in the late-1990s.

Island travel at that time was either on

foot or by boat. On one short sail to haul wood for the main strake of a friend's new boat, we stopped at a large flat island called Baltra. It was populated by a few Ecuadorian air-force men who, bored and surly, were guarding a run-down, rarely used airstrip. We later learned that it was the longest airstrip in Latin America, as it had served a World War II American airbase from which amphibious planes guarded the Panama Canal and B-29 bombers refueled en route to the Marianas and Japan.

By late 1970, planes loaded with tourists were arriving at Baltra to transfer passengers to waiting tour boats. Ecuadorians were entitled to low-cost air fares and as jobs, or the perception of them, increased, their numbers in the Galápagos multiplied to about 15,000 by the late 1990s. With a new full-service airport and twice-daily jet service, Baltra ushered in a tourist boom, making Darwin's park an obligatory continental attraction.

Controlling the numbers and movements of tourists was relatively easy in this largely coastal and marine tourist spot. With coordinated boat itineraries, established anchorages, and designated paths, a visitor could still see much of the Galápagos as Darwin saw it, though tourists often stumbled over fishermen cleaning their catch or sleeping on the beach. From the tourists' perspective, or rather from an idealized view imagined by the large tour operators, such commercial sights were about as welcome as the mutinied skip-





Approaching Cerro Brujo "Wizard Hill" in the Galápagos from the sea.

per's skull displayed to Darwin, as neither they, nor the growing port populations of Puerto Ayora and Baquerizo Moreno, were part of the "natural" landscape.

A landscape lush with plants and animals but devoid of human beings accords more with the sensibilities of John Muir than the science of Charles Darwin. Yet that view has dominated Galápagos Islands tourism. Muir, aghast at the damage produced by poorly controlled sheep in California's Sierra Nevada range, banned domestic animals when Tuolumne Meadows became Yosemite National Park. The same fate befell the resident Native Peoples of California, who also were removed. The resulting pristine image fit a strict "preservationist" image, in which the "natural world" is like an a historical snapshot where one can airbrush out the "unnatural," the features one prefers not to see, be they people, domesticated animals, industry, or agriculture. Conservation, by contrast, accepts environmental modification as inevitable, and seeks a balance.

In the Galápagos, such differentiations were simply theoretical parts of the casual local chat until the mid-1990s when ongoing debate over lobster fishing and species preservation was compounded by a rapidly expanding industry harvesting sea cucumbers for a lucrative Asian market. The preservationist responses of the national government and the scientific community brought solutions that the local population regarded as Draconian. Violent strikes,

blocked tour buses, demonstrations and global press coverage resulted. In response, the Darwin Center circulated apocalyptic e-mail messages around the world, as its director held off protesters with a loaded shotgun. For some of the most vocal, the message was a simple "save the islands from the rapacious masses"; for angry others, it was "environmental elites versus the people." None of this dichotomizing and mutual demonizing helped.

Fortunately, perspectives and approaches changed with the 1997 arrival of a new Darwin Center director and his wife, both of whom had backgrounds in international conservation and public policy. They worked well with and were supported by the Director of the Galápagos National Park. As an anthropologist working on natural resource disputes, I had been invited back to the Galápagos. My research report offered an alternative interpretation of the dispute and recommended collaborative local management. To us it was simple: everyone on the islands was proud of the Galápagos' unique environment and world fame, and all sectors were equally upset by their exclusion from participation in the archipelago's planning and policies, which always emanated from Quito. The parties thus readily achieved consensus for the creation of a multi-sectoral management team, a broad participatory process to set the rules, and a self-monitoring team for compliance. Some local politicians who

had benefited economically or politically were unhappy, but the community was not. It was a rebirth of the old electric light and potable water projects, and its ethos, now writ large, was conservation.

Within a year, the management team, working closely with congressmen, drafted a "Special Law for the Conservation and Sustainable Development of the Province of Galápagos," which, when promulgated in 1998, extended the boundaries of the Marine Reserve to 40 nautical miles around the entire archipelago and created a protected area of over 130,000 square kilometers (around 50 square miles). The Special Law also banned national and international industrial fishing (e.g., sea cucumber and large vessels), yet allowed local artisanal fishing. These new rules were implemented and monitored by a Participatory Management Board made up of representatives of the scientific community, tourism industry, and fishermen. They, in turn, were supervised by a national yet locally represented body, the Inter-Institutional Management Authority.

Since then, as with most evolutionary processes, the new approach to conservation and development in the Galápagos has encountered competition, changed direction, met political controversies, suffered economic uncertainty, and as a result adapted slowly and imperfectly. It is, as with any natural system, characterized more by a fragile and uneasy equilibrium than by any permanent homeostasis. The politics and physical geography nonetheless permit enthusiastic tourists to enter Darwin's park with a minimal footprint, provide unique research opportunities, and secure a living for those who are now a larger part of landscape, even if they are not in everyone's snapshots.

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For those who want a longer account, please see: http://www.people.fas.harvard.edu/~tmacdon/papers/galapagos/Macdonald_Galapagos.pdf



In Dire Straits

Charles Darwin and Fuegians

BY THEODORE MACDONALD

IN EARLY 1968, WHILE TRAVELING AS A PEACE CORPS VOLUNTEER to the Galápagos Islands aboard the Ecuadoran navy supply boat B.A.E. *Calicuchima*, I first read Darwin's *Voyage of the Beagle*. The most important chapter was, of course, "The Galápagos Archipelago." After all, his observations on finches and tortoises clearly illustrated adaptation and the origin of species, thus defining evolution. But after having read *On the Origin of Species* as a student, the Galápagos narrative did not seem to be a spontaneous travel account nor a deductive rendering of the evolutionary ideas. Later I learned that scholars, as well as the family and admirers of Darwin's close competitor Alfred Russell Wallace, demonstrated how Darwin's travel account became more "evolutionary" with each edition, serving to cement his claims to originality as well as chronicling his maturing analysis. So, while Darwin's Galápagos story was obviously dramatic for science, it was not a thriller to me then.

By contrast, the earlier chapter titled "Tierra del Fuego" was alive with adventure, uncertainty and drama, as well as some startlingly subjective observations on the region's indigenous inhabitants. Here

Darwin apparently felt no need to justify any emerging theory. The seas of the Antipodes were nothing like the calm, predictable, mid-latitude waters of the Galápagos, where well-laid courses and controlled exploration could be realized. Consider this January 1833 entry:

At noon a great sea broke over us, and filled one of the whale boats right up which was obliged to be instantly cut away. The poor Beagle trembled at the shock, and for a few minutes would not obey her helm. Had another sea followed the first, our fate would have been decided soon, and for ever. We had now been twenty-four days trying in vain to go westward...

Likewise, the people were like none he had even imagined. On Christmas day 1835, he writes that the crew went on shore near Wollaston Island where they "pulled along side a canoe with six Fuegians [Indians]. These are the most abject and miserable creatures I anywhere beheld." A week earlier, on observing an attempt at

VOYAGES OF DISCOVERY

In Dire Straits, p. 28

Travels and Science in Brazil, p. 34

Fungi at the Ends of the Earth, p. 38



This issue of ReVista focuses on “exploring the universe.” In the 19th and early 20th century, many did so literally by setting off on voyages of discovery. These observant explorers included Darwin, William James and Roland Thaxter.

communication, he writes that the Fuegians, apparently mimicking the crew, were

... talking and making gestures with great rapidity. It was without exception the most curious and interesting spectacle I ever beheld. I could not have believed how wide was the difference between savages and civilized men.” But even these tall guanaco skin-clad Selk’nam (Ona) were, he added “... a different race from the stunted, miserable wretches [Yamana] farther westward...

After reading this thrilling chapter, I dragged a hesitant spouse and two friends to Punta Arenas on vacation in 1969. No one was disappointed by the landscape of Patagonia and the Straits of Magellan. And there were wonderful museums filled with huge stuffed rodents, sea birds, and man-sized ostriches (Rheas), all nearly extinct.

But it was the ethnographic photographs by Austrian missionary Father Martin Gusinde and the single shot, an apparent self-portrait, of Julius Popper hunting Selk’nam in the 1890s that

plunked these exotic images into a harsh and sudden history. Within about seventy years of the *Beagle’s* voyage, the Indians of Tierra del Fuego—Selk’nam (Ona) and Huash to the east; Alacaluf and Yamana (Yaghan) to the west—were extinct as distinct and viable societies. By the late 20th century all but about two of the Fuegians were dead, most of the others having been killed by Europeans or perished from introduced illnesses.

Charles Darwin, of course, played no role in this. But his observations, like those of the *Beagle’s* captain, Robert FitzRoy, clearly project mid- and late 19th century European notions of hierarchical human evolution, and reveal the sentiments easily put into practice when Europeans came into competition with these “others.” In an odd irony, Darwin’s thoughts while aboard the *Beagle* capture the shallow anthropological notions and ethnocentric morality of his times, while his observations on all other natural life illuminate the

Left: Jeremy Buttons waving good-bye to the *Beagle*, which dropped him off after a year in London; above: Punta Arenas from the south.

dynamics of natural science, which he would change forever.

This shipboard convergence of ideas and history—as the Age of Exploration settled to one of charting, commerce, and imperialism on the oceans; as the finding of natural science changed forever the way people see history and, less memorably, as a new anthropology mixed science, evolution, and “race” with short-sightedness and greed—produced a travel account easily placed alongside Homer’s *Odyssey*, Marco Polo’s travel and Captain Cook’s journals.

PEOPLE, ISLANDS, AND STRAITS: AN EARLIER EVOLUTION

The Fuegians have long figured in travelers accounts. Both Magellan and Drake spotted signal fires (fuego in Spanish) as they traveled here and, rumor has it, thus named the Land of the Fires, or Tierra del Fuego. But long-time resident Lucas Bridges suggests (and we will read shortly) that both this naming tale and stories about cannibalism may be simply a part of the wild landscape’s lore. Residents and their inhospitable landscape only occasionally received travelers, who had their hands full simply navigating the stormy area, but, as they are mentioned by all travelers, it’s clear that the Fuegians had been on the island for a long time. Perhaps a very long presence, as archeologists now suggest.

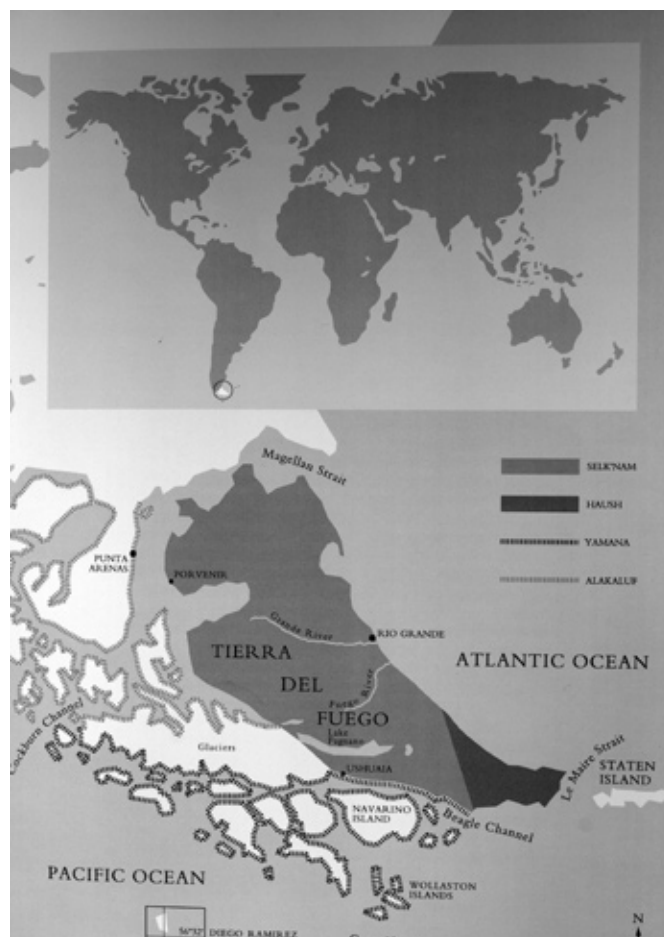
Who, then, are these various peoples, almost as different one from another as from their observers? How did they get there? It turns out to be an interesting laboratory with an answer not suspected by Darwin but nonetheless consistent with his notions of competition and adaptation applied to other species. Reflecting on his notes, he asked:

Whilst beholding these savages, one asks, whence have they come? What could have tempted, or what change compelled a tribe of men, to leave the fine regions of the north to travel down the Cordillera or backbone of America, to invent and build canoes, which are not used by the tribes of Chile, Peru, and Brazil, and then to enter one of the most inhospitable countries within limits of the globe?

Surprisingly unlike the evolutionist that he was who assumes competition, Darwin here seems to suggest that the western Fuegians somehow *decided* to travel there. But archaeology a century later illustrates a pattern that looks more toward population pressure

Both Darwin and FitzRoy observed people as well as fauna and geology. However, their analytical lens were shaped more by the times than by science.

than simple decision, thus foreshadowing the travails that would affect the Fuegians even more dramatically after Darwin left the Straits. As he notes, clear physical differences exist between the western coast’s short, squat shore-dwelling, canoe-using hunters and the notably tall hunters of the eastern plains. The pioneering archaeology of Junius Bird suggests not only a long human presence for both groups (9,000 BC, and most would now argue, much earlier). However, associated arrow heads and spear points suggest an economy of plains-dwelling large game hunters, much like the Selk’nam and bearing no resemblance to the coastal Yamana. Other archeologists, notably Donald Lathrap, argued that all the residents



Map of Tierra del Fuego

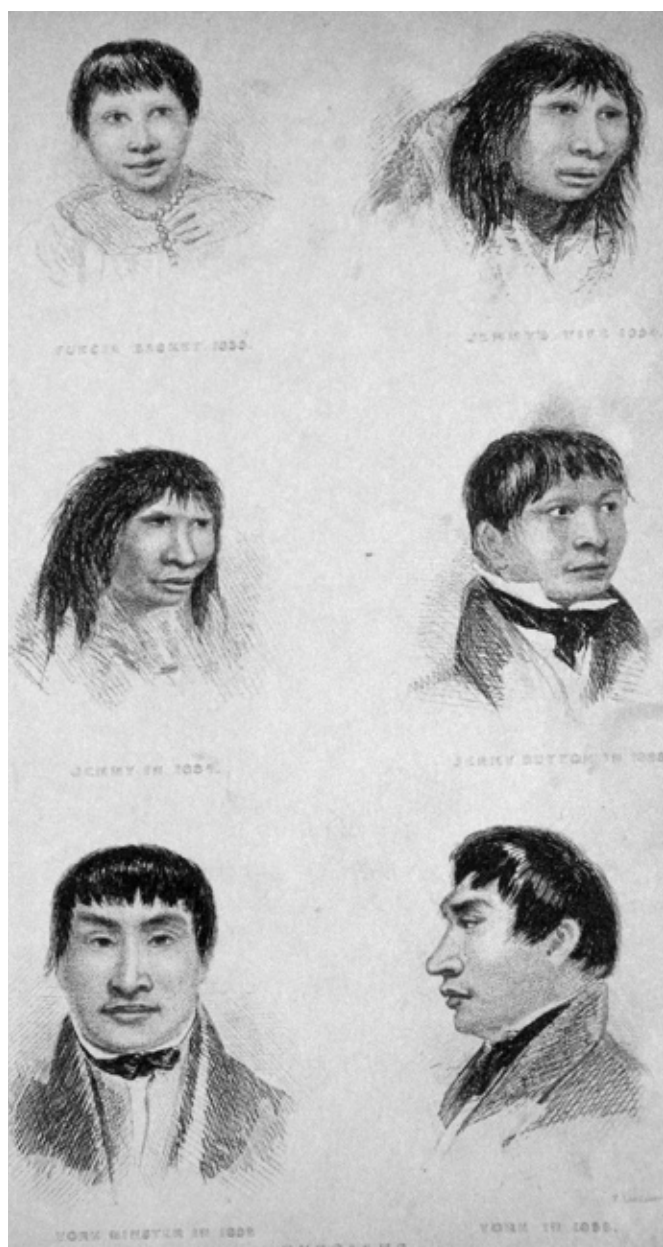
were, in fact, the same sorts of hunting peoples who populated much of Patagonia in historical times. And like such people they competed, indeed fought, with each other for territory. Archeologists further argue that some peoples, in this case the ancestors of Yamana and Alacaluf, lost the battles and were pushed, long ago, onto the inhospitable western shores by those, the ancestors of the Selk’nam and Huash, who then controlled the rich guanaco hunting territory to the east. It was onto this now well-established

demonstration of social change and adaptation, however, successful, that Darwin and FitzRoy wandered, unknowingly and with little of the objective observational skills that would carry them through the Galápagos. One can only wonder why Darwin, who could figure out such patterns for finches

in the Galápagos, missed the similar evolution in Tierra del Fuego. We shall see that it was Darwin’s times and his society, not his analytical capacity, that explains the failure.

FITZROY AND HIS FUEGIANS

The *Beagle* was Robert FitzRoy’s ship, and he was a powerful aristocratic presence as well as a superb sailor. Indeed at times it is hard to distinguish between his and Darwin’s observations on people, a distinction complicated by FitzRoy’s decision that the ship’s naturalist would be the only one to share meals with him aboard ship, and by extension the captain’s earlier experiences.



Fuegian heads: These engravings illustrate "Narratives of the Beagle," after drawings by Robert FitzRoy, taken from *Voyage of the Beagle*, James Taylor, Annapolis: Naval Institute Press, 2008.

In his first charting voyage (1826) to Tierra del Fuego, FitzRoy worked with the crew of another vessel, the HMS *Adventure*. During that trip, an exploratory whale boat disappeared. Assuming that the Yamana had stolen it, he took chase for several days, picking up and losing several Indian hostages en route. All escaped except for a woman, whom they called Fuegia Basket, named for the hastily built craft that replaced the stolen whale boat. In like manner, they captured a man, whom they named for the place he was sighted, York Minister. Later they captured a third and, in honor of the whaleboat, named him Boat Memory. Finally, FitzRoy encountered a man and a boy in a small boat; he gave the man a pearl button, and the boy jumped into FitzRoy's boat (he was later named Jemmy Button, after the item that purchased him). Though many sailors brought home such human souvenirs, FitzRoy took his for

philanthropic reasons. What's more and quite surprising, it appears that none of them, except the ever-sullen York Minister, seemed to mind their involuntary trips to England.

Once there, the four lived mainly aboard the *Beagle*, as FitzRoy's guests, with occasional visits to Queen Adelaide, aristocratic families, the Church Missionary Society, and other potential supporters. FitzRoy, meanwhile, prepared them for a return that would, he hoped in the best spirit of those times to "improve" them with European manners, food, dress and, of course, Christianity, all of which they were expected to spread on return to the "savages" three years later. They all, save Boat Memory who died of illness, were accompanied on their return by the Reverend Richard Matthews, who volunteered to help convert and "civilize" the Yamana but lasted only a few weeks among them before pleading, nearly insane from culture shock, to be taken back aboard. All this could be simply an interesting tale. However, it reveals attitudes. The dominant practice of European expansion was to come later in the century, and revealed the worst spirit of the times.

THE SECOND VOYAGE

In the months before the 90-foot, 10-gun brig HMS *Beagle's* departure from Plymouth Harbor (December 27, 1831), the ship's 27-year-old Captain FitzRoy set his priorities. FitzRoy first made sure that the ship's new chronometers and other new charting instruments were ready for the southern tip of South America, where old Spanish charts made navigating a nightmare. Weather permitting, they would travel north to explore the Galápagos Islands, the islands of the South Pacific, Australia, and New Zealand. Then he prepared the return of three Yamana (Yaghan) Indians to their kin on the rugged shores of western Tierra del Fuego. Finally, he had to select the ship's naturalist, who, this ardent creationist hoped, would locate, once and for all, God's hand in the geology, flora and fauna. All but the charting would eventually disappoint him.

Both Darwin and FitzRoy observed people as well as fauna and geology. However, their analytical lens was shaped more by the times than by science. The young Charles Darwin was the captain's second choice as ship's naturalist. On their first meeting, FitzRoy, following the tenets of phrenology at the time, wondered whether Darwin, with his nose shaped as it was, would be a good traveler. Darwin was accepted on board but his own observations were not much more refined than the captain's, as he viewed the Fuegians who, examining his skin, "... expressed the liveliest surprise and admiration at its whiteness, just in the same way in which I have seen the orangoutang do at the Zoological Gardens." Accurate perhaps, but hardly sympathetic, and clearly a reference to Jenny, the Orangutan star of the London Zoo at the time.

There were also some wild and, at the time, easily accepted assumptions. Darwin comments in passing: "The different tribes when at war are cannibals." He then goes on to describe how elderly women are killed in winter, while hunting dogs are never killed. We then learn that a certain Mr. Low, "a sealing master intimately acquainted with the natives of the country," confidently informed Darwin of the cannibalism. Darwin did not question this. However, years later Lucas Bridges—the son of one of the first missionaries in the region, an excellent linguist, and the author of the *Uttermost Part of the World*—had a far more reasonable interpretation of a confusion of tongues. The Fuegians were anxious to please their

inquisitive guests. Bridges begins by stating that there was not a shred of evidence to support cannibalism. Emphasizing instead the awkward nature of the encounter, in which the Fuegians “have, of course, learned how to satisfy their interrogator and after some initial smiles and puzzled looks,” the odd question was repeated.

“Do you kill and eat people?”

Pause...

“Umm, Yes.”

“What people do you eat?”

No answer.

“Do you eat bad people?”

“Yes!”

“When there are no bad people, what then?”

No answer.

“Do you eat old women?”

“Yes!”

And then the Fuegians went on to exercise their imagination and add that they would never eat a dog, because dogs are useful for catching otters, whereas women are of no use at all. But the meat, they stated, was “very good.”

This interchange would all be the grist of a Saturday Night Live episode were it not reflective of the dominant human evolutionary notions of the time. Bridges’ newly purchased lands were then serving as a refuge for the Selk’nam fleeing south from white settlers, and living alongside the long-term resident Yamana. The questioner’s attitude was common, as was Darwin’s unflattering summary comment.

Viewing such men, one can hardly make oneself believe that they are fellow creatures and inhabitants of the same world. This is a comment subject of conjecture what pleasure in life some of the lower animals can enjoy; much more reasonably the same question can be asked with regard to these barbarians.

Indeed there was conjecture, and some even had answers. Their view of a natural hierarchy among the human species was widespread at the time. Later, the concept was popularized by George Herbert Spencer, whose ideas on the “survival of the fittest” (“Social Darwinism”) would lead to his rejection of any social welfare programs that interrupted the “natural process.” The idea emerged briefly in Darwin’s *Descent of Man*. Such thinking was more consistent with a self-proclaimed scholar, Joseph Arthur Comte de Gobineau, whose *Essay on the Inequality of the Human Races* (1853–1855) claimed that race was the determinant of any advance in history. Moreover, among three “races”—white, black and yellow—history emerges from contact with the white race, and more precisely from the Indo-European, or Aryan, race. The Fuegians do not fit precisely here but were clearly neither white nor Aryans. Lest it appear that these ideas were not known and exchanged widely, one need only turn to Darwin’s half-cousin, Francis Galton. He built on his cousin’s work and, after Darwin’s death, was the first to formulate the controversial field of eugenics with its notions of racial supremacy.

Amidst this fiery and self-centered European intellectual landscape Darwin contemplated other peoples far less objectively than his other natural history. He, however, took pains to distance himself for his cousin Galton and was quite sympathetic as he watched Jemmy Button wave good-bye and then light the final departure



Julius Potter, 1886, randomly killing Ona Indians of Tierra del Fuego.

fire. And he wondered how people without hierarchy or property could ever expect to survive.

In Tierra de Fuego, until some chief shall arise with power sufficient to secure any acquired advantage, such as domesticated animals, it seems scarcely possible that the political state of the country can be improved.

And what’s more:

... it is difficult to understand how a chief can arise until there is property of some sort by which he might manifest his superiority and increase his power.

Darwin’s final entry is prescient, as the next half-century would reveal. Chiefs and property were to appear, but not to the advantage of the Indians.

GOLD: THE SETTLERS’ LURE

Until about 1880, contact between the Fuegians and others was limited to passers-by, and FitzRoy was probably among those who wandered among them the longest. None settled, save English missionaries who arrived in the Beagle Channel in 1859. Twenty years later, during a crossing of the Straits, one member of an Argentine party, Serrano Montaner, discovered gold along the beach. With starry-eyed miners throughout the world heading via the Straits to California since 1848, many were willing to stop



off in Tierra del Fuego and try their luck there. Among them, perhaps the most notorious was Julio Popper.

In 1886, Popper, a ruthless and adventurous Romanian engineer, funded by an Argentine congressman and others from Buenos Aires, led a gold-mining expedition, found gold, obtained a large holding, and generated considerable wealth for himself and his backers. He was intolerant of any opposition, as illustrated by the photograph here. He also fought with local governors and in Buenos Aires. Amidst one such dispute, he died suddenly, some say assassinated by his enemies. By late 1888, the rush on Tierra del Fuego gold was all over, with no gold veins found. But Popper's attitude towards "pesky natives" persisted into the next settler phase, sheep-herding.

SHEEP: THE SETTLERS' PROPERTY

That same year, another Argentine, Ramon Lista, led another expedition to the island. While there they killed twenty-six Selk'nam, leaving in their place about 50 sheep, which then occupied the open grasslands. At the time both Chile and Argentina were anxious to settle European immigrants. Spaniard Jose Menendez took over Popper's property to establish the first sheep-raising *estancia*. He was aided by his Scottish foreman, Alexander McLennan, known as the Red Pig. He too had no qualms about killing Selk'nam. Unlike Bridges' children, who later established an estate to shelter and train the Selk'nam in sheep-herding, Menendez' men were uninterested in such labor. As Bridges wrote, using a pseudonym of "Mr McInch" for MacLennan, efforts to get him to employ rather than exterminate were fruitless. Writing of a massacre of the Selk'nam by McInch

and several settlers as the Indians emerged from a seal hunt, Bridges was not sure how many had been killed, but added:

...McInch claimed afterward that he had shot fourteen. He maintained that it really was a most humanitarian act, if one had the guts to do it. He argued that these people could never live alongside the white man; it was too cruel to keep them in captivity at a mission where they would pine away miserably or die from some imported illness; and that the sooner they were exterminated the better.

However heartless and murderous, there is some truth to MacLennan's argument. The Selk'nam never did live alongside the settlers; they had no choice. As sheep displaced guanacos, the Indians took them for food. Selk'nam, in turn, were either killed for the thefts or herded off to mission settlements. In 1889, the Italian Salesian Order established the first mission on Dawson Island, which eventually held hundreds, mainly women and children who escaped the massacres. Argentine anthropologist Luis Alberto Borreo reports that on Dawson they "were concentrated in barracks, forced to wear European clothing and exposed to epidemics." It is no wonder that escape from Isla Dawson was a high priority and that violent attacks against the missionaries occurred. The Alacaluf, canoe hunters of the southern channels helped several Selk'nam to escape from the island. Ironically, it was the Selk'nam's ancestors who had displaced the Alacaluf from the plains. By 1900, there were no Selk'nam on the sheep *estancias* of Tierra del Fuego. Nor had they simply settled elsewhere. Diseases had taken them.

When the last Selk'nam and Alacaluf died in the 1960s, they were remnants, weaving baskets for the few tourists who might pass by, and certainly not reflective of the rough and tumble times of Fuegia Basket and Jemmy Buttons. That life was long over. It did not disappear due to any absence of leadership or outdated sense of property, which made them uncompetitive, Darwin suggested. The new "chiefs"—the settlers—sense of property, combined with their attitudes, sentiments, and physical power shifted competition to slaughter.

Unlike the guanaco hunters, who were gradually pushed into canoes, up fiords and toward a fishing life of western Tierra del Fuego thousands of years earlier, all native peoples in late 19th century were suddenly eliminated. It was certainly one of the most rapid "extinctions" in human history. But we must distinguish between a natural failure to adapt and the direct social and political efforts to eliminate them based solely and unnecessarily on greed and the ideas of property that supported it. In Tierra del Fuego there was an unnatural selection and purposive extinction. It drew largely and successfully on ideas of human indignity that flowered in Europe and the colonized Americas as the *Beagle* cruised the southern hemisphere.

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Travels and Science in Brazil

Charles Darwin, Louis Agassiz, and William James

BY MARIA HELENA P.T. MACHADO

THE YEAR OF DARWIN IS BARELY UNDER WAY, AND AMONG THE avalanche of events and publications commemorating this great scientist's life and works, a recent book has established itself as a notable reference: *Darwin's Sacred Cause: Race, Slavery, and the Quest for Human Origins*. A biography that is both comprehensive and refreshing, this book constitutes a *tour de force* in establishing the deepest motivations that inspired Darwin to pursue the task of his life, the patient and systematic testing of conjectures about the process that came to be known as natural selection. Throughout this massive study, authors Adrian Desmond and James Moore profoundly revise our understanding of Darwin, demonstrating that the naturalist's trajectory had solid roots in the context of abolitionist movements in England and the United States, with ramifications in the campaigns to eradicate the slave trade to South America and in the emergence of concepts claiming the racial inferiority of Africans, including the rise of a creationist polygenist theory. In rejecting interpretations anchored in the purportedly neutral and socially independent character of scientific thought, *Darwin's Sacred Cause* consolidates a view of the history of science in the 19th century that recovers the intrinsic links between science and race in the age of abolition.

While this approach may be new in studies on Darwin, several other 19th century naturalists did not escape from having their research carefully scrutinized, their methods (or lack thereof) reenacted and often demolished, their political ties and ideological convictions laid bare. One of them was Louis Agassiz, the omnipresent Swiss naturalist who moved to the United States in the 1840s and became not only one of the leading exponents of American natural science but also one of the defenders of polygenism, or pluralism, a doctrine holding that different human races had been created by God to inhabit the different zoological provinces of the earth, and of hybridism, which considered race mixture the cause of degeneration. He has been and continues to be the subject of many studies (even Desmond and Moore include a chapter titled "Oh! For shame Agassiz!"). The novelty of *Darwin's Sacred Cause* lies in its effort to show that not only bad scientists—reactionaries, clergymen, idealists or racists—remained prisoners of their convictions, but that good science was also rooted in the historicity of concepts and in the social issues of its time. In the case of mid-nineteenth-century natural science, the basic question underlying the work of these scholars was firmly grounded in the issues of slavery, abolition, and the fate of Africans and persons of African descent in the Americas.

With a wealth of details, the book shows how young Charles Darwin, who grew up in a family with strong abolitionist sentiments and harbored deep convictions with respect to the injustices of



slavery, experienced the critical years of the rise of abolition mulling over ideas about the brotherhood of man, ideas decidedly bound to his belief in the common origin of all species. Rather than reassert Mosaic anthropology or express religious dogmatism based on Genesis, Darwin restructured the unitarist-monogenist hypothesis through scientific observation and experimentation, establishing a scientific protocol in the modern sense of this term. This was not an easy path to follow, since in the 1840s and 1850s a powerful opponent, Agassiz, at Harvard University's Museum of Comparative Zoology, seemed capable of crushing any argument that failed to subscribe to a new creationist science. This new version sought to adjust ideas about the age of the earth and descent from a single couple in order to assert a theory of polygenism, to the delight of Southern slaveholders, who at that point clung dearly to the increasingly debilitated institution of slavery. Comfortable with the theory on the diversity of human races, Southern slaveholders became more at ease not only to defend slavery but also to dream of projects aiming to expatriate persons of African descent to tropical lands, where they would be resettled in their "natural habitat," tutored by colonization companies, and subjected to a system of apprenticeship for producing primary goods at low cost. It should be noted that these expatriation projects—ranging from Liberia to the colonization projects eyeing the occupation of the Amazon—gained support from individuals both in the South and the North, including Abraham Lincoln, who established in 1862 a special commission to deal with the voluntary emigration of African Americans.

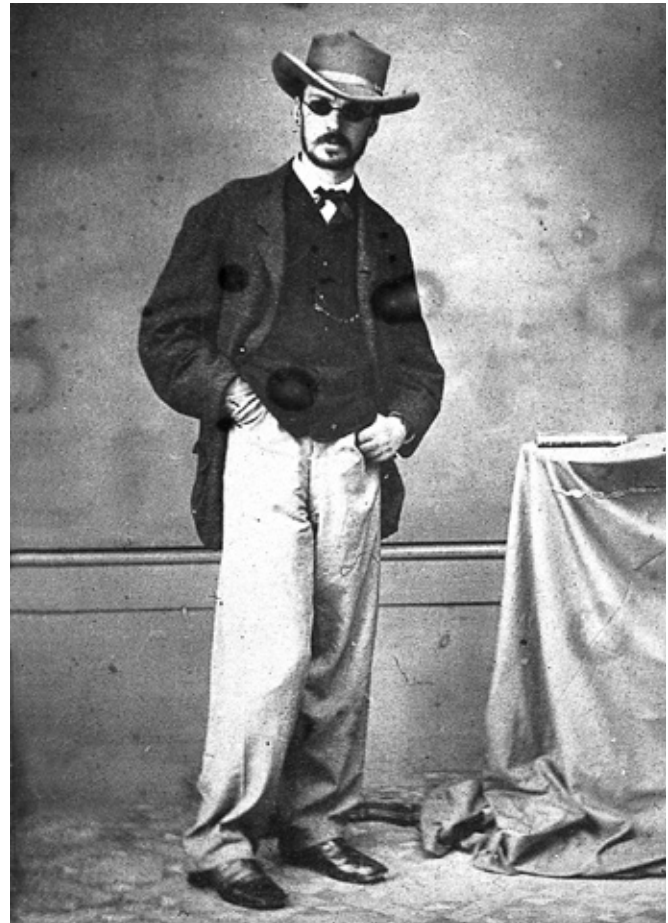
Between the 1830s and 1860s, significant battles involving naturalists—including idealists, proponents of the Biblical interpretations on the age of the earth, of the deluge or of glaciation, defenders of monogenism or polygenism—militant abolitionists, and ideologues defending slavery or apprenticeship, found the tropical regions of South America to serve as a sort of laboratory, with



Above: A wedding portrait of Charles Darwin painted by George Richmond. (right) Louis Agassiz, portrait probably by photographer August Stahl, Rio de Janeiro, 1865. (far right) William James, photographer unknown, Rio de Janeiro, 1865.

the Brazilian Empire becoming the most significant battlefield for the naturalists' different positions and solutions for the racial issue. Brazil had become an independent monarchy in 1822 through the maintenance of the Bragança dynasty, a strategy that placed the young empire on the countercurrent within the turbulent context of Spanish American republics. This strategy also guaranteed the continuity of slavery and control over a predominantly *mestiço* free population, which made the country the tropical Eden of amateur and professional naturalists' dreams. Young Darwin, during his journey around the world on the *Beagle* between 1831 and 1836, stayed in Brazil on two occasions, affording him the opportunity both to observe the wealth of tropical nature and to reflect upon the terrible ills of slavery. Darwin's trips to Brazil coincided with the period in which British ships began to patrol the coast in an effort to repress the landing of Africans after the 1830 treaty proscribed the slave trade, a treaty that Brazilians chose to ignore, as the authorities went through the motions of discouraging the trade while in effect protecting the slave business (the popular expression *para inglês ver*—to fool the English, or just for show—comes from this situation). Darwin came to know the worst aspects of slavery intimately: the illegal trade conducted openly; the drowning of captives to avoid the seizure of slave ships or to avoid the costs of returning the illegal captives to Africa. The *Beagle Diary* includes passages revealing Darwin's strong revulsion of slavery:

On the 19th of August we finally left the shores of Brazil. I thank God, I shall never again visit a slave-country. To this day, if I hear a distant scream, it recalls with painful vividness my feelings, when passing a



house near Pernambuco, I heard the most pitiable moans, and could not but suspect that some poor slave was being tortured, yet knew that I was as powerless as a child even to remonstrate. I suspected that these moans were from a tortured slave, for I was told that this was the case in another instance. Near Rio de Janeiro I lived opposite to an old lady, who kept screws to crush the fingers of her female slaves. I have staid in a house where a young household mulatto, daily and hourly, was reviled, beaten, and persecuted enough to break the spirit of the lowest animal. I have seen a little boy, six or seven years old, struck thrice with a horsewhip (before I could interfere) on his naked head, for having handed me a glass of water not quite clean; I saw his father tremble at a mere glance from his master's eye...

In addition to such horror stories, Darwin also commented on his encounters with blacks and *mestiços*. These anecdotes show an effort to understand the social situation in terms that at times were pleasant and even amusing. On an excursion on the outskirts of Salvador in Bahia, Darwin found himself surrounded by a boisterous group of black men, women, and children who showed a great deal of curiosity towards his research instruments, which they seemed to consider diabolical in nature. Rather than show irritation or condescension, as many other travelers would, Darwin commented on the "excellent manners" of the group, and concluded: "It is my firm belief, no Dutchess with three tails could have given such courtlike & dignified bows as the black women saluted me with."

Darwin's opponent, Harvard scientist Agassiz, also traveled to Brazil, when he led the Thayer Expedition in the mid-1860s.

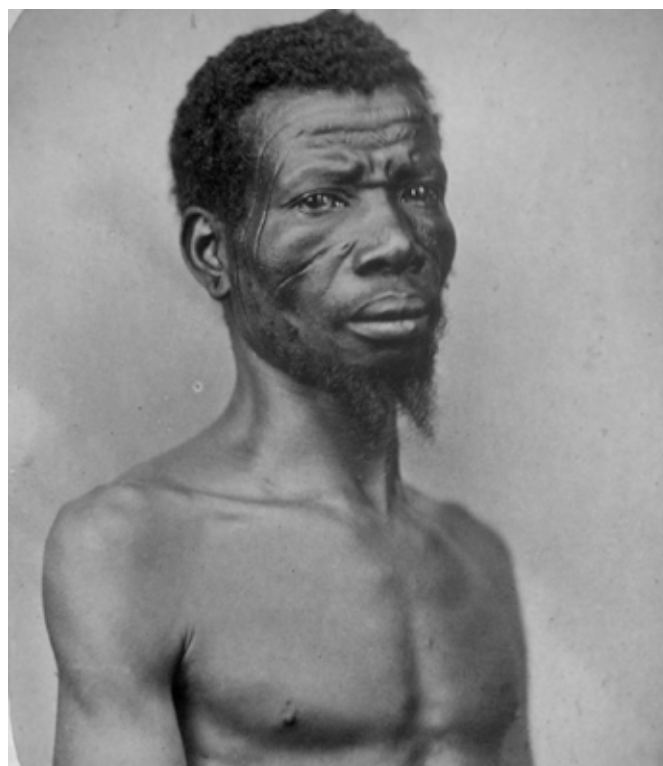
Although the slave trade had ended, slavery continued to flourish at this time, rapidly expanding into the coffee-growing region of southeastern Brazil. Like Darwin, Agassiz also visited the coffee plantations surrounding Rio de Janeiro, spent time in the northeast, and stayed in major cities with their bustling slave populations. The trip journal, *A Journey in Brazil*, although written by Elizabeth Cary Agassiz, clearly follows Louis Agassiz's orientation and includes many comments on slavery in Brazil, all of them in a positive tone: in the couple's estimation, slavery corrupts slave owners more than slaves; the heavy and inhuman tasks forced on urban slaves tended to disappear as it became clear that slavery itself was coming to an end; the Emperor, with his humanistic sentiments, would eliminate the institution with the stroke of his pen. Interspersed with the many blushing justifications for the maintenance, albeit temporary, of slavery, other comments get right to the point: because of their racial inferiority or their servile status, blacks should not live with whites. Furthermore, amalgamation or miscegenation—a term coined in 1864 in the pamphlet *Miscegenation: the theory of the blending of the races, applied to the American white or negro*, which defended race mixture, although critics soon adopted this expression to oppose it—was considered to be nefarious, and Agassiz could see the results in the Brazilian national character:

Another feature which makes a painful impression on the stranger is the enfeebled character of the population ... It is not merely that the children are of every hue; ... But here this mixture of races seems to have had a much more unfavorable influence on the physical development than in the United States. It is as if all clearness of type had been blurred, and the result is a vague compound lacking character and expression. This hybrid class, although more marked here because the Indian element is added, is very numerous in all cities and on the large plantations,....

A comparison of Darwin's and Agassiz's observations reveals their profound differences. According to Professor and Mrs. Agassiz, Brazil had produced an unparalleled spectacle in its tolerance of race mixture, affording the naturalist a clear glimpse at the horrors of a long process of intercourse that had blurred the lines between "pure" races—whether white, black, or indigenous—creating a situation in which people "as repulsive as mongrel dogs" were to be found everywhere. In one passage from *A Journey in Brazil*, the problem of amalgamation between "the different species of the human family" receives explicit mention:

The natural result of an uninterrupted contact of half-breeds with one another is a class of men in which pure type fades away as completely as do all the good qualities, physical and moral, of the primitive races, engendering a mongrel crowd as repulsive as the mongrel dogs, which are apt to be their companions, and among which it is impossible to pick out a single specimen retaining intelligence, the nobility, or the affectionateness of nature which makes the dog of pure type the favorite companion of civilized man.

Drawing inspiration from such convictions, Agassiz established a controversial *Bureau d'Anthropologie* in Manaus, capital of Amazonas province. The *Bureau* served the purpose of documenting differences between "pure" and "mixed" races. Since the Brazilian



Above: Mina Mondri; Opposite (left): Benguela Man; (right) Mina Igeicha Woman; portraits are by Augusto Stahl, Rio de Janeiro, c. 1865. From the Agassiz Collection, Pure Race Series, Peabody Museum.

population exhibited a high degree of miscegenation, it provided an ideal laboratory to study the consequences of different types of mixture in the constitution of individuals. Intending to illustrate the composition of the Brazilian population, Agassiz first requested Augusto Stahl, a Rio-based professional photographer, to assemble photographs of Africans in the city, classified by Agassiz as "pure racial types." This resulted in two sets of photographs: portraits and scientifically oriented physiognomic studies of African ethnic types, as well as of some Chinese living in Rio de Janeiro. All the subjects in the physiognomic set appear nude and in fixed positions (front, back, and profile). A third series of photographs was produced in a makeshift studio in Manaus, for which one of the student members of the expedition, Walter Hunnewell, served as photographer. This set documented "mixed" or "hybrid" Amazonian "racial types."

A generation behind Darwin and Agassiz, William James was only twenty-three years old and in the second year of his studies at Harvard University's Medical School in 1865. As soon as he learned that Agassiz was preparing a research expedition to Brazil, James signed on to the project as a volunteer collector, the trip to be covered at his own expense. As a student and assistant to Agassiz, James was already quite familiar with the discussions that pitted his mentor against Charles Darwin and his followers, and proved much more sympathetic towards the theory of evolution than the creationism espoused by the expedition leader. Going somewhat against the grain of contemporary travel writing, James's writings on the region—letters, diaries, and drawings—show a particular empathy in his descriptions of life in the tropics, in contrast with the views espoused by the expedition's leader, Louis Agassiz, whose political and ideological beliefs included racist theories of hybridism



and the deleterious effects of race mixture. Here, once again, family background appears to have been decisive: not only was his father, Henry James Sr., an eccentric thinker, a follower of Swedenborg and Fourier, as well as a believer in antislavery ideas, but also he enrolled two younger sons, following Emerson's advice, in the Sanborn School of Concord MA, which proposed a clearly abolitionist orientation. These influences had resulted in the engagement of both sons with the pioneer African American regiments that fought in the Civil War. William James, for his part, avoided fighting in the war, having preferred to enlist in the Thayer Expedition. His stay in Brazil certainly was marked by a constant anxiety in relation to the war and its consequences following Confederate surrender at Appomattox. His observations and contact with people refer to the broader issue of race, as James developed a distinctive view on *mestiços*, so maligned in Agassiz's hybridism.

I marvelled, as I always do, at the quiet urbane polite tone of the conversation between my friends and the old lady. Is it race or is it circumstance that makes these people so refined and well bred? No gentleman of Europe has better manners and yet these are peasants.

James noted the same cultural refinement and delicate manners governing his *mestiço* boatman's family, as Sr. Urbano not only guided the student on his last collecting forays but also put him up for a few days. Upon arrival, James encountered two *cafuzo* (mixed-blood of African and Indian descent) women, smoking their pipes and chatting as they squatted over a rug in Amazonian fashion. Without making any derisive, picturesque or derogatory comments, he wondered how the local people could spend hours and hours in a position that seemed so uncomfortable to foreign visitors, as they seemed more like "naked skeletons" than flesh-and-blood. A few days later, already accustomed to the family, James observed:



I now feel perfectly domesticated in this place & with these people. Never were there a more decent worthy set of gentry. Old Urbano especially, by his native refinement, intelligence and a sort of cleanliness and purity is fit to be the friend of any man who ever lived, how elevated his birth & gifts. There is not a bit of our damned anglo saxon brutality and vulgarity either in masters or servants. I am always reminded when the neighbors come in to visit Urbano of our family & the Tweedy family at Newport. Urbano & his gossips talk with just as much beauty & harmony or perhaps a good deal more than Tweedy & Father did, in an easy low slow tone as if all eternity was before them. I have never heard any swearing or any hyperbole or far fetched similes or extravagant jokes or steep piled epithets or chaffing such as we yankees delight in.

Much closer to Darwin's position than to that of Agassiz, William James' writings reveal his ability to recognize the humanity and appreciate the qualities of populations seen as incomprehensible beyond the picturesque mode. In the final analysis, empathy seems to be the most remarkable quality of James' writings in Brazil, a quality that sustained a prolonged reflection on the relativism of human belief. This quality also finds echo in Darwin's notes on the tropics and on the blacks and *mestiços* who made up the majority of the population he observed. In effect, the travel writings of these great thinkers seem to suggest that simple feelings could make all the difference.

Maria Helena P. T. Machado, an Associate Professor of History at the University of São Paulo, was a DRCLAS Visiting Scholar in 2003-2004. Her books include Brazil through the Eyes of William James (DRCLAS/Harvard University Press, 2006). She thanks John Monteiro, who translated this article from Portuguese.



Fungi at the Ends of the Earth

Roland Thaxter in Southern South America

BY DONALD H. PFISTER

THE SOUTHERN REACHES OF SOUTH AMERICA, THE UTTERMOST part of the earth, have held special fascination and navigational importance for explorers since Magellan's time. The names—Port Famine, Beagle Channel, Cape Froward, Drake Passage, Tierra del Fuego, Desolation Bay, Punta Arenas—evoke forlorn and exotic places that speak to the nature and history of the place.

Early explorers wrote of the sea, the native inhabitants and the forests. At several points in *Voyage of the Beagle*, Charles Darwin referred to these as the “dusky forests.” He and fellow naturalists of the Beagle days traversed these dusky forests distinctive not only in their robustness but also for the fact that they are composed of only a few southern beech tree species belonging to the genus *Nothofagus*. Nineteenth century naturalists collected plants and their seeds, as well as animals and fossils, but ignored small or ephemeral organisms. Aside from a few miscellaneous collections of fungi, algae, mosses and allied organisms, so-called cryptogams were largely overlooked. However, a peculiar fungus, parasitic on one of the southern beeches, came to be known for its collector as *Cyttaria darwinii*. It was collected partly because the indigenous people ate it. A few publications in the late 19th century helped fill the gap in

the fungal record (see Spegazzini, C. 1887. *Fungi patagonici*. Bol. Acad. nac. cien. Cordoba 11: 5-64; *Fungi fuegiani*).

Still it was not until 1906 that the beech forests truly began to yield their treasures when Harvard botanist and mycologist Roland Thaxter undertook a South American tour of discovery and exploration focusing on these neglected organisms of the dusky forests.

Thaxter (1858-1932) came from a long line of New Englanders. His childhood, rich in natural history instruction directed by his father, Levi Lincoln Thaxter, and mother, poet Celia Thaxter, led, in 1888, to a Ph.D. in Harvard's newly founded Graduate School of Arts and Sciences. There he worked under the guidance of William G. Farlow, a protégé of Asa Gray, the primary U.S. proponent of Darwin. Thaxter served on the Harvard faculty from 1891 to his death in 1932. Although his research was varied, his principal work combined youthful entomological interests with the study of fungi that parasitize insects.

Having read Darwin and the accounts of other explorers, Thaxter arrived in Punta Arenas, Chile, on the Strait of Magellan in January 1906. In Darwin's time, the town did not exist; it was founded in 1846 as a penal colony. By 1906, before the Panama



Left: Punta Arenas from the hill, right: burnt forest at mouth of ravine, Punta Arenas.

Canal opened, it was a stopping point for ships passing from the Atlantic to the Pacific Oceans. This stop came as the midpoint in Thaxter's proposed yearlong study trip through South America. No evidence indicates that his South American itinerary was consciously formulated in Darwin's footsteps. Nevertheless, Thaxter visited several of the sites Darwin had seen years before. Thaxter arrived on the continent in Montevideo and then spent an extended period in and around Buenos Aires. In Chile, he worked the territories around Santiago, Concepción, and Corral. He collected insects, mostly looking at and collecting their parasitic fungi; along coastal

**The forests held many surprises for Thaxter.
A few groups of fungi, which seemed wholly new
to him, were indeed new to the scientific world.**

areas he gathered seaweeds. He closely observed the plants, fungi, people and landscapes he visited. Fortunately, we have his 1910 published account, *Notes on Chilean Fungi*, as well as the vivid, descriptive prose of his diary and many letters he sent home housed in the archives of the Farlow Reference Library and Herbarium of Cryptogamic Botany, Harvard University.

Thaxter not only concentrated on the small and obscure but,

unlike earlier naturalists, he traveled alone. Staying in hotel rooms and guesthouses he carried with him all the equipment needed for his work. As he was alone and often ill, his letters and diary reflect his experiences in a way that may be more revealing than if he had traveled with companions. He carried gold to exchange for local currency and a revolver to protect himself from "cut throats." "One feels," he wrote, "as if he were landed in a paradise of cut throats and does not wonder that the traveler is almost universally advised to carry a revolver" (Diary, November 2, 1905). In writing of the gauchos, Darwin expressed a similar view, "whilst making their exceedingly graceful bow, they seem quite as ready, if occasion offered, to cut your throat." (*Voyage of the Beagle*, p. 74).

In Punta Arenas, Thaxter focused his terrestrial collecting on the beech forests primarily along the Rio Minas, a small river running into the town through a deep ravine. The mine at the head of the river yielded a low-grade coal which, along with wood from the forests on the perimeter of the town, heated local homes. A narrow gauge railroad brought the coal to Punta Arenas. Its tracks, and occasionally the locomotive itself, offered Thaxter access to the forest. The beech forests captivated him with their beauty and grandeur. But it was the paradox of finding riches of the fungus realm in a forest consisting of just a few tree species in a climate



Top: the canyon above Punta Arenas; Above: Matthew E. Smith's photographic rendering of *Underwoodia singeri*, Thaxter's geodon (right) and *Cyttaria gallis* (left). Opposite page: Plants of Chile, *Northofagus antartica*, a deciferous form seen inland next to a river

appearing barely able to support the hardest garden vegetables that proved most fascinating. Where Darwin had seen grand expanses of unbroken forests, Thaxter found them broken and fragmented, resulting from the extensive conversion of forests to grazing land as well as the harvesting of wood for fuel and construction.

To Farlow he wrote from the Hotel Oddo of the shipboard view of the landscape, "We were having typical Magellan weather and I was freezing with a bad cold. The coasts desperate looking regions, brown and bare, cold with snow ledges and never green it is said.... The beech forests neither so extensive nor the trees apparently so large as one imagines from the tales of travelers, rather scraggy in fact perhaps dull green, mostly thin." On a later approach in 1906 he wrote in his diary, "The weather being bad, and no chance for photographs, I lay abed and rose only as we were approaching Cape Froward but yet by a favoring lift of the clouds able to see the beech forest to better advantage than on my first passage. In some places a magnificent forest especially about a sawmill not many miles from the Cape. The wind blown beeches with horizontal tops more striking on some of the points running into the Straits than any other wind blown trees I ever saw."

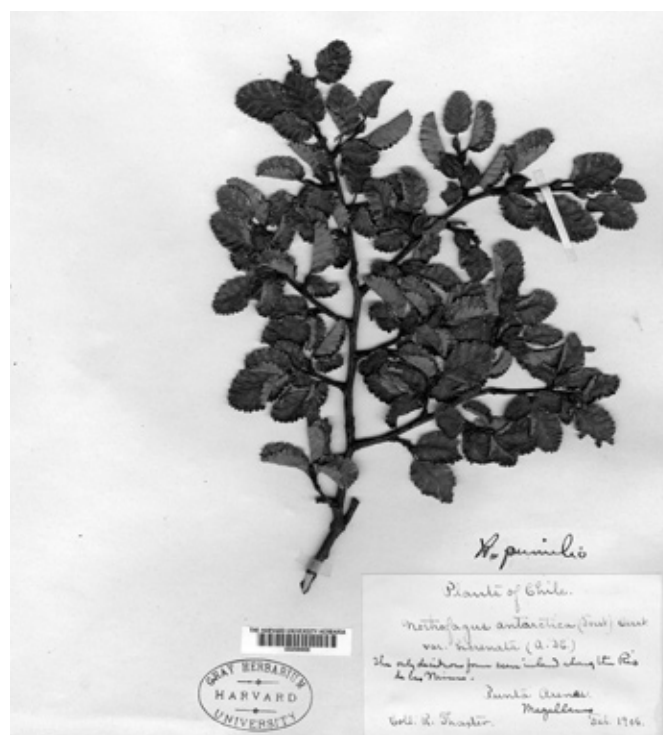
He observed in *Notes on Chilean Fungi* that around Punta Arenas

"...the whole shore of the strait, as far as one can see to the south and for many miles to the north, has been devastated by fire.... Formerly a superb forest of the Antarctic beech (*Nothofagus*) covered the whole region, extending from the water's edge over a somewhat undulating plain, which gradually rises to the base of a range of hills or low mountains, the highest not 2000 feet above the sea, which form a wooded background for what is now a ghastly waste of dead trees still standing or fallen in confused heaps."

Later, after having explored on land he wrote Farlow, "I went up to these woods the day after I wrote you and had a most interesting day, walking for the first time in the Antarctic beech forest which in this place is moist, that is with swampy areas, a good deal mostly flat or slightly hilly, the trees large with an undergrowth not very obtrusive of two species of barberry and an Ericaceous low shrub mostly (also many succulent herbaceous plants) among a chaos of moss and lichen covered prostrate trunks.... Everything was sopping wet and the lichens were at their best...."

The forests held many surprises for Thaxter. While most groups of fungi were represented, a few, which seemed wholly new to him, were indeed new to the scientific world. In one case, while collecting truffle-like fungi, he wrote, "In digging several times turned-up something that looked like the broken end of a big root tip, viscid, cream-colored, which proved to be a tooth-shaped fungus the apex directed upward and buried in the earth quite below the leaf cover. 'Geodon' I christened it." His christening was unofficial; this distinctive tooth of the earth was finally described in 1979 as *Underwoodia singeri*. The author of this piece and postdoctoral fellow Matthew E. Smith traveled to Thaxter's collecting grounds in March 2008. We found and photographed Thaxter's "Geodon." Smith's photograph is rendered here on the opposite page.

Thaxter's keen observations and lively descriptions extended beyond organisms to people and places. Punta Arenas became the "corrugated town" in his letters and diary, where he describes a first



impression of the town as "low lying and extensively spreading" in a setting of "whitened skeletons."

Today the corrugated town is situated in pasturelands with occasional wood lots. Though the "whitened skeletons" have vanished, this landscape of grasslands is dotted with stumps; nearly all show signs of being burned. The mine has long been closed. Now a National Park surrounds the area. In some of these areas the forests have regenerated.

In a day of rapid travel, of instantaneous communication, where web-pages guide nearly every undertaking, and where ATMs are found in the most out of the way places, Thaxter's narrative reminds us that forests persist, ever changing. It is heartening to know we may still visit areas and trace Thaxter's trail and to find some of the organisms he saw more than 100 years ago. Such observations provide insights concerning the biology and distributions of organisms that, despite the advance of time and science, remain little known. As to Thaxter, one is left with the quaint image of a solitary traveler going over his day's finds; working away in a small room at Casa Scott, on Avenida Colon, in the rough and tumble town of Punta Arenas. After all, it was Thaxter who, during his several months in Punta Arenas, first systematically studied the fungi growing at the far end of the earth. He was fully aware of the immense change that had occurred in these beech forests Darwin had seen over 70 years before. Certainly he pondered the future of these forests, which were the source of great pleasure for him. Of the beech forests at their best he wrote, "I could not shake off a certain sense of awe on entering this forest for the first time, the elements combining to make me feel as if I had no business here and were a trespasser in the domains of some ancient wind god."

Donald Pfister is the Asa Gray Professor of Systematic Botany and Curator of the Farlow Herbarium at Harvard University. He is also the Dean of Harvard Summer School.

COSMIC VISIONS

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Since the ancient Mayas, Latin Americans have been gazing at the stars to better understand their universe.

The International Year of Astronomy 2009

Help People Rediscover Their Place in the Universe

BY CATHERINE CESARSKY, PEDRO RUSSO AND LEE PULLEN

THE INTERNATIONAL YEAR OF ASTRONOMY 2009, IYA2009 in short, is a global celebration of astronomy and its contributions to society and culture and marks the 400th anniversary of the first use of an astronomical telescope by Galileo Galilei. The aim of the Year is to stimulate worldwide interest, especially among young people, in astronomy and science under the central theme "The Universe, Yours to Discover." IYA2009 events and activities will promote a greater appreciation of the inspirational aspects of astronomy that embody an invaluable shared resource for all nations.

In July 2003, at the International Astronomical Union (IAU) General Assembly in Sydney, members voted unanimously in favour of a resolution to declare the year 2009 as the International Year of Astronomy. In October 2005 UNESCO endorsed the year. In 2006 the IAU General Assembly in Prague reaffirmed its importance and main goals, and on December 20, 2007 the United Nations proclaimed 2009 as the International Year of Astronomy (IYA2009).

A rendered view of the Earth by night with detail over the Americas. Starfield and moon are also visible.

The next IAU General Assembly will take place in Rio de Janeiro in August 2009. The year will be in full swing, and all the main promoters will meet in Rio to exchange on their experiences and map out the conclusion of the year and the expected legacy.

The IYA2009 activities are taking place at global and regional levels, and especially at the national and local levels. National Nodes in each country are running activities throughout the year, aimed at establishing collaborations between professional and amateur astronomers, science centres, educators, and science communicators. 137 countries are participating in IYA activities, of which 17 are in Latin America. Each country or region has organized its own programme. Local activities are being supported by eleven global Cornerstone projects. These projects operate in many areas, whether it is the support and promotion of women in astronomy, preserving dark-sky sites around the world, empowering astronomical communities in developing countries, explaining the workings of the Universe to millions, or showing the lives of contemporary astronomers. Other Cornerstones are arranging exhibitions of astronomical images, improving the science education of young children, and even dis-

seminating low-cost telescopes, so that as many people as possible in the world can relive Galileo's experience.

There are also special projects, from exhibits of pictures of monuments pictured under a starry sky, to an international network of amateurs to observe the mutual effects of the Galilean satellites around Jupiter, on this equinox year.

Finally, dedicated books, documentaries, music shows and planetarium shows are being produced.

IYA2009 aims to provide a modern image of science and scientists, reinforcing the links between science education and science careers. This, we hope, will stimulate a long-term increase in student enrolment in the fields of science and technology, and an appreciation for lifelong learning.

ASTRONOMY AND IYA IN LATIN AMERICA

Astronomy is already well established in several Latin American countries. Many feature astronomy at the undergradu-

ate and graduate levels: Argentina, Brazil, Chile, Mexico, Venezuela, Uruguay, Colombia and Honduras. During the last decade astronomy in Brazil has experienced major growth and development, together with significant participation in the international astronomical community, such as the Gemini Telescopes in Chile and Hawaii and the Southern Astrophysical Research Telescope in Brazil. It is thus fitting that the next IAU General Assembly will be held in Rio de Janeiro, Brazil, on August 3-14, 2009. The great concentration of scientific and technological activities characterises Rio as one of the most important centres in Brazil and Latin America. It is the place where the first Brazilian national observatory was established by the Emperor Dom Pedro I in 1827. Argentina has had active astronomy for well over a century, with the La Plata and Cordoba Observatories. It is also part of Gemini, and hosts in Mendoza a world facility, the Pierre Auger Observatory, dedicated to the detection and study of cosmic rays at the highest

energies. Mexico has an active astronomy community as well, and developed with the USA the Large Millimeter Telescope, on Sierra Negra, which is by far the largest of its kind. Chile boasts regions with dark and crisp skies, ideally suited for large observatories. As a result, it enjoys heavy investment from the European Southern Observatory (ESO), which has built in Paranal the prestigious Very Large Telescope, as well as from entities from USA and Japan. The world class ALMA millimetre and submillimeter interferometer is being built at a height of 5000 m in the Atacama desert, by a wide international collaboration.

Some other countries need a boost, perhaps from the international community, to embark seriously in astronomy. IYA2009 could be a golden opportunity for the less developed Latin American countries to increase both astronomy awareness and scientific output. It is hoped that this year's activities will help to improve the levels of astronomy education.

LATIN AMERICAN PERSPECTIVES

Participating IYA2009 countries, of which there are currently 136, feature individuals known as Single Points of Contact (SPoCs). These people assist in organising and implementing activities throughout the Year for their respective countries. Opinions from 4 of the 17 Latin American SPoCs have been gathered.

"In Latin America astronomy is vitally important. It helps to stimulate the social, cultural, educational and intellectual development of towns. It is an integral part of scientific groups, and investigation centres. Therefore, I believe that the International Year of Astronomy 2009 is very beneficial for Latin America, and of course the scientific and educational level of Western countries will increase ours. IYA2009's cultural impact is unquestionable."

—JOSE ROBERTO VELEZ MUNERA
PRESIDENTE DE LA RAC (COLOMBIAN ASTRONOMICAL NETWORK - RAC)

"I believe that IYA2009 will be beneficial to Mexico, because it will call attention to science. Of course the price to pay is that there will be a lot of effort from the astronomers in the activities of IYA2009 with the corresponding loss of activity in their primary mission (research). But many of our astronomy colleagues are deeply committed to participating in this celebration."

—SILVIA TORRES PEIMBERT
MEXICO

"I think that astronomy is important for Latin America. By means of astronomy, people can come closer to science. The International Year of Astronomy 2009 will be beneficial by stimulating scientific activities for both the public and pupils in school. We have planned many activities in partnership with other Latin American countries, such as Olympiads of Astronomy and Astronautics for high school students, 3D photography of the Moon, and determining the Moon's distance by measuring its parallax. I think that the Year will lead to increased scientific and educational partnerships with Western countries. We are motivated by IYA2009 to share our experience in astronomy education at high school and university level with other countries. I hope that the events planned for 2009 will impact Latin American cultures by overcoming the strong influence that pseudo-sciences have in the population."

—TABARE GALLARDO,
INSTITUTO DE FÍSICA, FACULTAD DE CIENCIAS, MONTEVIDEO, URUGUAY.

"Astronomy is of paramount importance to countries like Venezuela. Astronomy is an ideal vehicle to convey the wonders and importance of science to the general public, and especially to children. Nothing inspires more than a beautiful astronomical image or produces awe as the new technological achievements of modern ground based and space observatories. Professional astronomy in our countries has been a powerful force driving scientific and technological development, through more young scientists and scientific facilities."

—CÉSAR BRICEÑO
CENTRO DE INVESTIGACIONES DE ASTRONOMÍA, VENEZUELA



Writer Laura Salvá reads her story about Pluto in the Centro de Desarrollo Pre-Escolar de la Administración de la Universidad de Puerto Rico. The children later acted out the story.

Each of the 17 countries has its own program. Most of them are much involved in the global cornerstones and in particular in Universe Awareness (UNAW), an international program that exposes very young children in under-privileged environments to the scale and beauty of the Universe. Most countries also have some original programs. For instance, IYA2009 was featured in the Carnival in Rio.

Costa Rica has Astronomy in the Park, featuring visits to communities and schools to observe the skies with guides and equip-

ment. Colombia had an Astronomy Festival in Villa De Leyva.

Cuba will be opening a new Planetarium, GOTO, obtained by the ODA Cultural Grant Aid of the Government of Japan, and an Interactive Cultural Centre for Science and Technology depicting astronomical motives in the Old Town of Havana.

Mexico also had a large event at the end of January, organizing sky viewing events and lectures for all publics in 17 archaeological sites and 5 historic ones, a magic night where everybody could contemplate the

Milky Way and the wonders of the sky.

Throughout 2009, there will be in Peru a Travelling Telescope, inviting children for a viewing of the sky, with the motto: Astronomers and condors fly away to the stars with the Peruvian children.

Meanwhile, Uruguay will hold astronomy Olympiads, first at the national and then at the Latino-American level. This will be a knowledge competition, partly web based, plus training in observational astronomy from a professional observatory.

Venezuela will foster professional Astronomy, gathering Venezuelan professional astronomers and students, those within the country and also those working/studying abroad. This meeting will be coordinated with activities geared to the public.

A LASTING LEGACY?

The evaluation of IYA2009's impact will begin in 2010. We expect that in six months, a clear picture of the successes and failures of the Year will emerge. Longer-term effects will naturally take more time to assess, but eventually the legacy of IYA2009 for Latin American countries will be known. Hopes are high, but increasing scientific awareness of the public at large is notoriously difficult, so our optimism is tempered with realism. Existing research and education programs, such as those instigated by ESO's and ALMA's investment in Chile, and long-term programs, such as UNAW and, hopefully, Galileo's teacher training, will play an important role and keep the momentum in the future. Perhaps IYA2009 will be a catalyst to increase Latin American involvement in astronomy, and help to foster collaborations among the Latin American countries themselves and with the rest of the world. This would be beneficial for all.

Catherine Cesarsky, from CEA in France, is President of the International Astronomical Union and former Director General of ESO, the European Southern Observatory.

Pedro Russo, from the International Astronomical Union and ESO, is the global coordinator of the International Year of Astronomy 2009 and editor-in-chief of the Journal "Communicating Astronomy with the Public."

Lee Pullen is staff writer for the International Year of Astronomy 2009 Secretariat and editor of the IYA2009 Cornerstone project "Cosmic Diary."

The Sky Within Reach

Democratization of the Cosmos

BY DIANA VALENCIA

IN 2009 WE CELEBRATE THE INTERNATIONAL year of astronomy and commemorate the work of Galileo Galilei, theorizing that the earth and the planets orbited around our sun. And now, 200 years later, we are exploring a new field, that of extra-solar planets. The study of our sky above is considerably more democratized than in Galileo's time; informal students of astronomy and even amateur astronomers are part of the process with some interesting collaborations.

To date, more than 330 detected planets orbit stars other than our sun dozens to thousands of light years away. The first discovery is considered by many to be that of Michael Mayor and Didier Queloz from the Geneva observatory in 1995, when they detected a Jupiter-like planet around a typical star named Pegasi 51. Since then, aside from making numerous discoveries, astronomers have measured the masses and radii of more than 50 planets, detected the atmospheres of a few, and even image directly two systems.

And this process of learning showed us, to our surprise, that some of our theories were biased. In fact, in hindsight, the first discovered planet was HD 114762b. In 1989 Harvard Professor David Latham and colleagues had reported the existence of an object that at the time was difficult to accept as a true planet. As Latham explained to me in an analogy with baseball, the discovery had three strikes against it: the planet

was 11 times the mass of Jupiter, and this made it too massive to safely be considered a planet at the time; its period was 84 days, thought to be too short for such a massive object; and the eccentricity was 0.35, too large from the solar system experience. We now understand this planet to not be uncommon. There are bigger planets, more eccentric planets and planets with much smaller periods. In truth, the discovery of exoplanets has shown us how biased our expectations were and that nature is extremely diverse.

Until a few years ago, the detection of planets was a job reserved exclusively for highly educated research astronomers. Nowadays, a new trend has emerged as our understanding on how to find other solar systems has improved: amateur astronomers are also contributing to the quest of planet hunting and confirming the detections. The confirmation of a planet after discovery is almost as important as the discovery itself. While discovering a planet is quite difficult for amateur astronomers (given the low occurrence of events, so that thousands of stars need to be monitored), follow-up is relatively easy. There have been successful collaborations and two big active groups are: the Transit Search network lead by Greg Laughlin, an astronomy professor at the University of California, Santa Cruz (www.transitsearch.org), and the microFUN group led by Andrew Gould,



a professor of astronomy from Ohio State University (www.astronomy.ohio-state.edu/~microfun). Amateurs are at the heart of these collaborations and in several cases have contributed crucial data.

The detection teams monitor the candidate star through different methods and look for indirect effects caused by the presence of an unseen planet. The radial velocity method measures the wobble of the star as the planet orbits around it,

BRAZILIAN RECEIVES L'ORÉAL-UNESCO AWARD

Beatriz Barbuy, a professor at the Institute of Astronomy, Geophysics and Atmospheric Sciences at the University of São Paulo in Brazil, and one of the current International Astronomical Union (IAU) Vice-presidents, became the 2009 Laureate for Latin America, winning one of the L'ORÉAL-UNESCO awards for exceptional women in science.

The Women in Science award is designed to distinguish, reward and advance the role of women in scientific research as well as provide the next generation of women scientists with inspirational role models. She received the award in recognition of her contribution to science through her work on the

life of stars from the birth of the Universe to the present time. Barbuy is an expert in both observational astronomy and the analysis and interpretation of spectroscopic data. Her skills in spectroscopy have allowed her to assemble a large library of synthetic spectra that has aided many other researchers in their investigations of our own and other galaxies.

This year's L'ORÉAL-UNESCO Awards for Women in Science coincide with the IAU International Year of Astronomy 2009 (IYA2009). Barbuy's award is especially meaningful in this year, because the role of women in astronomy is one of the Cornerstone projects within the framework of the IYA2009.



This cluster of galaxies in the constellation Centaurus is more easily seen from the Southern Hemisphere. CTIO 4-meter Blanco telescope, 1975.

while the transit method measures the dimming of light as the planet passes in front of the star. The combination of the two yields the mass and radius of the planet. These two methods favor the detection of short-period planets. The third successful method, microlensing, is sensitive to planets that are farther away. The presence of a star with a planet within the line of sight of a background star will cause the light to bend with a distinct signal indicating the presence of a companion.

Even though most of the discovered exoplanets are Jupiter-like (planets with massive H and He atmospheres), there are a few smaller, also very interesting objects. Going down in mass, there are a few Neptune-like planets with intermediate atmospheres, and about a dozen super-Earths, which we expect to be mostly solid. The term super-Earths has been coined for those planets that have an incipient or no atmosphere at all. They might resemble the Earth and the Terrestrial planets, or the icy satellites. You can tell why these are interesting objects - some of these might harbor life.

Among these, the remarkable planet CoRoT- 7b is the first super-Earth with a measured radius. The modest French-led space mission CoRoT reported in February 2009 having detected the first transiting super-Earth. Its size amounts to 1.7 times that of Earth. It has a mass less than 11 times that of Earth and a whopping period of less than one day! The proximity to its star makes this planet nothing like Earth. However, its very discovery is a positive sign because despite of sitting at the detection limit of CoRoT, the signal is distinct. We can safely expect many more super-Earths to be detected in the very near future with the recently launched U.S. space mission Kepler. Its goal is to detect an earth-mass planet around a sun-like star at a one-year orbit.

We are definitely getting closer to detecting an Earth analog, and that opens a whole set of questions. The obvious one, might there be life? Many of us scientists are working hard at eventually answering this question. And while we look for a true Earth-analog, we will discover larger and more massive versions of Earth and the icy

satellites first, the so-called super-Earths. As a PhD student at the Earth and Planetary Sciences department at Harvard and now as a postdoctoral fellow at the Observatoire de la Côte d'Azur, I have studied the structure, composition and thermal evolution of these planets, called exceptional in that they do not exist in our solar system. And the goal of all of us who are studying them is also to learn more about our planet and our neighbors.

As the next decade unfolds, we will discover more about stars, planets, and, in general, about our home on the earth in the context of the universe. As we celebrate the year of astronomy, let's celebrate the efforts by men and women to understand the sky above us, from the professional astronomers, to amateurs, to those training the future generation of scientists.

Diana Valencia received her doctorate from the Earth and Planetary Sciences department at Harvard University and is currently a postdoctoral fellow at the Observatoire de la Côte d'Azur.

Astronomers in Mexico

Doing Science from Scratch

BY VLADIMIR ESCALANTE-RAMIREZ

WHY ASTRONOMY? AND WHY IN Mexico? Science is an international effort. Newton's law of gravitation does not have nationality, says the philosopher. In actuality, however, nationality does count. For the last few decades, Mexican astronomers have struggled to make a mark in the international field, with reasonable success. Astronomy in Mexico—as in many other parts of the less industrialized world—has waged an uphill battle against economic downturns, technical backwardness and whimsical politics, but it has been worth the effort.

A LOST HISTORY

Astronomical practice in Mexico has followed the rise and fall of civilizations. Before the European immigration, all major civilizations in what is now Mexico and northern Central America were well versed in astronomy to keep a record of time for religious purposes and agricultural needs. Astronomy has always needed mathematics; the Mayas thus invented a positional numeral system similar to the present one. They also invented the conceptually difficult sign of nothingness, the zero. Positional numeral systems make for easy addition and subtraction and practical recording of arbitrarily large numbers. The Mayan system could record dates spanning 5,000 years. When Columbus stumbled upon the Americas, interest in gazing up to the heavens had faded quite considerably in Europe. Europeans also showed little interest in keeping written native records when they torched big piles of Aztec and Mayan documents as satanic texts. The Dresden codex is one of a few Mayan books that survived the religious burning, although it did not fare as well during the Dresden fire bombings in World War II when it was water-damaged and partially destroyed. The Dresden codex records with remarkable accuracy the positions of Venus, Mars, and eclipse dates. A few other codices and fire-proof stone steles are what remains of written astronomical records in ancient Mexico.

Astronomy sank into near oblivion in

official circles in Mexico until 1874, when an expedition of astronomy enthusiasts was sent to Japan to observe Venus as it passed directly between the sun and earth. Such an event, called a transit, happens in intervals of 8, 105 or 121 years.

Collaborating with astronomers from other countries to observe the Venus transits of 1874 and 1882 would prove important for Mexican astronomy. In 1887, an international astronomical congress met in Paris to propose to photograph the entire sky and record the positions of nearly 10 million stars by observatories around the globe. Mexico was among the 18 countries invited to join in the project, later known as the *Carte du Ciel* (Chart of the Sky). The *Carte du Ciel* was considered a failure because most countries did not complete their tedious and meticulous tasks. For those who did their part, like Mexico, the project became a burden and may have hampered development in other areas of astronomy. Yet the *Carte du Ciel* has regained some importance. As stars move within our galaxy, their positions in the sky change slightly. By comparing their present positions with those recorded in a distant past, it is possible to determine their motion in time across our galaxy, and here older catalogs like the *Carte du Ciel* are the key. Recently the Hipparcos satellite, launched by the European Space Agency in 1989, photographed the 2.5 million brightest stars in the entire sky to compare their positions with those recorded by the hundreds of men and women around the world who worked diligently in the *Carte du Ciel* project.

Astronomy in Mexico has always been close to the sphere of political power by chance or by need. During its early years, the National Astronomical Observatory (OAN) was supported both financially and physically by the government. Placed on top of several landmark buildings in Mexico City such as the National Palace and Chapultepec Castle, the observatory had to survive a revolution and government officials who reluctantly allocated meager budgets to people that preferred to



look at the stars rather than worry about the earthly needs of a country in the throes of social unrest and armed rebellions. The observatory passed to the administration of the National Autonomous University of Mexico (UNAM) in 1929.

BETWEEN NATIONALISM AND INTERNATIONAL COOPERATION

The Mexican Revolution produced a wave of nationalistic politicians after it ended in 1917. One of them, Luis Enrique Erro, had an interest in astronomy. Together with Harlow Shapley, director of the Harvard College Observatory and a prominent astronomer, Erro started a project to move Mexican astronomy from just measuring and recording star positions to the new field of astrophysics. Although largely a synonym of astronomy today, the term “astrophysics” was coined in the early 20th century to stress the application of the laws of physics to understand the universe. Why and for how long do stars shine, what are they made of, how do they form, why is the universe expanding? were some of the questions that astrophysics was trying to answer when Erro met Shapley while on diplomatic duty in the United States in 1939.

Mexican astrophysics required modern instruments and new observing techniques, but Mexico's relations with the United States were affected by the 1938 Mexican nationalization of U.S. and European oil companies, although overshadowed by U.S.



A Mayan observatory is part of the Chichén Itzá pyramid complex in Yucatan, Mexico. The Mayan Indians were one of the first civilizations to explore the heavens.

concern about growing fascism in Europe. The Mexican government had no sympathy for fascism: Mexico and the USSR had been the only countries to give military aid to the Republican Spanish government against Franco, Hitler and Mussolini, but a boycott by vengeful U.S. and British oil companies forced the Mexican government to seek technical aid from the Axis powers. Shapley, along with other Harvard astronomers like Bart Bok, had a keen eye for both astrophysics and politics, and soon an effort by the Harvard College Observatory and the U.S. government was under way to build a telescope for Mexico to win over its government during the war effort. In the middle of war preparations in the United States, President Roosevelt ordered waiving of restrictions on the use of strategic materials, like high-quality aluminum, to build the Mexican telescope in record time at the Harvard Observatory shops in 1941. The telescope --the largest of its kind at the time-- was dedicated in Tonantzintla, Puebla, a few weeks after the Pearl Harbor attack, and shortly thereafter Mexico declared war on the Axis powers.

While telescope diplomacy was moving ahead in Tonantzintla, one name entered Mexican astronomy to stay. Guillermo Haro had no college-level qualifications in physics or mathematics; he was a journalist when he interviewed Bart Bok in Mexico in

1941. Haro had instantly fallen in love with astronomy, and spent close to a year learning observational techniques at the Harvard College Observatory. He became the most famous Mexican astronomer because of his discoveries using the Tonantzintla telescope between 1949 and 1959.

In 1950 he discovered his most famous objects. George Herbig from Lick Observatory, CA, also discovered the same objects, a year later, but published the finding before Haro did. Herbig-Haro objects, or HH objects, as we prefer to call them, are peculiar clouds of hot gas in space. There is a lot of gas between stars, generically called interstellar matter. Most interstellar matter is cold in astronomical jargon, which means around 400°F below zero in earthly terms. A luminous star can heat nearby interstellar matter to tens of thousands of degrees, and turn it into a plasma. A plasma is a state of matter where atoms become electrically charged. Plasmas on earth are often found in situations and places too hot or violent for human comfort, like nuclear blasts, rocket exhausts, lightning, some fires, but also neon signs and lately plasma TVs.

HH objects became an instant puzzle for astronomers because they were hot plasmas mixed with normal gas of the type usually found in the cold interstellar matter. To add to the puzzle, no nearby luminous star was seen to produce and heat the plasma.

One piece of the HH puzzle is the star that makes the effect happen. Stars are born in cold clouds by collapse. Gas in space tends to spread apart, but if the gas is dense enough, the gas collapses into a ball of matter. As more matter falls onto the ball, its center heats up under the weight of the outer layers. Eventually nuclear reactions start up at the center, and a star is born. The newborn star remains surrounded by matter that did not fall onto the star. That matter blocks visible light, but there are other kinds of light that make it perceptible. Infrared light and radio waves can traverse more interstellar matter than visible light and reach earth, and the matter surrounding newborn stars produces bright infrared light and radio waves. Therefore the location of the star producing the HH object can be pinpointed by using telescopes that can detect infrared light and radio waves.

Before the 1930s most telescopes were built to record visible light, which is the kind of light our eyes sense. But much of the radiation of sky objects comes in radio waves. Astronomers use dishes similar to the old parabolic satellite television dishes to observe radio waves from the universe, but their dishes --called radio telescopes-- are much bigger than the home versions. Instead of having a TV at the end of the electronic circuitry, a radio telescope sends its signals to a computer that eventually prints images on paper of the objects observed by the radio telescope. Mexican astronomers have been especially successful with radio telescopes, not only in observing HH objects but also finding a wide variety of objects in the Universe.

Just as ancient Mayas needed a fast system of computation, Mexican astronomers today have been spearheading computer projects with a series of "firsts." Anxious to retrieve data from telescopes through the Internet, astronomers in Mexico made special efforts to install computer networks and fast Internet connections in the 1980s. However, government officials were reluctant to open satellite Internet connections in the middle of an economic slump. However, heavenly help came in the form of a supernova explosion in 1987 in the Large Magellanic Cloud, a satellite galaxy of our own Milky Way Galaxy, visible only from the southern hemisphere.

Witnessing a supernova is an event that nobody wants to miss, but a supernova is

as unpredictable as it is spectacular. One theory holds that when a star runs out of nuclear energy at its center, it collapses under its own weight. The implosion of a star tens of times more massive than the sun can generate enough energy to produce a rebound of the inward-falling layers and blow the star apart. From earth all we see is a brightening star. It is not yet possible to know in advance when a star will turn into a supernova. The last supernova exploded in our galaxy in 1604. Every year astronomers observe a few supernovæ in other galaxies, but having a supernova in the neighborhood sent U.S. astronomers scrambling for real-time connection with observatories in South America, where all available telescopes were aimed at the exploding star. Mexico happened to be one place where an intermediate link could be installed to make that connection. Thus, Mexican officials took a more positive attitude, and a satellite Internet connection with other observatories and universities around the world was established at the UNAM Institute of Astronomy in 1989, after passing countless bureaucratic hurdles. Today commercial Internet lines link Mexican universities and observatories with the rest of the world.

Some astronomers do not observe through telescopes but prefer to hypothesize about objects observed by other astronomers. For those theoretical astronomers, computers are also an important tool, if not the only one, to simulate how the universe works. By describing mathematically assumptions about how matter must behave under certain conditions in space, an astronomer can program a computer to calculate what should happen at different places and times in the universe. Today astronomers in Mexico use a number of high-speed computers to test hypotheses and theories about the universe.

Haro had another telescope built in Tonantzintla in 1961. Eventually the Tonantzintla observatory and its two main telescopes were split between the UNAM Institute of Astronomy in Mexico City—the heir of the old OAN—and the Institute of Astrophysics, Optics and Electronics (INAOE), created in 1976 in Tonantzintla. During the following decades UNAM and INAOE have competed tightly for government funding to build larger telescopes. Astronomical observation in Tonantzintla was ruthlessly quashed when lights from the

city of Puebla lit its night sky and rendered any attempt to see dim sky objects hopeless. But Mexico still has one of the three best sites for astronomical observation on earth on the San Pedro Martir Sierra, Baja California. At 9,200 feet above sea level and far from city lights, the OAN has reincarnated in San Pedro Martir with new telescopes—largely built in Mexico.

INAOE for its part has been building a giant radio telescope on Sierra Negra volcano in Puebla in collaboration with the University of Massachusetts at Amherst—the most ambitious Mexican science project to date. The technical challenges to build a 50 meter wide radio telescope are tremendous. When INAOE's radio telescope starts gathering data, hopefully soon, it will be observing planets in our solar system, and galaxies at the limits of the universe.

In 1996 a group of adventurous astronomers from the UNAM Institute of Astronomy started the Center for Radio Astronomy and Astrophysics (CRyA) at UNAM's Morelia campus in Michoacan. Moving from Mexico City to Morelia was a new start for Mexican astronomy.

CRyA has become a partner on equal footing with institutions in the United States, Canada, Europe and Japan that are building the Atacama Large Millimeter Array—an array of 64 radio telescopes in Chile—and two other arrays of radio telescopes through the United States and the Caribbean. Mexico got a foot in those projects by contributing instruments to detect the signals from the radio telescopes. Once finished, those radio telescope arrays will be able to make detailed images of objects like star-forming regions, and galaxies, and even search for planets around other stars.

Today, close to 200 astronomers work in Mexico, investigating virtually every topic in astronomy. Like other pure sciences, astronomy depends heavily on government funding in Mexico, but there is a catch. Mexican astronomers have to start from scratch most of the time, training technicians in electronics, mechanics and optics, and hoping that they will not migrate with their skills to more lucrative jobs in private companies. It also means fighting government bureaucracy and red tape, not to mention the eternal question government officials often ask: "Why do we need astronomy in Mexico?"

In May, 2004, TV news programs aired

a video taken by the Mexican Air Force, showing alleged UFOs flying along their aircraft. The video took public attention away from an unfolding diplomatic crisis with Cuba. The Air Force declined to give a copy of the video for analysis to the Institute of Astronomy, arguing it was a classified document. Mexican astronomers have been trying to wrestle the public stage from UFO hunters and other scams through popularization talks, media conferences and astronomy books and articles for the layman. Watching a government branch and the media take the side of the swindlers was not good news for astronomy.

The saga of Mexican astronomy has been dramatic enough to inspire the novel *"La piel del cielo"* (The Skin of the Sky) by renowned author and journalist Elena Poniatowska. Astronomy in Mexico has always been seen as a cultural enterprise against general ignorance as much as a mission to leave a mark in universal knowledge. It has been a polemic over nationalistic beliefs and international collaborations—building telescopes in Mexico or collaborating with observatories abroad. Erro and Haro might have had strong nationalistic views, but they jump-started modern Mexican astronomy with a U.S.-made telescope. Regardless of the outcome, science in a given place on Earth has been the reflection of those who did it. When Spanish conquistadores torched almost all native literature, they were showing contempt not only for native math and astronomy, but for the societies that produced them. But perhaps the best answer to the questions at the beginning of this article was given by more than 10,000 people who showed up at the star party held in the Tzintzuntzan archaeological site on the night of January 31, 2009, to kick off celebrations of the International Year of Astronomy. People patiently waited in line for hours in cold weather to peek through telescopes while overwhelmed astronomy graduate students from the UNAM Morelia campus tried to answer questions on planets, nebulae and galaxies from thousands of inquisitive people. That is why Mexico truly needs astronomy.

Vladimir Escalante-Ramírez is an astronomer at CRyA at the UNAM campus in Morelia with an undergraduate degree in physics from UNAM and a Ph.D. in astronomy from Harvard University.



Parallel Worlds of Mexican Cosmology

Another Way of Exploring the Universe

BY LAANNA CARRASCO

YOU COULD CALL IT A TREASURE MAP, a time machine or a 16th century painted labyrinth. For me it became a magical board game filled with pictures of characters whose personalities and adventures I could imagine and re-create. Yet, for the indigenous people who created the Mapa de Cuauhtinchan 2, a Mexican map that records events from the 12th to the 15th centuries in a region near the present-day city of Puebla, it was a crucial artifact documenting how that community struggled to find a new life and maintain its sense of place within the universe.

The Mapa first caught my attention one afternoon when I was living in Mexico City studying Spanish and attended a lecture by my father, Harvard Professor David Carrasco, who was completing a five-year study of the map. He explained that the map is both a sacred history of a world that ended once the Spaniards conquered Mexico, and a “foundation and migration” story. A migration story because it sums up the authors’ (the Chichimecas) various ordeals that included surviving storms and floods and shows them performing sacrificial rituals in their quest to discover their own sacred lands and found a new community. The map then depicts the eventual settlement and social transformation of the Chichimecas from hunters/gatherers to city folk as well as how their gods played a central role in their lives.

My father saved a little bit of magic for the end, when he described what digital photography and restoration of the map revealed in areas that had been damaged. First, he showed a picture of the map before restoration. At the bottom left corner, along a pathway marked by footprints, there is an image of a man falling head first into a crack in the earth. This was significant because it was the only such crack shown on the map, and it was unclear whether it represented a rip in the earth or a rip in the map with a passageway to a world behind the surface. The man’s bottom torso and legs are sticking out, but his head and upper body have already disappeared into what might be an alternative reality or underworld. I was amazed when he showed a second picture of this part of the map digitally restored: right below the disappearing torso is the head of this or perhaps another man moving out of the crack and back into the map.

Clearly, this key moment in the narrative of the map would have been lost if it weren’t for photographic technology. It showed that the Chichimecas had access to another world, whether an underworld, dream world or some other alternative form of reality that existed beyond a surface awareness. Carrasco said that such access to parallel worlds is common in Mesoamerican cosmology: the Aztecs too had an underworld where humans and gods could play

games, and the rip was most likely representative of the Chichimecas’ world view.

A FEW MONTHS LATER, A TREATMENT FOR A children’s book based on the pictorial narrative in the map fell into my hands. The initial treatment had been written by Anthony Aveni, a Colgate University professor of astronomy, who had been involved in the original analysis of the map. Because I had been trained as a journalist and was an avid reader of children’s literature, Aveni invited me to work on the project with him.

The plot consisted of a contemporary young Mexican American boy describing the adventure of two of the map’s characters—Serpent Foot and Feather Lip, twins who ask the gods for advice on where to build a new town free of human conflict. One of the gods, Coatzin, cryptically advises the brothers to follow the “Road of *Teyolia*,” a metaphorical path that will allow them to acquire intuition—known in Nahuatl as *Teyolia*—by sensing the soul-force in the plants, animals and other elements in nature. Coatzin suggests that the brothers pay attention to the messages that spontaneously come to them from the natural world and use them to guide their actions. By developing their skills of intuition and a respect for the earth, the brothers will acquire the skills they need to establish their new town.



Cave, City, and Eagle's Nest: An Interpretive Journey through the Mapa de Cuauhtinchan No. 2, edited by David Carrasco and Scott Sessions (University of Mexico Press, 2007), reflects on Mexican cosmology.

The treatment, aimed at young readers and already loaded with science and adventure, would benefit from the addition of a twin sister for the protagonist. This would allow the contemporary siblings to learn from the ordeals faced by the ancient twins in the map and acquire a bit of *Teyolia* themselves. I saw the map as a board game: as our players follow the footsteps that lead through the landscape of Cuauhtinchan, we could create the rules using the dramatic episodes and satisfying outcomes that appear in the map's marvelous painted pictures. Inspired by scenes of Harry Potter tumbling into Dumbledore's pensieve and Alice falling through the Looking Glass, I suggested that we have the Mexican-American twins magically fall into the map and follow Serpent Foot and Feather Lip on their adventures.

Another writer, Robert Wilder, suggested that the story begin on Halloween, because it coincides with the beginning of the Mexican holiday *Día de los Muertos* (Day of the Dead), a day when Mexican and Mexican-American families typically make an altar in their homes to remember and honor their dead ancestors. In fact, some people believe the dead travel through spiritual openings and return to earth for a brief visit with their families.

We decided to have the contemporary twins in the story, Marc and Maria, feel disgruntled with their "traditional" Mexican-American parents who bar them from going trick-or-treating because of the tradition of making the family's altar. I hoped the narrative would portray a learning experience in which the characters come to value the ritual of Day of the Dead and appreciate the memory of their ancestors.

The essence of the narrative was developed when Aveni and his wife, Lorraine, invited me up to their tiny cabin in the Adirondacks last August. I arrived at the Aveni's just as the rain began to diminish from the hammering that had followed me from Boston. Perhaps it was the strange glowing light of the sun through rain clouds that made me feel like I was nearing the edge of reality itself, just before it turns into a dream. Indeed, I remember the creative dialogue that followed with Aveni as happening in a parallel universe—one that became a metaphor for the alternate world that the map represents.

We started work with a replica of the

map large enough to cover a picnic table. Aveni liked the idea of having Marc and Maria unexpectedly fall into the map on Halloween night to enter the world of their indigenous ancestors. The plan was to have them be invisible in this other realm and follow behind Feather Lip and Serpent Foot on the "Road of *Teyolia*." The biggest challenge we faced was to write the pre-Hispanic practice of human sacrifice into a story for children today. Because human sacrifice is such a frightening issue for many people, I suggested we allow all four characters to observe a sacrificial episode and discover what it means to give up something highly valued for the greater good. Feather Lip and Serpent Foot dialogue about what would motivate them to make a sacrifice. Serpent Foot admits that he doesn't know if he can give up something very valuable, much less his own life even if it is for the benefit of his family. Feather Lip agrees, suggesting wisely that "at some point in our lives *Teyolia* will help us realize that we need to give up something important and then because of our inner knowledge we will be able to do it."

The unfinished text ended abruptly with Serpent Foot and Feather Lip descending into Mictlan, the Land of the Dead. How would our characters make it through the Land of the Dead alive, what would they learn, and how would we return Marc and Maria to the present day?

I will always remember our subsequent dialogue. The energy seemed quite auspicious, allowing us to craft a resolution that answered all of our questions. The following is what resulted: Feather Lip and Serpent Foot encounter the Guardian of the Land of the Dead and must sacrifice something of ultimate value in order to pass through the ordeal of death and emerge onto the earth. At first, the brothers refuse to sacrifice anything, but their hope of returning to the living world of their families grows stronger and they discover a way through. The Guardian of the underworld tells them that he collects memories, savoring the experiences, joys and difficulties of humans who have lived: one of the brothers must give up his memory of the adventure and all that he has learned. Serpent Foot agrees to sacrifice his memory, meaning that Feather Lip has the responsibility of teaching his brother the knowledge they had acquired on their adventure—refilling his mind with the wisdom of *Teyolia* as well as their conclusions

on the meaning of sacrifice. Thus, young readers could realize how much people value and cherish memories, using these recollections to sustain them during difficult times. The sweet part of this decision was that having Serpent Foot sacrifice his memory would allow Marc and Maria to begin to understand the importance of remembering their ancestors.

After Serpent Foot and Feather Lip make the memory sacrifice and pass through the Land of the Dead, they journey back to their village, Feather Lip retelling their adventure to his brother all the while. The other twins, Marc and Maria, follow but can't help embellishing the story and shouting out parts that Feather Lip misses. Their outbursts somehow break the magic of the map and the twins fall out of it and back into their present day living room on Halloween night. At home, the pair animatedly recall their adventure and appreciation for the past: both people and actions that came before them. They realize that this is what Day of the Dead is all about and enthusiastically shout: "Man, this sure beats trick-or-treating!"

Marc and Maria choose the magic map over candy and call up from the dead a world that did not want to disappear from earthly memory. In falling in and out of the map over the past year, I have helped create them; they in turn have coaxed me into a world that is ordered by the mixture of painted images, indigenous cosmology and my own bubbling imagination. For me, the map conjured up a magical game and through a surprising series of moves, Anthony Aveni, the great scholar of the stars, and I followed the painted footprints and open up the rip in the map for you for you to enter too.

Laanna Carrasco is a freelance writer and editor with an MA in Journalism from the University of Colorado. Her Master's thesis explored how bilingual Latino music with hybrid musical styles has been used for political and social empowerment. She is an avid runner and has a passion for children's literature.

Laanna gives special thanks in honor of Angeles Espinosa Yglesias whose dedication to understanding indigenous cultures led her to commission an interdisciplinary study of the manuscript at Harvard University and rescue the map from obscurity.

Chile is one of the best places on earth to observe the sky and is the site of many fascinating astronomical investigations. The University of Chile in 1960 actually created the initiative for modern observatories.





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Heavens Above

Peeking at the “Energetic Universe”

BY ROBERT P. KIRSHNER

LASERS, SILICON-BASED LIGHT DETECTORS, SUPERCOMPUTERS, and giant glass disks all contribute to new techniques for astronomers to discover the properties of our universe. But one of the most powerful tools of modern astronomy is jet travel: it makes a telescope in Chile practical for observers from the north. And that’s important because Chile is the best place to observe.

It’s been the site of fascinating investigation into so-called dark energy and black holes that lurk in the centers of galaxies. A brand-new radio telescope and a new and larger optical telescope will soon make Chile’s modern observatory even more up-to-date.

The University of Chile actually created the initiative for modern observatories. In 1960, Prof. Frederico Rutlant suggested establishing a “cooperative” observatory and astronomers in the United States responded. Site surveys for optical telescopes, mostly staffed by people from the University of Chile, soon concentrated on the mountains on the southern fringe of the Atacama desert, in the north of Chile, not too far from the provincial capital of La Serena. By 1963, the Cerro Tololo Inter-American Observatory was a reality. The Carnegie Institution installed its first telescope at the Las Campanas Observatory in 1971, and the European Southern Observatory at La Silla started observations in 1964. These sites proved effective, with 300 clear star-lit nights a year and excellent atmospheric conditions that allow telescopes to form sharp, still images. This is what astronomers call, in our own argot, “good seeing.” Chile has the best seeing.

In the early days, the airline of choice (because there was no other choice) was Braniff, with airplanes painted goofy colors. Flights from Miami were infrequent and indirect, often including midnight stops in Guayaquil or Lima, or both. An astronomer arriving in Santiago could breathe the sweet scent of summer in Chile during a North American winter, but the trip was only halfway done. The next day was occupied by a long bus ride 250 miles up the Pan-American high-way. Vendors would hop on to offer toothache-inducing sweets as the bus labored up the hills near La Ligua. There was a brief lunch stop at the seaside town of Los Vilos, and then, just when your hopes of seeing La Serena were lifted by the distances posted on the road signs, the bus would veer off to

The Cerro Tololo Inter-American Observatory 4-meter telescope dome in June of 2006.



Cerro Tololo Inter-American Observatory as seen from Cerro Pachón, April 2004.

Ovalle to let a few people off and on in that market town. From La Serena, the observatories ran their own vehicles either up the Elqui river valley to CTIO, or further north on the Pan American to Las Campanas. ESO ran its own flights to an airstrip at the base of La Silla, evoking envy (disguised as scorn). It was a long trip, but it was worth it.

Today, travel is easier, and the telescopes at the destinations are much more powerful. While I strongly recommend a walk outside on arrival to sniff summer through freshly thawed nostrils, you can walk from international arrivals over to national departures without going outside. The world of astronomy is a small town—there are about 10,000 astronomers. They are spread rather thinly around the globe, but the chances are good that the departure lounge for La Serena includes members of our tribe. Pallor, down jackets and laptops are distinguishing characteristics we use to recognize one another.

At Harvard, we're partners in the Magellan Observatory, two telescopes at Las Campanas with 6.5 meter primary mirrors that were put into operation in 2000 and 2002. The drive from La Serena to Las Campanas is about two hours, ending with a climb up our own unpaved road to the mountain that ascends to almost 8000 feet. While our purpose is astronomy, and looking up, there's no harm in looking horizontally. Chile is a skinny country—from the observatory you can see fog on the Pacific coastline off to the west, and the high ridge of the Cordillera and the border with Argentina off to the east.

The Magellan Telescopes were very carefully designed by our Carnegie partners to avoid disturbing the good seeing the site provides. They are kept cool, since temperature differences between the telescope and the nighttime air spoil the images. For the same reason, the enclosures can be opened up to let breezes flow through. This ventilation is good, but has to be balanced against the shaking that high winds can produce, which is not good. The building has a set of big adjustable louvers to regulate that flow of air. At the

Magellan Telescopes, about once a minute, we analyze the images that the telescope is forming, compute the errors in the shape of the big 6.5 m mirror, and gently apply small forces to make it nearly the perfect shape. The combination of excellent atmospheric conditions, thoughtful engineering and constant correction provides astronomers using the Magellan telescopes with the best natural seeing in the world.

In 1998, there was an amazing discovery published by an international team of astronomers that included many of my former students and postdocs and a strong representation from Chile that included Alejandro Clocciatti at the Pontificia Universidad Católica and Mark Phillips, Bob Schommer, Chris Smith, and Nick Suntzeff

Harvard is a partner with the Magellan Observatory, two telescopes at Las Campanas with excellent atmospheric conditions and thoughtful engineering.

at Cerro Tololo. We showed that the expansion of the universe was speeding up. Astronomers had known from the 1920s that the universe was expanding, with the distances between galaxies stretching out over cosmic time. Most people who worked on cosmology expected that, once the measurements were good enough, we would find that the expansion was slowing down due to gravity. Our observations of distant supernovae, or exploding stars, showed that these expectations were wrong. Instead of gravity slowly braking the expansion something else, which we call the dark energy, appears to be speeding it up. In 1999, another group published the same result—if we were wrong, we had company.

Subsequent observations of more supernovae, of the glow from the Big Bang itself, and of the way galaxies are clumped together all point to a universe that is about 2/3 dark energy and only 1/3 matter. We have to take this seriously. I've changed the name of the course I teach for non-scientists from "Matter in the Universe"

to “The Energetic Universe.” The dark energy seems real—but what is it?

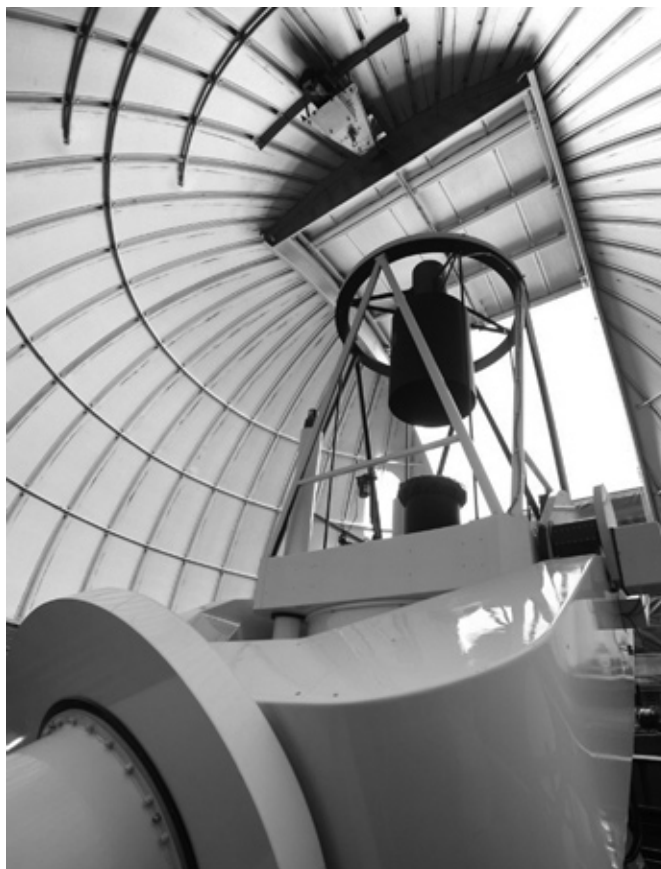
One idea for the dark energy is that it is a modern version of Einstein’s “cosmological constant” a repulsive mathematical construction he invented to balance out gravity and make a static universe back in 1917. After Edwin Hubble demonstrated that the universe was expanding, Einstein tossed the cosmological constant into the history of science ashcan. But perhaps we need to dive back into Einstein’s dumpster to extract the cosmological constant as the source of the dark energy.

There are other possibilities: to distinguish between the cosmological constant and these alternatives; we need many more careful distance measurements to supernovae that exploded 5 billion years ago. To find and follow up these explosions, for 6 years, Harvard Professor Chris Stubbs and a large posse of astronomers from around the world have conducted the ESSENCE project. We’ve used the new generations of telescopes in Chile: the 4m telescope at Cerro Tololo and its 8 m neighbor of the Gemini Observatory, the twin 6.5 m telescopes at Magellan, and ESO’s wonderful new “Very Large Telescope,” with four 8m telescopes farther north, at Paranal, near Antofagasta. So far, our best efforts show that the mysterious substance that drives cosmic acceleration has exactly the same properties as the cosmological constant. Astonishing as it may be to have dark energy as the principal component of the universe, it would be even more interesting if we found that the dark energy was something more complicated than Einstein’s old idea.

Chile has as good a claim as any place to be the center of the astronomical universe. Future developments in the field recognize the unique aspects of Chile’s geography. The world is collaborating to build a radio telescope, the Atacama Large Millimeter Array, now taking shape 16,400 feet above sea level on the Chajnantor plain near San Pedro de Atacama. Many celestial objects that are invisible with optical light emit radio waves. Learning about the universe in this way will teach us about the origins of galaxies, of stars, and of planets. But ordinary water vapor can absorb these waves. The millimeter region of the radio spectrum is accessible only from sites that have extraordinarily dry air above them. San Pedro is legendary as a dry place and the Chajnantor plain is so high that there is relatively little air above the antennas, providing a transparent view for this unique instrument.

Looking ahead, the partners of the Magellan Observatory, along with new partners, are now developing the plan for a new and larger optical telescope for the Las Campanas site. The first of seven giant 8.4 meter mirrors has already been cast for the Giant Magellan Telescope, which will take advantage of the steady air, dark skies, and dry clear nights that have already made Las Campanas a favorite destination for astronomers. This telescope will explore planets around other stars, black holes that lurk in the centers of galaxies, galaxies back through cosmic time, and may help us understand the dark energy that drives cosmic expansion. Looking up through the clear air of Chile is the best way to see where we have come from and to puzzle out what the world is made of. Astronomers are going to be traveling to Chile for a long time to come.

Robert P. Kirshner is the Clowes Professor of Science at Harvard University.



Las Campanas Observatory

THE SKY ABOVE, THE EARTH BELOW



Observing Under the Splendor of Chilean Sky

Classical Observing and Other Approaches

BY CHRIS SMITH

I LOOK AT THE SKY. THE STUNNING CHILEAN NIGHTTIME SKY. Walking outside from the cozy control room of the telescope, from where I control the instrument and make my observations, I let my eyes adapt to the night and the stars come into focus. It is awe inspiring, and a bit overwhelming. The universe is laid out before me, with our Galaxy taking center stage as a mottled stripe across the sky, while two nearby galaxies, the Magellanic Clouds, hover around the South celestial pole impersonating real clouds. Amazingly enough, as I walk outside on this star-filled night, I really don't need a flashlight. Although there is no moon, the sky is bright with stars and I can see my surroundings clearly in starlight. It is an amazing sensation.

Earlier, I gather with a group of colleagues at sunset, watching from the western wall of the parking lot on the summit for the "green flash" as the sun sinks into the ocean. The sky overhead is losing the bright, almost blinding, blue color it has shown all day. As is often the case, not a cloud has been seen over Cerro Tololo the whole day, which bodes for an excellent night of observing. We are the astronomers gathered on this summit tonight, each pursuing his or her own investigation in one of the telescopes here, each having competed and "won" a few nights of time on the telescopes and each having made the long journey to this mountaintop to use the facilities under the pristine skies of northern Chile. We are fewer each year, but we know the special nature of this place, recognizing it rationally but also feeling it as we watch the sunset and relax before turning to go to work for the night.

In years past there would be many astronomers here, usually one or more in each telescope. Often during the night the astronomers would visit other domes to discuss what projects were being pursued, how the instrumentation was working, and how clear the night was. The nights are often clear at Cerro Tololo, more than 300 nights per year on average, and astronomers come from all over the world to use the telescopes here. It is a long trip for most, some 5,000 miles from the U.S. mainland, but these travelers are usually rewarded with conditions that are among the best in the world to observe the cosmos. That is, if they come.

The Moon, planet Venus, the bright star Spica and planet Jupiter are seen (in descending order) over Cerro Tololo Inter-American Observatory in Chile in September 2005.

Astronomy is changing. The success of space-based observatories has led the way. Of course astronomers don't travel to those telescopes, so observations are made for the astronomer and the data are then packaged and sent back. In this case the astronomer never leaves his or her office. This mode of observing is changing expectations, and more and more changing the way ground-based astronomy is done. To meet expectations, we (the national observatory) now offer a range of observing modes. The most like the space-based model is queue observing, where one project's observations are only made when the conditions are right. Observations are made by a trained technician or resident astronomer, based on detailed instructions from the astronomer who proposed the project. Service observing is similar, in that the trained technician does the observations but on a specified night. And remote observing allows the investigators to actually participate in the observations, but at a distance, communicating with the technician on the mountain via telephone or video from their own office or remote observing room at their home institution.

I myself prefer "classical" observing, traveling to the telescope and participating directly in the observations. The advantages are quantifiable, given that I can modify the observations based on the conditions, investigate problems in real time, and work closely with the local technical staff to optimize my use of the telescope and instrument in pursuit of my science. But perhaps just as important are the qualitative aspects. I am on a mountaintop, working with the team here and focused on my science. I have time to think, many miles away from home and office.

I must go back in and continue my observations. I take one last long look at the sky, and realize yet again how special this place, and this experience, is.

Chris Smith is Director of the Cerro Tololo Inter-American Observatory (CTIO), the southern branch of the U.S. National Optical Astronomy Observatory (NOAO), operated by the Association of Universities for Research in Astronomy (AURA) on behalf of the National Science Foundation. He moved to Chile immediately after obtaining his PhD at Harvard (working with Bob Kirshner) to take a postdoctoral position at CTIO, and has now lived there for over 15 years.

An Astronomical Scene

Learning at the PUC

BY ROGER FU

WHERE CAN YOU FIND AN ITALIAN PROFESSOR TEACHING AN American student in Spanish using lecture slides written in English?

In the astronomy course I took at Chile's Pontificia Universidad Católica (PUC), few sentences were spoken in only one language. As an undergraduate student of astronomy at Harvard College taking a semester abroad, I felt strangely close to home—finally here was a course taught in Spanglish. Yet this odd mix of the domestic and the foreign was rather appropriate for the subject matter. The advanced state of astronomical research in Chile has always owed much to international involvement.

Northern Chile's dry, predictable weather has drawn astronomers for more than a century. The Atacama was the place to go to make the most acute and critical observations. In 1907, famed astronomer Percival Lowell obtained his photographic "proof" of canals on Mars when he worked in a little town just south of Antofagasta. Complete with mule-drawn wagons and porters, such undertakings were not unlike the African expeditions of Victorian days. Significantly, they were sponsored by foreign universities with their own staff and equipment. This pattern of detachment from Chilean scientific institutions continued in the following decades.

It was not until 1962 that a Chilean university first took a permanent stake in the establishment of a major observatory. Even then, the construction of facilities at Cerro Tololo was a collaborative effort between the University of Chicago and the Universidad de Chile (UCH). In a model that has since been duplicated at the other major observatories at La Silla and Las Campanas, the foreign institution provided much of the funding and the critical components of the telescopes, while the Chilean side provided on-site personnel and smoothed out the details of importation and land purchase with the Chilean government, which proved to be keen in encouraging the construction of the facilities.

Little work in astronomy was done in Chile itself at the time, and the research community was limited to the Universidad de Chile. Yet the very presence of the new observatories on Chilean soil sowed the seeds for upcoming generations of Chilean-born astronomers. Maria Teresa Ruíz, a stellar astrophysicist and professor at the UCH, was then a young student of chemistry. She recalls being captivated by her first night under the pristine sky at the newly completed Cerro Tololo. "It was love at first sight, [and] I decided that, if I had the talent for it, I would become a professional astronomer."

At the time, it was an ambitious goal. Astronomical education in Chile was still in its infancy, and students such as Ruíz had no choice but to go abroad for doctorate programs. Here the long-standing tradition of international mobility in the astronomical world worked in their favor—anyone walking down the hallways of Harvard's Center for Astrophysics is sure to learn a few foreign phrases. Ruíz and most of her colleagues received their advanced

degrees from American universities, while a few spent their time in Europe or Canada.

At home, the Chilean astronomical scene seemed to be static. The problem lay in the lack of international involvement in research. Even though Chile had the facilities and trained personnel to operate the great telescopes, Chilean astronomers lacked the international experience to investigate the big unsolved problems in astronomy on equal footing with their foreign counterparts. Unlike the case in many other sciences, in astronomy the number of active researchers in any one country is likely to be small, and the wide range of topics means that one must look all over the world to find researchers with the same interests. "In order to compete in this field, [one] must have international experience," explains Leopoldo Infante, a galactic astrophysicist and professor at the PUC.

The return of the first generation of foreign-educated Chilean astronomers in the 80s and 90s changed all that. They brought with them not merely technical expertise but also the acquaintance of hundreds of collaborators they met during their years as graduate students and as post-docs. Beyond just cooperating remotely on projects, many of these foreign-born astronomers moved to Chile permanently, a rare choice in the early days. "Twenty years ago Chilean astronomy was quite local... now a large fraction of [astronomers] are not Chilean-born. This change in Chilean astronomy demographics has created a vital international community," says Infante.

In effect, an increased openness to an exchange of scientists and knowledge has been Chile's admissions ticket into the major leagues of astronomical research alongside the United States and European nations. Beyond increasing opportunities for Chilean researchers, foreign collaboration comes in the form of better funding. Although government agencies such as FONDECYT and FONDAP provide the necessary astronomical research grants, the dollar value of a typical grant is "one or two orders of magnitude smaller" than a grant from a European or American agency such as NSF or NASA, according to Ruíz. Major projects—a state of the art telescope, for example—cannot be completed with Chilean funds alone. "Some of these instrumentation-related projects would require joining multi-national consortia," says PUC professor Andrés Jordán, who until recently was a post-doc at Harvard's Center for Astrophysics.

Indeed, instrumentation is still an area in which direct foreign involvement is crucial. Evaluating locations for and eventually building and monitoring a giant telescope are complicated tasks for which one can readily benefit from prior experience working with observatories outside of Chile. For example, "seeing," or atmospheric stability, is the most important environmental factor at an observatory, and likely the premier specialist in seeing monitoring in Chile, Andrei Tokovinin, is a Russian scientist working for the American National Optical Astronomy Observatory (NOAO).

If Spanglish is the de facto language of the astronomy departments of the Santiago universities, then pure English is the common language spoken on site at the major observatories. On my visit to



Aerial view of Cerro Tololo Inter-American Observatory in Chile, taken in the late 1970s.

the La Silla observatory complex, I overheard exactly zero words of Spanish among the scientific staff who work there. My day ended with a stop in the dining commons where I topped off with one of the most American meals I had in Chile—garden salad and chicken breast complete with a cheesecake and Jell-O dessert.

The other visitors there on that day, all Chileans, were less impressed with the little bastion of all things gringo at 8,000 feet. One man even questioned, quite indignantly, why foreigners should be using Chilean telescopes at all and why should Chile give them 90% of the telescope time. In reality, given the universal rule that 10% of all observatories' time must be reserved for domestic observers, Chilean astronomers already enjoy by far the longest telescope time per person in the world.

Professors, however, are determined not to let that reality be lost on their students. "All of my students must complete six weeks of research abroad as part of their training," says Monica Rubio, a professor who studies stellar formation at the UCH. Most professors strongly encourage their graduate students to spend at least one post-doc abroad. Even undergraduate students are hearing the call. Upon introducing myself on the first day, one of my classmates quickly approached me for help with perfecting their already very good English. Likewise, all course readings were given in English.

On the flip side of the coin, the universities are doing all they can to attract foreign students and faculty. A majority of current post-docs are foreign-born, as are half of the professors. No inherent advantage is given to native-born candidates. The government also does its part. A U.S. student applying for a Fulbright grant for Chile will see that Astronomy is at the top of the list of desired specializations, and not because it begins with an "A."

Yet the spirit of multi-nationalism does not take precedence over everything else. "New foreign faculty candidates must speak Spanish

or convince us that they will learn fast," says Andreas Reisenegger, a PUC professor. The truth is that any astronomy researcher today in Chile is guaranteed to speak good English. This linguistic requirement is meant to benefit none other than the students, particularly those in the undergraduate program, who are almost all native Chileans. Chilean universities are keen not only to encourage ongoing exchange of personnel, but also to pass the benefits of foreign ideas to the next wave of Chilean astronomers.

This dedication to undergraduate education stands in contrast to many U.S. universities, a difference that I can personally attest to and appreciate. The choice here is partly one of practicality, explains Reisenegger. In the end, training people is cheaper than building the next World's-Largest-Telescope, and, with limited resources in hand, the universities as well as the government are investing with an eye for future returns.

This decision has visible consequences. The population of astronomy undergraduates at the PUC dwarfs that of Harvard College by more than a factor of ten. Not all of these students will end up pursuing astronomical research, but those who will are highly motivated to eventually find faculty positions in Chile. Unlike in the old days, staying in Chile can be fully justified on professional grounds in addition to any personal motives. Already, one can begin to see a trend towards ever-higher proportion of Chile-born researchers. Yet this is by no means a return to the state of affairs of the early 80s. Chile's capacity for international collaboration is here to stay and, with it, the assurance that its scientists' rapid rise to prominence in the international astronomical community can continue.

Roger Fu is a fourth-year astronomy student at Harvard College. He invites comments at rogerfu12@gmail.com.

The Cartonera Comes to Mexico

BY DORIS SOMMER

Chalco is one of Mexico City's poorest neighborhoods, far enough away from the center along the traffic-clogged highway to Puebla to feel isolated as well as arid. There, migrants from several indigenous and mestizo communities settle alongside one another in precarious constructions. Though the Federal District government has begun to construct an administrative infrastructure here, the unpaved streets are still lined with makeshift dwellings put together from any available materials, including cardboard. The arts of recycling are no news here. But before the Cartonera came to town, no one had yet made books from used cardboard.

In July 2008, José Luis Falconi and I—directors of Cultural Agents at Harvard

fairly difficult literary texts in a range of arts. Mostly local artists worked with us in Chalco, as elsewhere, to insure sustainability of the collaborations, but we also invited Mexican artist Pedro Reyes, who developed a block-type poster with Mano Amiga students.

The Cultural Agents Initiative, which seeks to identify and promote arts as social resources, has brought the Cartonera to other Mexican sites, including Puebla's Museo Amparo and the University of Guadalajara. We have also collaborated with the Secretary of Education in Puerto Rico, where artist Antonio Martorell helped facilitate a week-long training workshop; with Caribbean University in Bayamón, Puerto Rico, invited by resident artist Anaida Hernández; and in training teachers and art-

education, two distinguished artists, Paloma Torres (a student of Martorell) and Betsabé Romero invented activities to take advantage of the Museo's pre-Colombian collection. Later, a city initiative expanded into new school sites and planned to establish Cartoneras in market places to benefit residents at large. Similarly, the Arts Academy at the University of Guadalajara hosted training for already sophisticated arts educators last summer. At the 2008 International Book Fair in Guadalajara, we directed a workshop for over 120 "promotores de lectura" (literacy coaches) with generous help from Cultural Agents abroad, including Antanas Mockus, Angela Pérez, Cultural Coordinator for Colombia's Banco de la República, and Doris Moromisato, director of the

to give public lectures, then multiplying their contributions through workshops, Cultural Agents hosted two young Cartonera founders in 2007. Javier Barilaro—the painter who helped establish Eloísa Cartonera in Buenos Aires—and Milagros Saldariaga, one of the initiators of Sarita Cartonera and its pedagogical program in Lima—stayed for a week-long residency at Harvard. [See the six-minute video on our website: cultural-agents.org. Go to programs, and to Paper Picker Press.] With an "Idea Translation" grant received by one of our members, Nathalie Galindo, from Harvard's Professor David Edward's class on creative entrepreneurship, three pilot programs were launched in the Boston area (with the Brazilian American Association in Framingham, the Boys and Girls Club in Chelsea, and Zumix in East Boston), eventually developing into the entertaining and efficacious Cartonera program. Student participants become so engaged in acting, painting, making music, photographing, and dancing their interpretations of difficult texts that they hardly notice how hard they work at critical reading.

The "Cartonera" is an innovative Harvard-based project whose name honors the recycled material that paper pickers use to make artisanal books, from Buenos Aires to Boston.

University—were hosted by Worldfund to train educators in the Mano Amiga Catholic school in a literacy program we call the "Cartonera." The name honors the recycled material that paper pickers use to make artisanal books, from Buenos Aires to Boston. The project develops higher-order thinking among students of all ages, through interpretation of

ists in Bogotá's main library, the Luis Angel Arango, where workshops will resume in August 2009.

In Puebla, the Fundación Amparo hosted the week's training program especially to benefit its Proyecto Roberto in developing communities. At Puebla's beautiful Museo Amparo, with the collaboration of Puebla's office of public

International Book Fair in Lima. But nowhere has the success of the Cartonera been more stunning than in Chalco.

But first, we should say something about the origins and philosophy of the Cartonera.

ORIGINS

Following our general practice of inviting creative agents

CONCEPT

Learning through creativity energizes the Cartonera, aka the Paper Picker Press. More than "learning by doing," which can mean the repetition of useful models, creative



Left: Former Bogotá Mayor Antanas Mockus participates in the "Cartonera" project; right: workshops emphasize learning through creativity.

interventions of materials on hand promote exploration and originality. Given situations and texts become points of departure or stimuli for critical thinking and therefore for judgment about social as well as personal issues.

Our goal reaches far beyond advancing a better understanding of literature. How far would literary interpretation get us, if it were not also a training to interpret everything else: non-literary events, film, family conversations, and the discourses of politics, love, and work?

As human beings, we constantly interpret whatever happens around us, so that the more we stimulate our critical and interpretative capacities, the better we will live as active citizens engaged in promoting social justice. Existing material, including literature, offers points of departure or stimuli for critical thinking and therefore for judgment about intellectual, social as well as personal issues.

In the Paper Picker Press, each participant authors books

through a series of artful interventions in texts written by literary masters. Youth learn to appreciate great art by trying their hand at "improving" on it or at least developing personal and imaginative interpretations.

The Cartonera/ Paper Picker Press develops the educational contributions of good literature for everyone, no matter what cultural background or tastes he or she may bring to the workshop.

A LO CHALCO

Maybe it is the intensity of dedication of Mano Amiga School director, Lilia Garelli, and her devoted faculty that determined the exceptional success of the Cartonera in Chalco. Maybe it is also the refreshing contrast of a creative—even iconoclastic—approach to teaching in an otherwise traditional Catholic school where convergent responses had been the standard value, and where divergent varieties of possible responses tended to be unelicited and undervalued. For example, when on the first day

of the week-long training workshop we asked the ten teachers and ten artists to say what came to mind after hearing a reading of "Los dos reyes y los dos laberintos" by Jorge Luis Borges, all but one gave the moral of the story, convinced that the coherence was a sign of correct understanding. The only outlier, a young Oaxacan painter who took time to warm up to the group, asked, "What color is the sand," suggesting a path out of the intellectual grid-lock. By week's end, everyone was taking brilliant risks and multiplying the possibilities of the one-page story.

Later, throughout the ten-week implementation and up to the present they have been inspiring innovation in their students. [See the weekly photographic reports from Chalco on the culturalagents.org website.] Maybe success there also stems from everyday practices of recycling in a poor but resourceful neighborhood, making the Cartonera a natural and giving this scarcity-induced resourcefulness a new legiti-

macy as art and interpretation.

Garelli would typically address a challenge that required more resources than those available by doing things "a lo Chalco." Dark crepe paper, for instance, substituted for room-darkening window shades. Salaries for five artists, in addition to the five teachers paid for extra-hour collaborations, stretched the school's purse, so two mothers donated their skills in photography and music to complete the design of rotating multiple arts.

However one describes the combination of personal, economic and pedagogical factors, they came magically, or providentially, together in "Amiga Cartonera" at Mano Amiga. It is to date our most inspiring success and also our inspired instructor for new developments of the Cartonera.

Doris Sommer is Ira and Jewell Williams Professor of Romance Languages and Literatures, and African and African American Studies at Harvard University and Director of Cultural Agents (culturalagents.org).

Rx for Human (and Planetary) Health

Eric Chivian and Aaron Bernstein, editors; *Sustaining Life: How Human Health Depends on Biodiversity* (Oxford University Press, 2008)

A REVIEW BY JAMES HANKEN

"The entire world is a battlefield, and we must decide whether we are to be the soldiers that kill upon that field, or the leaders who sign a firm and lasting peace with the planet."

ÓSCAR ARIAS SÁNCHEZ
PRESIDENT OF THE REPUBLIC
OF COSTA RICA

"WE WILL NOT GIVE UP
ON LIFE ON EARTH"
LAUNCH OF PEACE WITH NATURE
INITIATIVE NATIONAL THEATER,
SAN JOSÉ, JULY 6, 2007

In September 2004, Hurricanes Jeanne and Ivan struck the Caribbean and southern United States in rapid succession. Damage to Haiti in the West Indies was particularly severe. High winds and intense rains caused widespread flooding and mudslides, which devastated urban population centers and rural villages alike. Jeanne alone killed at least 2,000 people and left an estimated additional 300,000 homeless. Scenes of stunned citizens walking chest deep in water that had inundated their homes were broadcast around the globe. Less than a month later, the Global Amphibian Assessment (GAA), a multi-year effort mounted by The World Conservation Union (IUCN) to evaluate the abundance and geographic range, population trends and risk of extinction of the world's approximately

6,000 species of amphibians, released its findings in a widely publicized article in *Science* magazine.

Among the GAA's shocking findings was that nearly half (48%) of the amphibian species native to the West Indies—all of them frogs—were threatened with extinction if they were not already extinct. The situation was most severe for Haiti, where nearly all (92%) of the native species known at that time were regarded as vulnerable, endangered, or critically endangered. Indeed, most of these species are expected to become extinct in the next 20 years in the absence of intense and costly actions to save them.

Unrelated events? Hardly, for the same primary cause that has left Haitian cities and villages susceptible to severe flooding and devastation during hurricanes and other tropical storms—deforestation of natural woodlands, especially in steep, mountainous areas—underlies the decline and eventual disappearance of much of the country's native biodiversity. Indeed, the primary reason invoked for the precipitous population decline of all 47 species of native Haitian amphibians threatened with extinction is human-mediated loss of their forest habitats. Meanwhile, a UN-sponsored assessment of the

damage wrought by Jeanne and Ivan concludes:

Haiti relies upon steep hillsides to meet much of its agricultural production. Erosion is a serious problem affecting the agricultural sector, with an annual soil loss of about 36 million tons. This has led to declining crop yields, damage to downstream lands and the destruction of coastal marine resources. Most hillsides are highly eroded and widely practiced cropping systems encourage continued erosion. Pre-existing factors such as deforestation...may combine with storm effects to increase future risks and vulnerability....

—"HURRICANES IVAN AND JEANNE IN HAITI, GRENADA AND THE DOMINICAN REPUBLIC: A RAPID ENVIRONMENTAL IMPACT ASSESSMENT," COMPILED BY THE JOINT UNEP/OCHA ENVIRONMENT UNIT BASED ON ASSESSMENT REPORTS FROM UN DISASTER ASSESSMENT AND COORDINATION (UNDAC) TEAM MEMBERS, OCTOBER 2004.

This example encapsulates the general and fundamental relationship between the Earth's biological diversity and human health and wellbeing that is explored in impressive fashion in the new book edited by Eric Chivian and Aaron Bernstein, *Sustaining Life: How Human Health Depends on Biodiversity*.

Chivian directs Harvard Medical School's Center for



Health and the Global Environment, which for many years has sought to promote greater awareness of the reciprocal and causal links between global biodiversity loss and threats to human health. Bernstein, also affiliated with the Center, is a resident pediatrician at Harvard Medical School and Boston University School of Medicine. Their contributions to the present volume, however, go well beyond simply editing; the two of them jointly authored or co-authored (with additional specialists) seven of the book's ten chapters.

The major topics covered can be broken down roughly as follows: what is biodiversity, how is it threatened by human activity, and what can individuals do to help conserve it (3 chapters); ecosystem services (1 chapter); the relation of biodiversity to medicine, human infectious diseases, and biomedical research (3 chapters); and biodiversity and food production (2 chapters). All of

these topics are *au courant*, and many, such as the promise and pitfalls of genetically modified (GM) foods, are controversial. Specialist (outside) chapter authors are well chosen. They, combined with 25 additional “contributing authors” (who wrote particular sections of individual chapters) and more than 60 chapter reviewers, all of whom are listed in front of the index, provide the book with the necessary backbone required for it to be considered an authoritative source on the topics covered. Additional intellectual and societal heft is conferred by the brief foreword and prologue by Harvard biologist Edward O. Wilson and

This is a scholarly work, but one that assumes very little specialized background knowledge on the part of the reader. It’s intended for the general reader and policy-makers, especially those who might find themselves in a position to remediate environmental problems. It also could effectively serve as a textbook for college-level courses that seek to address the consequences of global environmental change for biological diversity and human society. As a whole, the contents offer a comprehensive and novel approach to addressing the link between biodiversity and human health. I really can’t think of another

biodiversity is of global significance. Moreover, had the authors wanted to, they easily could have provided examples of each topic solely from Central and South America and their adjacent seas. Medicines derived from naturally occurring compounds? How about the antimalarial drug quinine, derived from the bark of cinchona trees native to the Amazon basin. (“Peruvian bark” to 19th Century Europeans desperate for a cure, it is still popular among contemporary herbalists and homeopaths.) Or epibatidine, a highly potent compound isolated from the skin of the Ecuadorian Poison Frog, *Epipedobates*

Ultimately, these outbreaks were traced to population explosions of one particular species of native mouse, the natural “reservoir” of the AHT virus, in response to altered land use.

But what about the future? As nicely explained in the closing chapter by McNeely and colleagues (“What individuals can do to help conserve biodiversity”), a helpful way to evaluate the environmental impact or cost of any human population is through estimates of its “ecological footprint”—the amount of biologically productive land it needs to obtain all the resources it consumes and to process its wastes. Not surprisingly, recent estimates are highest for North America and Western Europe and lowest for Africa and the Asia-Pacific region. Values for Latin America and the Caribbean are less than half that of North America, but still higher than can be sustained on a permanent basis given current population sizes. Moreover, as these countries’ economies expand, standards of living increase, and human populations grow, their footprints, too, will enlarge, further compounding present problems and future threats.

Thus, Latin America today finds itself at an important ecological crossroads. Extending current trends of consumption and waste ultimately will

This book is intended for the general reader and policy-makers, especially those who might find themselves in a position to remediate environmental problems.

former UN Secretary-General Kofi Annan, respectively. The publication quality is high, and I encountered very few factual or stylistic errors (one of them being, in the caption to Figure 1.3, an amusing but fanciful definition of DNA barcoding, a recently developed technique for identifying biological species from DNA sequence data). The presentation also contains many attractive and informative illustrations, including a large number in color.

treatment with this focus of equivalent breadth and depth. It’s also an interesting read.

Virtually all of the book’s topics and main themes are relevant to contemporary Latin America, and their consideration is very timely. For many kinds of organisms, the New World tropics hold more species than any other comparably sized region of the world, and most of these species are found nowhere else. Hence, the fate of Latin American

tricolor, which is contributing to the development of a whole new class of analgesics, or pain-killers. Destruction and fragmentation of natural habitats promoting the spread of human infectious disease? A catastrophic consequence of the large-scale conversion of much of the Argentine pampas into cornfields in the 1950s was recurrent outbreaks of Argentine hemorrhagic fever (AHF), a frequently fatal illness, in adjacent human settlements.

extract a tremendous cost in terms of environmental destruction and diminished quality of human life. You cannot fool Mother Nature. There are, however, more promising alternatives, which also present opportunities for Latin America to lead the way for both more industrialized and other developing regions. One was offered in 2007 by Costa Rica's president, Óscar

Arias Sánchez, in announcing his country's "Peace with Nature" initiative (*Paz Con La Naturaleza*), quoted at the beginning of this article. This bold plan, already being implemented, would make Costa Rica's economy "carbon neutral" by 2021; design and implement a national environmental action plan; significantly expand areas of natural forest cover and the

size of protected areas; and install an ambitious curriculum of sustainable development and environmental education in elementary and high schools. Poverty alleviation and economic development are not incompatible with protection of the environment and conservation of biodiversity. Ultimately, appeals on behalf of human health and wellbeing may be the most successful means of

accomplishing all these ends.

James Hanken is the Alexander Agassiz Professor of Zoology, curator in herpetology, and director of the Museum of Comparative Zoology at Harvard University, and a professor of biology in Harvard's Department of Organismic and Evolutionary Biology. He chairs the steering committee of the Encyclopedia of Life, an internet site that provides information about the biology of all living species.

A Profile in Courage

David Cox, *Dirty Secrets, Dirty War: The Exile of Editor Robert J. Cox* (Evening Post Publishing with Joggling Board Press, 2008)

A REVIEW BY GRACIELA MOCHKOFKY

It may be argued that *Dirty Secrets, Dirty War: The Exile of Editor Robert J. Cox* should have been written three decades ago, most likely in 1981, when Cox was enjoying, as I do now, a Nieman fellowship.

Cox was then in his second year of exile, the bitter prize he had been awarded for making the English-language newspaper *Buenos Aires Herald* into one of the main advocates against state terrorism in Argentina.

The military junta was still in power, backed by the Reagan administration, and Latin American politics were a matter of public concern for a broad U.S. audience. Bob Cox's book would have come out as a powerful indictment against the human rights violations taking place in Argentina at the time.

But he could not write this book then, neither can he today. "I have always believed in personal journalism, the reporter in a shabby raincoat that nobody notices who writes his stories without a byline,"

he explains in the prologue to *Dirty Secrets, Dirty War*. Modesty, he concedes, was only one reason; it was too painful a story for him to write.

Twenty-eight years later, the Argentine tragedy of a distant past awakens little interest in a country that is beginning to come to terms with its own government's human rights violations in the "war against terrorism." But it is now when Cox's son David, at last conquering his own arduous distance from the country in which he was born and raised, writes the book his father couldn't. Significantly, he does it the year in which his father, 75, retired from journalism.

Why is this story still important for both the United States and Latin America?

In 1959, at 26, seeking to escape a dull middle-class existence in his native England, Cox answered a classified advertisement for a newspaper job in Buenos Aires. The *Buenos Aires Herald*, founded by a Scotsman in 1876 as a shipping news single sheet, was,

83 years later, a small daily newspaper for the equally small English-language community in Argentina. Cox said good-bye to his homeland and boarded a ship that traversed the Atlantic toward a life of adventure and exoticism.

He got much more than that. After two years as a reporter at the *Herald*, he was promoted to news editor and soon afterwards he married Maud Daverio, an Anglo-Argentine whose prosperous family claimed an aristocratic British lineage.

Cox's Argentina was quite different from that of most Argentine journalists. Bob and Maud lived in a wealthy, Parisian-like neighborhood, owned a weekend villa in an exclusive country club, sent their five children to an elitist English school, and spent their vacations in Europe. Cox entered a fraction of the Argentine society which was, for most part, fiercely anti-Peronist (mostly for class reasons, Peronism being the party with which the working class identified) pro-military (several

members of Maud's family were officers), politically conservative and, in many cases—to Cox's shock—anti-Semitic.

In the late 1960s and early 1970s, when Argentina's working and middle classes radicalized, Cox opposed the guerrilla movements (plain "terrorism" in his nomenclature) and the political left. He received death threats from the Montoneros, the Peronist guerrilla, and was viewed "as a right-wing imperialist by the left," as he puts it in his introduction to David's book. When in 1976 a new military dictatorship overthrew a democratically elected government and took power with the stated purpose of crushing the "subversive elements" in the country, Cox, then editor of the *Herald*, almost applauded.

The *Herald* supported



the military junta and its first leader, General Jorge R. Videla, as did the majority of the press. Cox had good contacts in the Armed Forces and met often with high-ranking government officials. He supported the new economic plan and had a dear friend who was appointed finance director at the Ministry of Economy.

Almost everyone Cox knew and loved saw the dictatorship as a way out from one of Argentina's darkest periods. It would bring, at last, an end to Peronism and its evils; it would transform the economic structure of the country and put an end to the political violence stemming, as they saw it, from the "terrorism" of the left and internal Peronist feuds.

But Cox soon realized that something very different was taking place. At cocktail parties, in conversations with military sources, in calls from the *Herald's* readers, he started to hear about people being kidnapped and "disappeared." The first confirmation came from an English expatriate couple whose son had been abducted by a squad of policemen in the middle of the night and later found dead with signs of having been tortured.

Far-right factions within the government, he concluded, had adopted the methods of the left-wing "terrorists." It had become, he deplored, "another terrorism."

While praising the economic plan and other aspects of the military administration, the *Herald* ran front-page stories about disappearances. Those articles saved lives: several people "re-appeared." It was a courageous decision, and the *Herald* was mostly alone among Argentine publications. The government had issued strict censorship regula-

tions, and reporters and editors were among the detainees and disappeared. *Herald* news editor Andrew Graham Yool came up with the idea of having relatives of the disappeared secure *habeas corpus* writs so that reports of kidnappings would have an official source. Only one other Argentine newspaper, *La Opinión*, followed the *Herald* in publishing *habeas corpus* writs.

As a frequent stringer for U.S. newspapers such as *The Washington Post*, Cox wrote the first stories about the gatherings of the relatives of the disappeared in front of the Government House to clamor for the truth about their children's whereabouts. The Mothers of Plaza de Mayo and, later, the Grandmothers of Plaza de Mayo would become world-wide symbols of the fight against state terrorism.

The *Herald's* newsroom became a meeting point for the relatives of the victims—the only newsroom in which they were welcomed. A few other newspapers occasionally agreed to run lists with the names of the disappeared in the form of "solicitudes," paid ads. But Cox refused to take money from the relatives.

The *Herald* became the most reliable source of information about human rights violations in Argentina. The newspaper reached a circulation of 20,000 and gained international prestige. Argentines found in it what they couldn't find in their Spanish-language publications.

Most journalists in Argentina know Cox's record. What not everyone knows is the price he and his family paid. David Cox tells of his father's severe asthma seizures. With threats mounting against him and his family—Robert Cox was detained for 24 hours and

faced the prospect of his own disappearance—the children "alternated their route home from school to the apartment, sometimes taking the train and other times riding the bus." He also became isolated from friends and people he thought were friends. To many in his own social circle, he'd become a "subversive Communist:" in June 1979, Cox lamented, "People treat me, I imagine, in the same way they would treat a condemned man." He designed mental escape plans from his home and from the newsroom in case they came looking for him.

After three long years of the family's living in fear, his son Peter, an elementary school student, received a threatening letter. It contained personal information that only someone close to the family would know. The letter stated that the family had the "option" of seeking exile or they would be "assassinated." (Years later Cox would learn that the informer was a cousin of Maud's who served in the Navy.)

Cox asked General Videla for protection. When Videla argued he couldn't guarantee his own security, Cox decided to go into exile. Bit by bit, he realized that it was not just a fraction of the military involved in state terrorism, but the entire government. From the United States, he continued to be an outspoken critic of the human rights violations until in 1983 democracy was restored in Argentina.

It took years for the press, which had praised the dictatorship and omitted coverage of most of its crimes, to regain public credibility. But the *Herald* was never again such a fine newspaper. Last year, after a long financial struggle, the U.S.-owned Evening Post Publishing Co. sold it to an Argen-

tine entrepreneur of dubious reputation. Almost simultaneously, Cox retired as assistant editor for the *Charleston Post and Courier* of South Carolina.

Once or twice a year, Cox goes back to Buenos Aires, where he keeps an apartment. I met him there a few times, at afternoon tea parties he organizes to catch up with his Argentine friends and acquaintances. A strange crowd he gathers: Anglo-Argentines, high-society ladies, human-rights advocates, a few young journalists. I first attended a gathering while researching the life of Jacobo Timerman, a legendary Argentine newspaperman of his generation. Many journalists I interviewed at the time argued I needed to understand "the context" in which they had lived to justify their silence. Cox was the living refutation of that argument: he had been able to escape his context.

That rarity speaks to the importance of Cox's story. And today, when the ideal of journalistic truth risks becoming old-fashioned and another "war against terrorism" with government-sponsored torture and disappearances has again been waged, it is as important as it was three decades ago.

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Imagineering: Globalization in the Developing World

Andreas Huyssen, *Other Cities, Other Worlds. Urban Imaginaries in a Globalizing Age*, Durham and London: Duke University Press, 2008.

A REVIEW BY GEORGE YUDICE

Author of a marvelous book that excavates the palimpsests of memories encrypted in the image-filled voids of Berlin, Andreas Huyssen extends his investigation of the urban imaginary in this volume, which brings together twelve renowned authors' reflections on the impact of globalization on cities in Latin America, Africa, Asia and the Middle East.

These cities have "their own very specific modernity distinct from the modernity of the Western metropolis" (14), in most cases because of their colonial legacies. The existence of analogous legacies does not entail that urban experiences or imaginaries are similar, for their insertion into European and North American circuits are different—e.g., British, French, Portuguese or Spanish colonial rule—as are their processes of decolonization and national consolidation. Different too is their insertion into current global processes: while Buenos Aires, one of the wealthiest countries in 1900, continues a half century of decline, Shanghai is poised to become the newest center of global command and control.

As Akbar Abbas writes in his chapter on the Asian city, globalization now requires the "acculturation of the commodity," rather than the more common view that culture is commodified (259). He refers to the cultural and creative process, such as design and

information programmed into commodities. Similarly, cities are branded or imagineered as part of the strategy to compete in the global market of advanced services. Bilbao put culture at the center of its revitalization plan, and creative city boosters like Richard Florida tell us that culture is a major attractor of creative talent, which in an age of increasing valuation (and policing) of intellectual property rights, is the most important contributor to economic growth.

Architecture and other components of the built urban environment play a major role, evident in each succeeding European Capital of Culture that recruits renowned starchitects to brand them. One of the most recent schemes, the Universal Forum of Cultures (2004), invented by the Catalonians as a New World event congruent with the information and knowledge society of the global era, and which was a controversial gambit to regenerate Barcelona, is now circulating like the Olympics. Its second edition was held in Monterrey (2007) and its third was vied for by Alexandria, Amsterdam, Budapest, Chicago, Durban, Fukuoka, Gwangju, Santiago, Suwon, and Valparaíso, which was selected.

Okwui Enwezor analyzes a similar process of circulation of biennales and mega-exhibitions, which seem to multiply like mushrooms, and

which some critics celebrate as a "decentering of the West" (155). While he acknowledges that these circuits provide an opportunity for "artists hoping to leap outside under-funded contexts and into the resource-rich pastures of the global space" (157), thus reinforcing the artistic field, Enwezor rejects the view that postcolonial artists merely mimic Western forms. Instead, the postcolonial response springs from an "ethics of dissent" that enables historical transformation "and . . . is able to expose some of the Western epistemological limits and contradictions" (167). He further identifies this dissent with "postcolonial subjective claims (multiculturalism, liberation theology, resistance art, feminist and queer theory. . .) [that] deviate from the hegemonic concept of spectatorial totality and render it fragmentary" (172).

Enwezor associates this new spectatorship with De Certeau's notion of everyday users, who instrumentalize their agency in diasporic public spheres, where the translation of culture takes place. As such, the organization of biennales in the periphery does not constitute mimicry but points to "the possibility of a paradigm shift in which spectators are able to encounter many experimental cultures without wholly possessing them" (170). But Akbar Abbas' lucid observation that artistry is part of the



global cultural commodity gives a different spin to the new paradigm of spectatorship. He finds a parallel process of inclusion celebrated by Ziauddin Sardar to be overly optimistic—“Malay bodies clad in fake designer jeans . . . are included, fashion and fancy, and not excluded, marginalized onlookers. In the international politics of self and style they are fully empowered” (260). Moreover, Abbas argues that in the spatial logic specific to the information age, Castells space of flows, the circuitry of networking permits centralization and decentralization, such that command remains in cities like New York and London, while back offices are located in peripheries that form part of the network. These circuits can be grassroots, but it takes a long time for that to make a difference; hence uneven development in the global era.

Abbas' "Faking Globalization" is more than about the fake; it is about new spatialities in Asian cities. The above-mentioned uneven development of the global era is manifest in the X-urban or pairing of urban and suburban, which circumvents the ring of poor neighborhoods and factories that envelop the urban core. What is new in this spatiality is not the spectacular architecture that sprouts in the business centers of the suburbs, but the process of replication, which is not, according to Abbas, Westernization (249). The fake breathes a new life, so to speak, in this spatiality, which marks the threshold where it can transform . . . into what? Abbas observes astutely that makers of genuine articles make recourse to faking in their own production processes. Nevertheless, they clamor for intellectual property laws that are hypocritical. The best way, then, "to go beyond the fake is not through legislation, but to encourage the development of design culture" (263). But it is not clear what the value of transformed

Caldeira's São Paulo, García Canclini's Mexico, Judin's Johannesburg, Prakash's and Mehrotra's Mumbai, and Ghannam's Cairo are all characterized by an uneven development that will not easily flip into "unstoppability." In all of them, the same process of X-urbanization takes place, but the fragmentation prevails, as the state retreats, public space is privatized or terrorized by crime, informality in the form of street vendors, migrants and squatters leeches through the formal city, and even "nature find[s] its way through the crevices" (Judin, 122). One can discern a variation in the affect of each author. For Sarlo, the double whammy of Losangelization and Latinamericanization of Buenos Aires, once Queen of the Rio de la Plata, seems to elicit frustration, perhaps even a resigned outrage. Caldeira's disjunctive democracy, failed modernization, civil society lapsed into fear and an aesthetics of security spatialized in the X-urban walling off informality, is barely offset by the hope that the institutions built in better times will receive a shot in the

helped Mexicans learn how to be modern, Carlos Monsiváis has written. Now, however, the media, festivals and public events need to establish intercultural relations, particularly in this megalopolis of nearly 20 million in which neighborhoods are so distant from each other, and traffic so congested that residents' paths will never cross. But inequality remains a sticking point (95).

For Mehrotra, Mumbai is characterized by a pirate modernity in which a formal-static city and an informal-kinetic one are most often at cross-purposes. Architecture is the mode of spatialization of the first; motion and the space of the everyday, that of the second. Mehrotra discerns, however, instances of reconciliation that may enable the city to cope with its dualism. For example, arcades can maintain the illusion of architectural integrity while they provide a place for the hawkers of the kinetic city. The "disciplined Victorian arcade . . . could contain the amorphous bazaar within" (213). Likewise, festivals, which enable the articulation of subalterns' fantasies,

cooperative municipal governments gave a more formal shape to the negotiated solutions proposed by Mehrotra.

Other Cities, Other Worlds is filled with so many insights that could not be mentioned in such a short review. Aside from the essays themselves, what I most appreciate are the resonances, wherein one essay echoes or responds to another. Together, the chapters deal with a range of scales, images, actors, forces and affects. I conclude with two of the latter. Simone's resolute defense of the practices of everyday life whereby actors in Middle African cities continually reconvert commodities. It is the kinetic city writ large, in which the process of conversion resolves, as Cubans say, that for which there are no resources. Orhan Pamuk's eloquent anatomy of *hüzün* or collective spiritual loss that suffuses Istanbul, or as he writes, is "spread like a film over its people and its landscapes" (299). Pamuk distinguishes it from the more individual melancholy and nostalgia or the external observer's *tristesse*. Tellingly, it is an emotion absent in all the other contributions, even those that dwell on "everyday actors," perhaps because, as Simone remarks, there is an unpredictability to acts of "making do" that foreclose conviviality, an essential feature of *hüzün* that for Pamuk gives poetic license to a dignified resignation. That is a poignant observation on global imaginaries.

George Yúdice teaches Latin American Studies at the University of Miami. He is the author of *The Expediency of Culture: Uses of Culture in the Global Era* (Durham: Duke UP, 2003) and *Nuevas tecnologías, música y experiencia* (Barcelona: Gedisa, 2007).

This book examines how many cities in Latin America and elsewhere experience their own very specific modernity distinct from the modernity of the Western metropolis.

objects will be if there isn't a hypocritical intellectual property law that assigns it. Abbas writes, "Once [China] can design, it will be unstoppable" (263). Will it join the US and Europe in upholding intellectual property?

In this book, Asian cities are the only ones capable of joining Western metropolises as centers of command and control. Sarlo's Buenos Aires,

arm to assuage the inequality (75), probably the most acute in Latin America. García Canclini holds out a bit more hope in the partial democratization of Mexico City, and he also banks on a media policy that resonates with the majority and contributes to the construction of an intercultural public culture. In the heyday of modernization and the golden age of Mexican cinema, the movies

can be accommodated in formal architectural spaces. Solutions like these have been tried in cities like Bogotá and Medellín, which would have been excellent points of comparison, for they have been quite successful in diminishing fragmentation through architecture as well as accommodating the kinetic city through events. In both cases, plural and vibrant citizen movements and

READER FORUM

Dear June:

I'm writing to congratulate you on the fall issue of the *ReVista*. I finally had the time during this magnificent Christmas break to read it thoroughly and found many interesting thoughts on Venezuela past, present and future.

I feel the next couple of years will be a rollercoaster ride for our people, worth analyzing. Regarding *ReVista's* issue on Venezuela, I liked how you approach the effect these past years have made in "the people living in cardboard boxes." Coronil's Magical

LETTERS TO THE EDITOR ARE WELCOME IN ENGLISH, SPANISH OR PORTUGUESE!

Please send your comments, suggestions and complaints to:

June Carolyn Erlick
jerlick@fas.harvard.edu
or by mail to her at:
1730 Cambridge St.
Cambridge, MA 02138.

www.drclas.harvard.edu

State piece was especially insightful, as he explored how my country is ruled by stereotypes, product of an economic and social crisis fueled by government spending due to expanding oil revenues. As I once heard Ricardo Hausmann say, to understand Venezuela we seem to need more social psychiatrists than economists.

In a way it's a similar question expressed by Colette Capriles in the fall issue when she asks what is going on in a country that appears to be "drowning in a sea of oil and whisky"? As I've been working this last year in my country's oldest rum Company, it's has been easier to convince Germans and Italians than Venezuelans to buy Venezuelan premium rum. During this period, I've concluded trying to sell our own homemade rum products to my countrymen it's more a socio-cultural thing ingrained in deep beliefs, than a simple marketer dilemma. I put at your disposal our work in the Company Ron Santa Teresa. We have a social program aimed to reform delinquents, called Alcatraz Project. This initiative has been



a Harvard case for entrepreneurs wanting to do explore the road of Corporate Social Responsibility. You can find more of this initiative at http://www.proyectoalcatraz.org/home_eng.php.

In the different *ReVista* articles, one viewpoint tells us the country appears to be extremely complex and difficult to grasp. On the other hand, it's quite simple and most things are explained as an oil country with a "black gold rush," as I explained in a presentation together with DRCLAS director Merilee Grindle during my time at KSG.

I also enjoyed the piece on the Urban Think Thank as it showed and interesting

way of solving complex social problems through great design. I've seen the Metro Cable idea working in Caracas and though it's a creative way of adapting to the facts of reality, I emotionally struggle with this project as it seems to be the government's acceptance that shantytowns will be there forever. As you eloquently put it in the editor's letter, those cardboard boxes in the hill-sides are a symbol of a world without tomorrow. For me, real progress in building a better tomorrow for Venezuela has to address the fact those cardboard boxes are no way to develop a healthy, dignified and productive society.

LUIS PALACIOS,
VENEZUELA MASON FELLOW
2006 KENNEDY SCHOOL
OF GOVERNMENT

Dear June,
I've just begun to read through the Winter 2009 issue, *The Sixties*, of *ReVista Magazine*. June, this is extremely well done! The articles by returned Peace Corps volunteers who are now on the Harvard faculty are each different and so wonderful in their own

READER PICKS: YOUR FAVORITE FILMS!

Do you have a favorite film relating to Latin America, Latinos, Spain or Portugal? Or have you seen a movie that made a difference in the way you view Latin America, even if it has nothing to do with the area? (*Battle of Algiers*, *Bananas* and even *Slumdog Millionaire* might be examples). Did seeing a film make you travel to Latin America? Is there a movie that changed your life? The film can be from any period, old, new or in-between. Please include movie title, director, date and country of origin, and tell us why this film is your favorite or how it changed your life or point of view. Maximum length is 250 words; three

paragraphs is ideal, and should include one sentence about yourself. Most interesting answers will be published in the Fall 2009 issue on Film in Latin America, and runners-up will be featured in a special section on the website <http://www.drclas.harvard.edu/publications>. Please send submissions to June Carolyn Erlick, jerlick@fas.harvard.edu before June 1.



way; much the same as our Peace Corps experiences were for each of us. Your parallel tracks of the idealism associated with the US Peace Corps with that of the Cuban Revolution is a particularly creative weaving of the events of that time. The issue is so well organized that I look forward to reading it from cover to cover!

Of particular note is your terrific Editor's Letter and

how beautifully it recalls the emotions of the era. When I read of your friend's comment about the sixties being a time of "exploding paradigms", I choked up with emotion. So, so true! Muchas gracias, June for this truly amazing issue of *ReVista*!

LELAND D. COTT
 ADJUNCT PROFESSOR OF URBAN
 DESIGN HARVARD GRADUATE
 SCHOOL OF DESIGN

FE ERRATA *Errata Marysa Navarro's name was inadvertently misspelled in the ID in her article in the Winter issue. Her name does not have two s's!*

NEW WEBSITE FEATURE!

You can now leave comments at the bottom of each *ReVista* article online, allowing you to dialogue with the *ReVista* editor and individual authors. Use



this space to share ideas, ask questions, raise doubts, and express your reaction to each article in *ReVista*. Comments are visible publicly, creating a space to debate and consider the content in every issue. We invite you to join the conversation! See: <http://www.drclas.harvard.edu/revistaweb/1960s>

FREQUENTLY ASKED QUESTIONS ABOUT REVISTA

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I'M A PHOTOGRAPHER AND WOULD LIKE TO CONTRIBUTE TO REVISTA. WHAT SHOULD I DO?

Since *ReVista* is a thematic publication, we are often looking for very specific images. However, we also want to build our archives. Photographers are not paid, but are given complementary copies of *ReVista* for their portfolio, as well as publication of website and e-mail information. We prefer digital photos, 300 dpi. Queries to <jerlick@fas.harvard.edu>.

WHY DON'T YOU PUBLISH IN SPANISH AND PORTUGUESE?

We'd love to, but space and economic factors prevent this. However, we are publishing as much as possible in those languages on the *ReVista* website at <<http://drclas.harvard.edu/publications>>. You can also find longer and footnoted versions of some articles on the website.

I WOULD LIKE TO WRITE FOR REVISTA. WHAT'S THE PROCESS?

ReVista, the *Harvard Review of Latin America*, is published three times a year, and each issue focuses on a different theme. Upcoming themes include film, architecture, Bolivia and Guatemala. We welcome queries from students, professors (Harvard and non-Harvard) and community members, but most article assignments are made by invitation. Harvard faculty and students may submit suggestions for the "Making a Difference" section. Interested book reviewers (non-Harvard welcome!) are also welcome to express their interest. Queries to <jerlick@fas.harvard.edu>.

CAN I GET MY BOOK REVIEWED IN REVISTA?

Book reviews are one area that we give priority to Harvard authors, including professors, alumni, students, past and present Visiting Scholars and other affiliates. Please have your publisher send a copy of your book to June Carolyn Erlick, DRCLAS, 1730 Cambridge St., Cambridge, MA 02138.

THE SKY ABOVE, THE EARTH BELOW



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The Voyages of Charles Darwin

By Janet Browne

Darwin, Lizards and Evolution

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Conservation Finance in the Galápagos Islands

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In Dire Straits

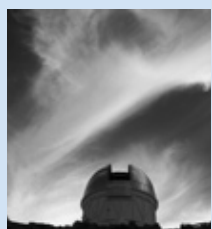
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MAKING A DIFFERENCE

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