Alexander von Humboldt: A Republican Scientist In the Tradition Of Franklin

by Timothy Rush

The most renowned scientist worldwide in the first half of the 19th Century, Humboldt is barely known today in the country of his greatest philosophical affinities, the United States.

Library of Congress

Benjamin Franklin (1706-1790)

The 200th anniversary of the celebrated travels of Alexander von Humboldt in the Americas (1799-1804) is a fitting time to re-examine the work of this titanic figure of 19th Century science. A naturalist, explorer, and philosopher, Humboldt, who lived from 1769 to 1859, was above all a nation-builder, one of a tiny handful of passionate republican intellects who kept the outlook of Benjamin Franklin alive across two generations of oligarchic reaction, to deliver it safely to the age of Lincoln.

A gateway for gaining acquaintance with such a varied life, is Humboldt's own summation of his work. *Cosmos: Sketch of a Physical Description of the World,* was the publishing sensation of mid-19th century Europe. It outsold all books but the Bible in its German editions, and was translated immediately into nine other languages. In *Cosmos,* Humboldt proclaimed the views of science and man which had animated him from his earliest years: in brief, that true wealth is to be found "in Man and the development of his power to discover and create."

Rejecting the racism of the British and other empires, Humboldt boldly proclaimed: "There are no inferior races. All are destined equally to attain freedom."

In his Preface to *Cosmos,* Humboldt says that the "principal impulse" which had "floated before my mind for almost half a century" was "the earnest endeavor to comprehend the phenomena of physical objects in their general connection, and to represent nature as one great whole, moved and animated by internal forces."[1] [See box, page 14.]

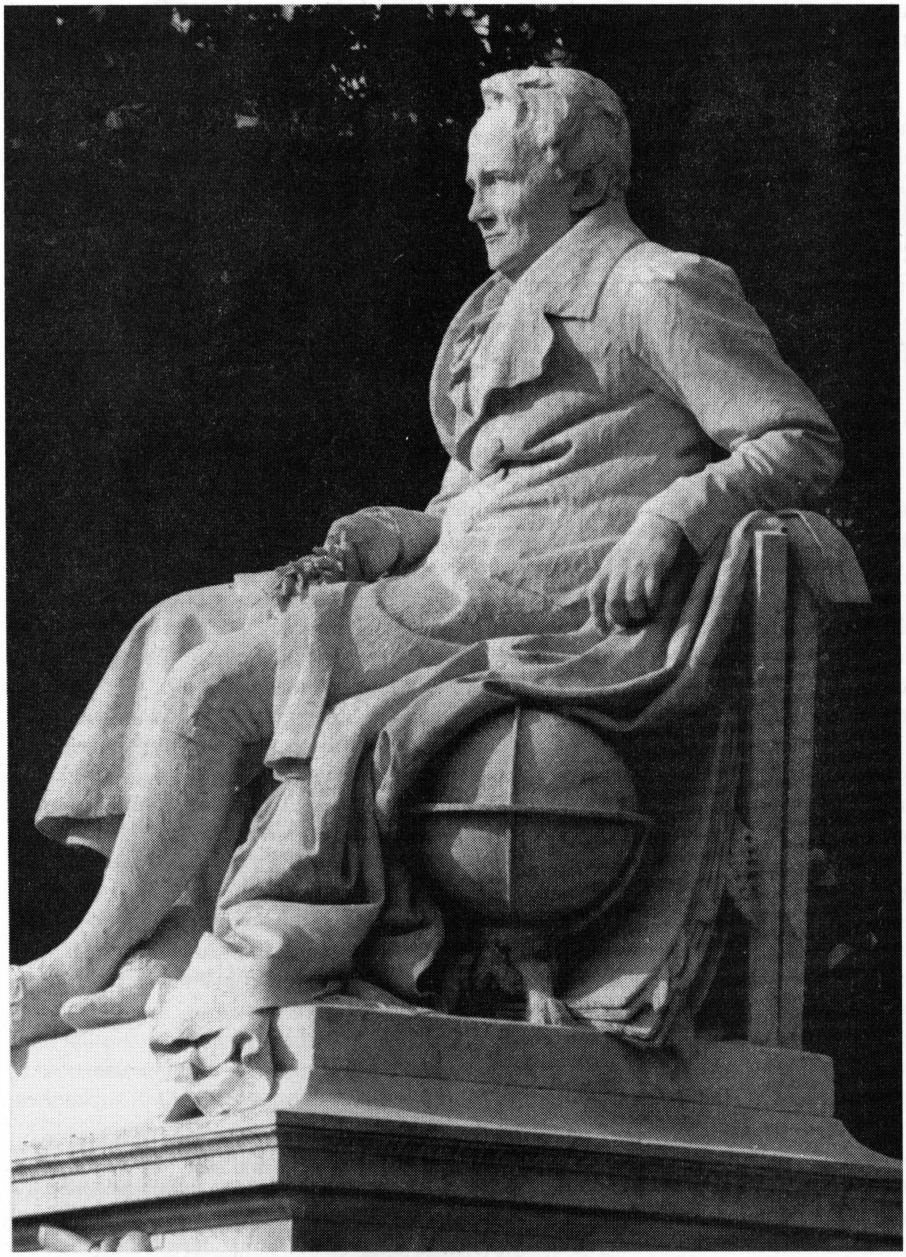
Humboldt's Republicanism

Although born into a family of newly created, minor nobility, and circulating in high social and administrative circles throughout his long life, Humboldt was a thorough republican who revered the principles of the American Revolution. At age 21, he passed through Paris just as the first year anniversary of the beginning of the French Revolution was being celebrated. In this hopeful moment before the Jacobin phase of the Revolution took over, when he thought that the principles of the American Revolution had reached across to Europe, he exclaimed to Georg Forster, his travelling companion,

> The time is already coming, in which people will prize the worth of a man, not because of rank due to birth or accident, nor because of his power or his wealth, but only on account of virtue and wisdom.[2]

Nine years later, while searching for an opportunity to leave the Old World and finding himself stymied by the onrushing Napoleonic Wars, he was no less vehement:

> I am so hampered in all my projects that I daily feel



Statue of Alexander von Humboldt, in front of Humboldt University in Berlin; photo by Chris Lewis/*Fusion*

Alexander Humboldt (1769-1859: "In claiming the unity of the human race, we resist the unsavory assumption of higher and lower races."

> inclined to wish I had lived either 40 years earlier or 40 years later. There is only one advantage to be gathered from the present state of things, and that is the extermination of the feudal system and of all the aristocratic privileges which have so long pressed upon the poorer and more intellectual classes of mankind.

These were not idle sentiments for Humboldt. Trained in his early 20s as a mining engineer at the famed Freiburg School of Mining, he was named mining overseer of a large district, and he immediately undertook to improve the conditions of the miners, whose life expectancy was only 30 years. Humboldt set about inventing a series of safety devices and other items of improved equipment, and in testing one of them, almost lost his own life. He recognized that the miners had no understanding of geology or other basics of an education, to more intelligently and safely carry out their work. In a stroke of dissimulative genius, he set up a special school for the miners, which he named the "Royal Free Mining School," even though it had no royal sanction or involvement whatever. Humboldt paid the expenses out of his own pocket. Attendance was voluntary, but the program was a success from the start, and featured aspects of geology and mineralogy, hydrology (the functioning of water tables and the like), local geography, and basic mathematics.

Humboldt wrote at the time:

> If it is a pleasure, to broaden the domain of our knowledge by making new discoveries, then it is by far a greater and more human joy, to discover something which is connected to the preservation of a laboring class of people, with the perfection of any important industry.[3]

One can easily understand Humboldt's excitement at finding an egalitarian commitment to bringing all strata of society forward into productive life, in one experience he records from his travels in New Spain (Mexico) in 1803:

> What a number of beautiful edifices are to be seen in Mexico [City]!. . . Instruction is communicated gratis at the Academy of Fine Arts. Large rooms, well lighted by Argand's lamps, contain some hundreds of young people every evening, of whom some draw from relief or living models. In this assemblage, (and this is very remarkable in the midst of a country where the prejudices of the nobility against the castes are so inveterate) rank, color and race is confounded: we see the Indian and the mestizo sitting beside the white, and the son of a poor artisan in emulation with the children of the great lords of the country. It is a consolation to observe, that under every zone the cultivation of science and art establishes a certain equality among men, and obliterates for a time, at least, all those petty passions of which the effects are so prejudicial to social happiness.

Humboldt, in fact, saw the full participation of *all* the population in upgraded productive activity, not only as desirable, but *necessary* to the successful state:

> Knowledge and inquiry . . . joy and preparation of mankind, these are part of national wealth, often a substitute for those goods which Nature, in all too scanty measure, has apportioned. Those nations, which are inferior in general industrial activity, in the use of mechanics and technical chemistry, in careful selection and transformation of natural resources, [and] in which the attention to such activity does not penetrate all classes, will inevitably see their well-being collapse.

Not surprisingly, Humboldt was a passionate opponent of slavery, and even though his travels in New Spain depended on an extraordinary safe conduct from the court of the Spanish king, his writings on Cuba and Mexico included searing

'Unity and Harmony': Humboldt's View of Nature

In his extensive Introduction to *Cosmos,* Humboldt emphasizes that

> Nature considered *rationally,* that is to say, submitted to the process of thought, is a unity in diversity of phenomena; a harmony, blending together all created things, however dissimilar in form and attributes; one great whole animated by the breath of life. The most important result of a rational inquiry into nature is, therefore, to establish the unity and harmony of this stupendous mass of force and matter. . . .[1]

A little phrase in the Summary of Contents which Humboldt himself drafted, is the kernel of his prodigious life labors:

> Necessity for a simultaneous regard for all branches of natural science. Influence of this study on national prosperity and the welfare of nations; its more earnest and characteristic aim is an inner one, *arising from exalted mental activity* [emphasis added].

Later in the text, this notion blossoms into this inspiring passage:

> I take pleasure in persuading myself that scientific subjects may be treated of in language at once dignified, grave, and animated, and that those who are restricted within the circumscribed limits of ordinary life, and have long remained strangers to an intimate communion with nature, may thus have opened to them one of the richest sources of enjoyment, by which the mind is invigorated by the acquisition of new ideas. Communion with nature awakens within us perceptive faculties that had long lain dormant; and *we thus comprehend at a single glance the influence exercised by physical discoveries on the enlargement of the sphere of intellect, and perceive how a judicious application of mechanics, chemistry, and other sciences may be made conducive to national prosperity* [emphasis added].[2]

And a little later, Humboldt writes:

> It is with nations as with nature, which, according to a happy expression of Goethe, "knows no pause in progress and development, and attaches her curse on all inaction." The propagation of an earnest and sound knowledge of science can therefore alone avert the dangers of which I have spoken. Man can not act upon nature, or appropriate her forces to his own use, without comprehending their full extent, and having an intimate acquaintance with the laws of the physical world. . . . The knowledge that results from the free action of thought is at once the delight and the indestructible prerogative of man; and in forming part of the wealth of mankind, it not unfrequently serves as a substitute for the natural riches, which are but sparingly scattered over the Earth.[3]

Note the affinity of this perspective with a crucial quality of conception embedded at the core of American System economics, as expressed by Alexander Hamilton, Lincoln, and LaRouche.[4]

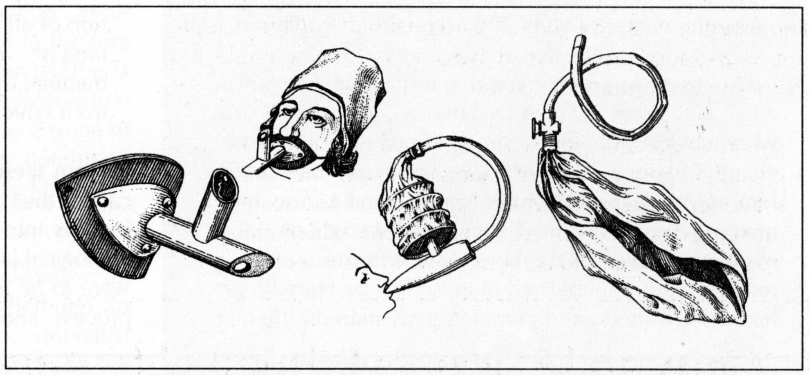
Notes

1. *Cosmos* I, p. 24.
2. *Cosmos* I, p. 52.
3. *Cosmos* I, p. 53.
4. On this requirement of the republican nation state, see Lyndon H. LaRouche, Jr., "The Issue of Mind-Set," *Executive Intelligence Review,* Vol. 27, No. 9 (March 3, 2000), pp. 12-44. LaRouche states (page 33), "For the purpose of the science of physical economy. . . the roles of the two kinds of universal principles are distinguished as follows.

   "First, the validation of discoveries of new universal physical principles, leads to the unique experiments needed to prove those discovered principles. By necessity, those experimental designs, if successful, include features which express the distinct principle of the inquiry. Thus, each such application of a new principle, as in different media, and in different combinations of principles, defines what are to be regarded as new *technologies,* technologies expressed in both the design of products, and of productive and related processes. It is by these and related means, that the measurable power of the individual over nature is increased.

   "Second, the discovery of such principles and of related technologies, is not sufficient. Although discovery of universal principles occurs, in each instance, within the sovereign powers of cognition of the individual discoverer, the process of transmission of such knowledge, and of its application, *expresses a social process.* Without cooperation among relevant members of society, the propagation and realization of these discoveries and technologies can not occur in such a manner and degree, as to have a notable sort of beneficial effect upon the demographic characteristics of society. Indeed, without such cooperation, such propagation might not occur at all. . . ."

denunciations of slavery, which he never attempted to tone down. In his very last years, he even struck a blow for the establishment of the Republican Party in the 1856 U.S. presidential elections, by writing a condemnation of a bowdlerized edition of his *Political Essay on the Kingdom of New Spain,* which had just appeared in a new U.S. edition (printed in New York), stripped of his denunciations of slavery. An outraged Humboldt wrote that the omitted part had greater importance than all the geography and statistical data put together. He put this condemnation directly in the hands of Gen. John C. Fremont's Republican campaign organization for its use in the campaign. In that same year, Humboldt succeeded in getting a law passed in Prussia that granted freedom to any black slave upon crossing onto Prussian soil. This paralleled his lifelong efforts for full emancipation of Jews in Prussia.



As a young mining official, Humboldt invented this breathing apparatus and other safety devices, out of concern for the terrible conditions under which miners worked.

Humboldt loved to promote far-reaching infrastructure development. Chapter 2 of his *Political Essay on the Kingdom of New Spain,* outlines no less than nine possible sites for an Atlantic-Pacific canal. (One of them became the Panama Canal 100 years later.) Chapter 8 includes a fascinating hydraulic history of Mexico City, with detailed proposals for dealing with the problem of drainage of its site, a valley lacking an outlet. A memorable anecdote from 1844, when Humboldt was a captive of Prussian court politics as King Friedrich Wilhelm IV's chamberlain, recounts Humboldt calling the King's attention to drawings of the then just-completed New York City aqueduct. When the King showed interest, Humboldt reportedly plied him for a week with classic examples of aqueducts throughout history, to stimulate his interest in similar public improvements for Prussia. Throughout the 1840s and 1850s, Humboldt was a patron of great railroad-building projects on both sides of the Atlantic; in fact, he took an interest in all new technological frontiers—from steelmaking to the daguerrotype—all his life.

Transmitting the Legacy of Franklin

The true significance of Humboldt's work can only be seen on a canvas stretching from his formative years in the period of the American and French revolutions, to the Lincoln-era revival of the American System, three quarters of a century later. Humboldt was among the small number of rigorous and courageous intellects who made possible the survival of the American Republic and its mission in the world, over the intervening years of retreat in both Europe and the United States.

In scientific methodology and use of the most advanced measuring instruments of his time, he was a protégé of the circles of both Benjamin Franklin and the Ecole Polytechnique; in broader philosophic matters, his thought was influenced by intense collaboration first with the family and circle of Moses Mendelssohn (see box, page 16), and then with the greatest of the German Classical thinkers, Schiller and Goethe.

Gottlob Christian Kunth, one of the first tutors of Alexander and his older brother, Wilhelm, introduced the Humboldt brothers to the centers of Berlin intellectual life in 1783: the household of Moses Mendelssohn, and the salon run by noted Jewish physician Marcus Herz and his daughter, Henriette. It was in the Herz home, that young Alexander was introduced to the work of Benjamin Franklin, and he replicated several key experiments of Franklin and of Volta. Alexander promptly arranged for a lightning rod to be installed on the Humboldt family home at Tegel, about 10 miles north of Berlin. It was Prussia's second lightning rod, after the one at the University of Göttingen.

Through the Mendelssohn-Herz circle, Humboldt became a defender of Leibniz's scientific and philosophical method (against the "Enlightenment" promotion of the anti-Leibniz Voltaire and Newton), which was the hallmark of the heroic collaboration of Mendelssohn and Lessing in the 1750-1780 period.

During a semester at Göttingen in the spring of 1789, Humboldt studied mathematics with Abraham Kästner, the man who transmitted the Leibnizian outlook to Carl Friedrich Gauss, and who had brought Franklin to Göttingen for a visit during the American Revolution. Humboldt's professor of classical philology and archaeology, Christian Gottlieb Heyne, introduced him to Georg Forster, who 15 years earlier, had travelled the South Seas with Captain James Cook, and was a passionate supporter of the American Revolution. Forster took Humboldt with him as his travelling companion to the Low Countries, England, and France, and sowed the seeds of Humboldt's lifelong passion for exploration.

Humboldt's year of study at the Mining School of Freiberg, and his subsequent employment as mining inspector, brought him into contact with two of the most important pioneers of German industrialization: Abraham Gottlob Werner, head of the school, founder of the study of layering in geology ("geognosy"), and expert in the theory and construction of iron foundries; and Friedrich Wilhelm von Reden, later Minister of Mines in Silesia, who in 1790 had imported Germany's first steam engine from Franklin's circles in England. During three weeks when Humboldt was Reden's houseguest in Breslau, Reden outlined detailed plans to Humboldt, for harnessing the steam engine to ironworks, based on using pitcoal rather than charcoal as the raw material.[4]

A third crucial acquaintance of Humboldt in these circles was Johann Sebastian Claiss, the greatest expert in saltworks of

the time. In a letter of early 1792, Humboldt wrote of Claiss:

> He possesses great physical and mathematical knowledge, was seven years in England, worked a great deal with Franklin, was a long time in France. . . and is in charge of all the Bavarian saltworks. I have been asking him questions from morning to night, and I know of no man in whose company I have learned so much. I took many new materials on these matters from Claiss, received also unpublished manuscripts by Franklin on heat contrivances, and completed my map on the relation of all the sources of salt in Germany. The principal idea is . . . that all saltworks in Germany lie in a certain manner, that can be shown through lines on a map, and from which one can find mile after mile of salt sources.

From these kinds of "thinking observations," as Humboldt called them, he was later to develop one of his greatest insights into "unity in diversity": the recognition that similar geological layering characteristics, *wherever in the world they were to be found,* all had to come from a common formative process and share common characteristics. He thus con-

Humboldt and the Mendelssohn Family

All their lives, both Humboldt brothers enjoyed a singular and intense relationship with the family of Moses Mendelssohn (1729-1786) and related Jewish intellectual circles. The importance of Mendelssohn, and his collaboration with Gotthold Ephraim Lessing, has been told in a special issue of *Fidelio* magazine, Summer 1999 (published by the Schiller Institute). Their collaboration was the keystone in igniting the German Classical period, and pivoted on defending and reviving the work of Gottfried Wilhelm Leibniz and Johann Sebastian Bach, against the machinations of Voltaire and other fanatic Newtonians.

The first contact between the Mendelssohns and the Humboldts was in 1783, when Alexander and Wilhelm's mathematics tutor, E.G. Fischer, taught mathematics jointly to the Humboldt brothers and two sons of Moses Mendelssohn. Moses himself, then at the end of his life, became a mentor to Wilhelm. Alexander became close to two of the sons especially, Joseph (1770-1848) and Nathan (1782-1852), and kept them as lifelong friends.

The Mendelssohn family acted as a kind of financial safety net for Alexander throughout his life, as his devotion to his travels and the publications of his works eroded and then used up his own inheritance. For instance, in 1799, when Alexander was in Spain having finally won permission for his trip to South America, his normal bank arrangements broke down. Only a last-minute bank draft from the Mendelssohn family bank enabled his departure. Similarly in 1819, it was the Mendelssohn and Fraenkel bank which stepped in to arrange a credit line in Paris for Alexander to purchase the instruments and books that he needed. At one point after his return to Berlin in 1827, Alexander faced being thrown out of his apartment on the Oranienburger Strasse, when the owner planned to sell the building. The Mendelssohn family secretly bought the building, and made an arrangement for Humboldt to live for the rest of his life in the apartment with no raises in the rent.

But Humboldt found in the Mendelssohn family much more than financial assistance. There was a remarkable ongoing scientific and intellectual collaboration. In 1805, on his first trip back to Berlin since returning from the Americas, he worked with Nathan Mendelssohn on some innovative physical instruments of Nathan's own design. Humboldt demonstrated these intruments at the Berlin Academy of Science.

In 1828, Felix Mendelssohn, grandson of Moses and son of Abraham Mendelssohn, was commissioned to write a special cantata to celebrate the great international scientific conference organized by Humbolt that year. The resultant work, known subsequently as the "Humboldt Cantata," was written for men's voices and an orchestra of basses and cellos, trumpets, horns, and clarinets, to a text by Ludwig Rellstab which celebrated the triumph of the harmony of mind, over the chaos of the elements. One of England's most reknowned "Leibnizians" at the conference, Charles Babbage, wrote that after a walk with Humboldt, "discussing the singularities of several of our learned acquaintances," the two kept their respective engagements, and "met again at the most recherché of all, a concert at Mendelssohn's."

Humboldt's own magnetic researches, reinvigorated by contact with Gauss at the scientific conference, were conducted in special facilities constructed on the property of Abraham Mendelssohn. The following description by Kellner (pp. 119-120) provides a striking portrait of this extraordinary moment:

> . . .a specially-constructed, non-magnetic hut in which all metal parts were made of copper, was set up in the garden of the house of Abraham Mendessohn-Bartholdy... Humboldt's hut was in a corner of the garden, not far from the summer-house where Felix ... and his older sister [Fanny] made music in the evenings and practiced for the great musical event of the spring of 1829, the performance of the newly discovered St. Matthew's Passion [of J.S. Bach], a hundred years after it had first been performed.

In his declining years, after the death of his brother Wilhelm in 1835, the Mendelssohn family—particularly Joseph and his wife—became Alexander's own family, as he spent his birthdays and other special occasions with them.

It is no wonder that Alexander was out of favor in Germany during the Nazi years, accused of "philo-Judaism."

tributed the name and concept of "the Jurassic period" to all subsequent dating schema in geology, after a visit to the Jura mountains. Similarly, during a whirlwind expedition to Siberia in 1829, he made a seemingly preposterous prediction that diamonds would be found in a district on the eastern slope of the Ural mountains—only to have his prediction confirmed even before his return to St. Petersburg five months later.

Science against Empiricism

By 1794, Alexander's older brother, Wilhelm, had taken up residence with his new bride, Caroline von Dacheröden, in Weimar, at the invitation of the "Poet of Freedom," dramatist and historian Friedrich Schiller (1759-1805). It was to be the defining period of Wilhelm's life; the intense collaboration with Schiller and Schiller's circle of friends, bore fruit later in Wilhelm's humanist educational reforms as Prussian minister of education (1809-1810), his founding of the University of Berlin, and his profound works in the theory of language.

But his younger brother, Alexander, was no stranger to the Weimar circle. He often visited, establishing especially close relations with poet and natural scientist Johann Wolfgang von Goethe, whose work on underlying form and structure in plants and animals, resonated strongly with Alexander's "Oneness Out of Manyness" methodology.[5]

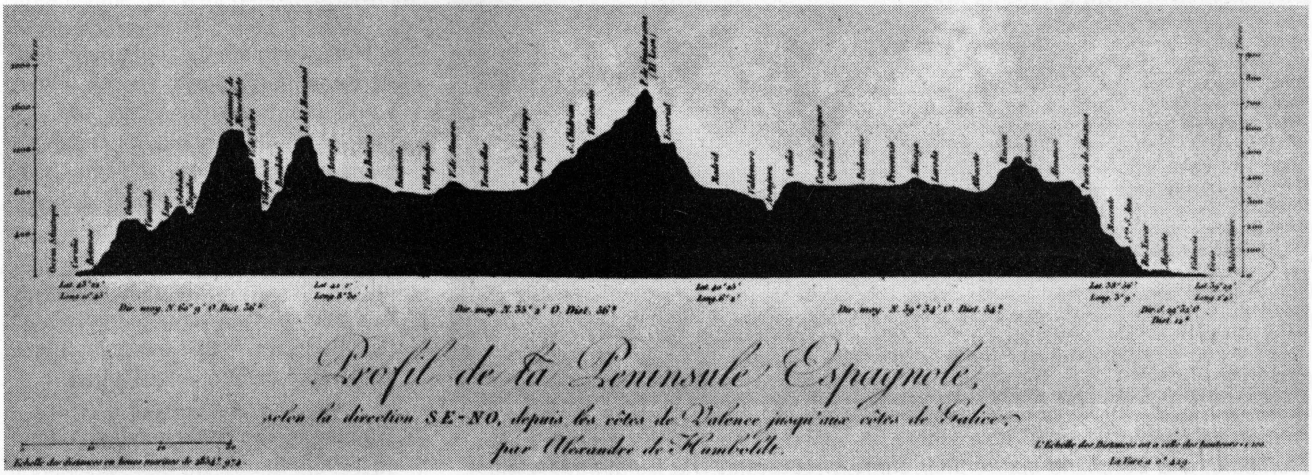
Much is made in shallow biographies of Humboldt, of a disparaging remark Schiller made of Humboldt in a letter to Schiller's intimate, Christian Gottfried Körner, in 1797. "His mind is that cold, dissecting kind that wants all nature to be shamelessly measured," Schiller wrote, ". . .when Nature must be seen and felt in its single manifestations and highest laws. With unbelievable impertinence he uses his scientific formulae, which are nothing but empty words and narrow concepts, as a universal standard."

Körner's response was a fitting rebuke to Schiller's misappraisal.

> His [Humboldt's] striving to measure and anatomically dissect [*anatomieren*] everything, rests on sharp obser-

Archiv für Kunst und Geschichte, Berlin

The Humboldt brothers were among Schiller's circle of friends at Jena. Here, an illustration of Schiller (right) entertaining in his garden. Alexander Humboldt (at balcony) with Goethe (back row, left) and his brother Wilhelm (back row, third from left).



From *Atlas géographique et physique du Nouveau Continent*, by Humboldt and Bonpland

Humboldt measured and recorded the altitude of the Spanish Peninsula, during his six-week walk to Madrid, across the Pyrenees. He was the first to note that the interior of Spain is a plateau. This "cross-sectional" method of showing broad swaths of topological features was a Humboldt innovation.

vation, and without this, there are no useful materials for the investigator of Nature.... Meanwhile, he indeed seeks to order scattered materials, into a Whole, pays attention to the hypotheses which expand his view, and gives rise thus to new questions regarding Nature.

Wilhelm's appropriate observation regarding his brother, was that "Alexander really attempts to embrace all in order to explore one thing, which can be done only by approaching it from all sides. He maintains a horror of the single fact."

Humboldt was then, and for the rest of his life, locked in combat with exactly the empiricist ("just the facts, ma'am") school of Bacon, Hobbes, and Hume; just as he would become locked in combat with the other extreme, the German Romantic "philosophers of nature," who rejected quantification and strict measurement, and extolled feelings and intuition as the source of true knowledge of the natural world. This latter school, exemplified in the work of F.W. Schelling (1775-1854), became known for such statements as "Forests are the hair of the animal earth"—not too different from the Gaia thesis today.

If Schiller disparaged Humboldt on this occasion (although Humboldt was also the only scientist invited to contribute an essay to Schiller's philosophical journal, *Die Horen*), there can be no doubt of Humboldt's keen absorption and appreciation of Schiller's outlook and genius. In the introduction to *Cosmos,* Humboldt describes the origins of what he calls a "philosophy of nature," in terms which uncannily echo Schiller's *Letters on the Aesthetic Education of Man:*

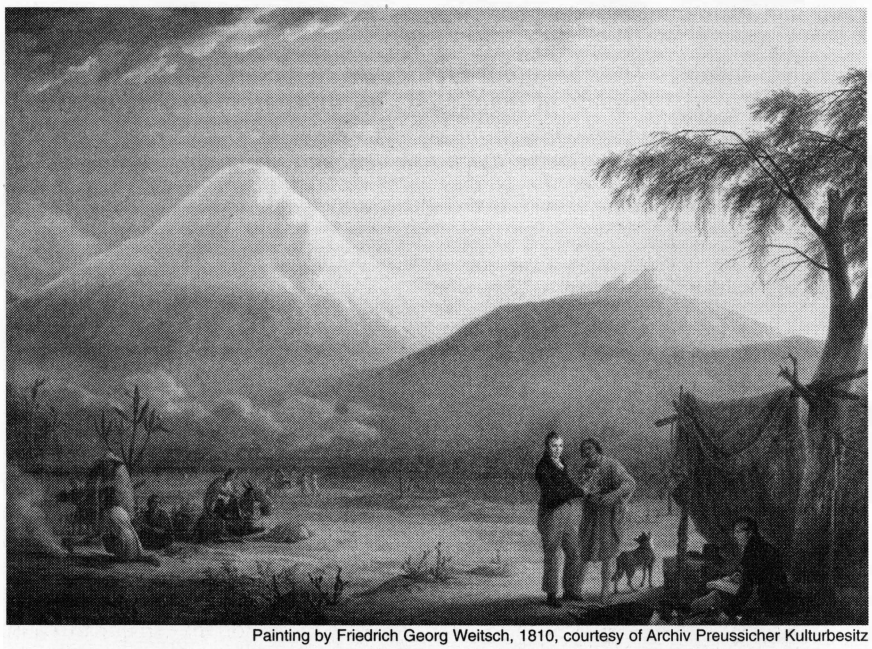
Reproduced from Douglas Botting, *Humboldt and the Cosmos* (London: Sphere Books Ltd., 1973), p. 60

Aimé Bonpland in an illustration by Pellegrini at the National Museum of Natural History in Paris.

> An intimate communion with nature, and the vivid and deep emotions thus awakened, are likewise the source from which have sprung the first impulses toward the worship and deification of the destroying and preserving forces of the universe. But by degrees, as man, after having passed through the different gradations of intellectual development, arrives at the free enjoyment of the regulating power of reflection, and learns by gradual progress, as it were, to separate the world of ideas from that of sensations, he no longer rests satisfied merely with a vague presentiment of the harmonious unity of natural forces; thought begins to fulfill its noble mission; and observation, aided by reason, endeavors to trace phenomena to the causes from which they spring.

Humboldt dedicated one of his volumes of botanical researches in the Americas, to Goethe; and he dedicated his book on Columbus and the Rediscovery of America, to Schiller. It was with a line from a poem by Schiller, "Der Spaziergang" (The Walk) of 1795, that Humboldt summarized a crucial point in *Cosmos:*

> Here we touch upon the point, where, in contact with the sensuous world, the stimuli to pleasure are joined to a different kind of enjoyment, an enjoyment which springs forth from Ideas. That which in the strife of the elements, is not perceived as ruled by order and lawfulness, becomes subject to reason. And man, as the immortal poet [Schiller] says, "seeks the immobile Pole in the flight of appearances."[6]



Painting by Friedrich Georg Weitsch, 1810, courtesy of Archiv Preussicher Kulturbesitz

Humboldt and Bonpland before their climb of Ecuador's Mt. Chimborazo, 20,577 feet, at the time thought to be the world's highest mountain. Even though they came 700 feet short of the summit (they measured their altitude with sophisticated barometric readings), it remained the world record in mountain climbing for 30 years and earned Humboldt enduring popular acclaim worldwide.

Training by the Ecole Polytechnique

In 1796, Humboldt's mother died (his father had died years before, when he was 10), and he was left with a substantial inheritance. Though his career in mining administration offered presti-

gious prospects, he resigned all his posts and dedicated himself to preparations for world travel—wherever an opportunity should open up for the ambitious scientific bent he had had since childhood. Throughout 1797, he trained with the best botanists and geologists of Central Europe; in 1798, his road led to Paris where his brother, Wilhelm, had been dispatched as Prussian envoy. In Paris, Alexander gave lectures on his own considerable researches and writings,[7] met the leading figures of French science (those who had not embarked for Egypt with Napoleon that year), and even joined the French geodetic survey team working on the triangulation measurements of the Dunkirk-Barcelona meridian line (passing through Paris), which later served as the basis for establishing the length of the meter (one 40-millionth of the Paris meridian).

It was during the summer of 1798, that Humboldt received an invitation that seemed sent from heaven: One of his childhood heroes, Louis Antoine de Bougainville, celebrated for his circumnavigation of the globe a generation earlier, had received a mandate from the Directory that then ruled France, to organize a five-year scientific exploratory mission, which would make extensive stops in South America, the South Pacific, Southeast Asia, the east coast of Africa, and even Antarctica. Bougainville asked Humboldt to join it. Because departure was imminent, the ecstatic Humboldt plunged into a whirlwind of training in the use of the most advanced instruments that the scientists of the Ecole Polytechnique had available, some of which—telescopes and magnetometers—featured new designs and capabilities.

But the project was postponed at the last minute, as a result of French preparations for war with Austria. Humboldt was left high and dry. He had met a capable young botanist, however, Aimé Bonpland, and the two of them set out to explore ways to get into the Near East through southern France. When that looked too dangerous, they set off on foot to Spain.

University of Pennsylvania Library

Fausto Elhuyar was one of an extraordinary cadre of scientists and mining engineers recruited by the pro-American faction in the Spanish Court, and sent to Spanish America to unleash a Franklin-style scientific and economic revolution. Another in this circle, Manuel del Río, was Humboldt's classmate at the Freiberg Mining School, and hosted Humboldt in Mexico in 1803.

Drawing of Don José Celestino Mutis by Fernandez, at the Cadiz Museo Iconografico; reproduced from Douglas Botting, *Humboldt and the Cosmos* (London: Sphere Books Ltd., 1973), p. 147

José Celestino Mutis, the "Linnaeus of South America," was Humboldt's host in Nueva Granada (today, Colombia). A master botanist and astronomer, he was the most eminent of the scientific cadre dispatched by Charles III to the New World.

Breakthrough in Spain

The way in which Humboldt suddenly found the patronage, in the court of Spanish King Charles IV, to undertake his mammoth five years of travel through what is today Venezuela, Colombia, Ecuador, Peru, Mexico, and Cuba, is glossed over in virtually every biography as just a lucky break. As the story goes, the envoy of Saxony to the court of Aranjuez managed to get a good word in for Humboldt with the Foreign Minister, Mariano Luís de Urquijo, who in turn bent the ear of the King, and that was that.

In fact, Humboldt's arrival had been seized upon as providential by a group of Spanish notables who had been collaborating with Franklin and his allies for the previous 30 years, and had sponsored an enormous *scientific mobilization of the best minds in Spain and the colonies* throughout that time. They were on the defensive at the time of Humboldt's arrival; his mission would revive, and focus all their previous efforts.[8]

Spain had begun economic renewal when the French Bourbons became Spain's ruling house at the beginning of the 18th Century. By mid-century, the work of Jean Baptiste Colbert, the great exponent of industry and national development under France's Louis XIV, had been fully translated into Spanish, and a school of National Economy was forming. Charles III, who reigned 1759-1788, was the greatest of the Bourbon kings. He tilted Spain toward the American cause in the American Revolution, and sponsored a Commonwealth policy toward the Spanish American colonies, which was designed to break the grip of feudalist interests within Spain, by mobilizing a scientific and economic breakout in the colonies.

His leading ministers included:

- The Count of Aranda, sent by Charles as Spanish ambassador to France during the years of the American Revolution. Aranda met Franklin, sealed Franco-Spanish cooperation for the American cause, and even sent arms to the colonists' side;
- Pedro Rodríguez de Campomanes, who became a correspondent of Franklin's American Philosophical Society at the end of Charles's reign;
- José de Gálvez, Charles's Minister for the Indies who abolished the *repartimiento,* a form of de facto slavery for the Indians, in 1776, year of the American Declaration of Independence. Gálvez's nephew, Bernardo de Gálvez, took up arms for the American cause; Galveston, Texas, is named for him.

The Great Expeditions

Charles and his ministers sent wave after wave of scientists and expeditions into the Spanish colonies.

Humboldt's Travels in South and Central America

Humboldt and his botanist co-adventurer, Aimé Bonpland, left Spain from the port of Coruña on June 5, 1799, dodging British warships blockading the coast. They returned to Europe via the French port of Bordeaux just over 5 years later, August 3, 1804. Whatever itinerary they had in mind at the start, it soon vanished in the labyrinth of accident and happenstance which dominated their actual route of travel. Alongside their multi-faceted scientific accomplishments, it was their cheerful handling of dramatic hazards, discomforts, and setbacks (they were reported dead on repeated occasions in various U.S and European newspapers), that made their travels such a sensation to the European and North American public at the time.

June 1799 to December 1800: Venezuela

After a stopover in the Canary Islands, Humboldt's ship headed to Cuba. But typhoid broke out on board as the ship neared the South American coast, and a panicked captain put in at Cumaná, Venezuela. From this abrupt change of plans, Humboldt and Bonpland seized the opportunity, over the next 16 months, of travelling across 1,500 miles of interior Venezuela, and collecting close to 5,000 plant specimens, 3,000 of them unknown to European botany. Among the phenomena Humboldt studied closely was the use of natural rubber and the physiology of the electric eel. He brought the poison, curare, back to Europe for the first time.

Their travels, after crossing the vast llanos (savannahs) of interior Venezuela, carried them to the spectacular hydrographic anomaly of the Casiquiare, a natural canal joining the Orinoco River of Venezuela with the Rio Negro of the Amazon basin. Here Humboldt observed petroglyphs high on a bluff overlooking the Rio Negro, which first prompted his fascination with pre-Columbian civilization and his conviction that, far from originally being primitive peoples, the tribes of the New World represented degenerated higher societies that had had maritime trans-oceanic contac .

Humboldt made careful observations of astronomical singularities, (including a solar eclipse of October and a meteor shower of November 1799, one of the greatest on record), along with precise observations of an earthquake, and extended notations on what he called "atmospheric tides": a rise and fall in temperature and barometric readings in four oscillations every day at exactly the same times, at complete variance with normal daytime heating. ("The mercury falls from 9 o'clock in the morning until 4 o'clock in the afternoon. Then it rises until 11 o'clock, falls again until 4:30, rises until 9 o'clock.")

December 1800 to March 1801: Cuba

After a perilous 25-day voyage, Humboldt and Bonpland disembarked in Havana, Cuba, the "pearl of the Spanish Antilles." It was also the slave-trade capital of the region, run largely by the British, and Humboldt collected statistics which constituted one of the most devastating indictments of slavery ever assembled. "It would be easy to prove," Humboldt later wrote, "that the whole of the West Indies, which now comprises scarcely 2,400,000 Negroes and mulattoes (free and slaves), received from 1670 to 1825 nearly 5,000,000 Africans. These revolting calculations regarding the consumption of the human race do not include the number of unfortunate slaves who perished on the passage or were thrown into the sea as damaged merchandise." Humboldt excoriated the Adam Smith British school by name, for portraying this "greatest of all evils", as a "universal benefit."

Humboldt planned next to head up to the U.S. Great Lakes, descend and map the Mississippi, cross over Mexico, and head out to the Philippines. But just at that moment a newspaper account reached him, saying that the French expedition which had almost sailed with Humboldt aboard from France two years previously, had been reconstituted under a Captain Baudin, and was under sail for South America and the South Seas. Humboldt resolved to meet up with it in Lima, Peru. So he headed back to the South American mainland.

March 1801 to March 1803: The Andes

Upon arriving in Cartagena, Colombia, the two travellers embarked on what eventually stretched out to two years of travel along the "Spine of South America," the great corridors of volcanoes called the Andes. Here flourished Humboldt's insights and researches into plant geography, volcanic phenomena of all sorts (he broke definitively with the "Neptunist" school of geology, which argued that all rock formation was fundamentally sedimentary), and the multi-faceted history, archaeology, and ethnography, of the Indian civilizations. He also mastered high-altitude mountain climbing and set a world climbing record on the slopes of Chimborazo, in Ecuador, not surpassed anywhere in the world for 30 years.

It was in Quito, in June of 1802, that word reached Humboldt that the effort to catch up with Baudin's expedition was in vain; Baudin had turned east in the South Atlantic, to circumnavigate the globe by way of Africa, rather than west, via the Pacific coast of South America.

After their mountain-climbing exploits, the travellers continued south, crossing over the Andes Cordillera into the headwaters of the Amazon for a short time; and then re-crossing at Cajamarca, where Humboldt watched the needle of his compass turn from North to South: It was the first ever determination of an exact value (in the dip of the needle) for the "magnetic equator," and it would serve as a world gauge for magnetic measurement for 35 years.

Soon after, in the mountains above Trujillo, Peru, the travellers caught their first glimpse of the Pacific. Two dreary months in Lima were largely spent packing and shipping their collections to Mexico and Europe, but Humboldt took advantage of the time to make observations of a transit of Mercury across the Sun, to accurately set the longitude of Lima's port, Callao, for the first time.

Humboldt resolved to proceed to the most developed of the Spanish possessions in the Americas, New Spain (Mexico). Heading to a stopover in Guayaquil, Ecuador, by ship, he made measurements of the great northward-flowing cold current of that part of the South American coast, from then on known to world geography as the Humboldt Current—despite Humboldt's own repeated protestations that he in no way had discovered it, but only investigated it.

March 1803 to April 1804: Mexico

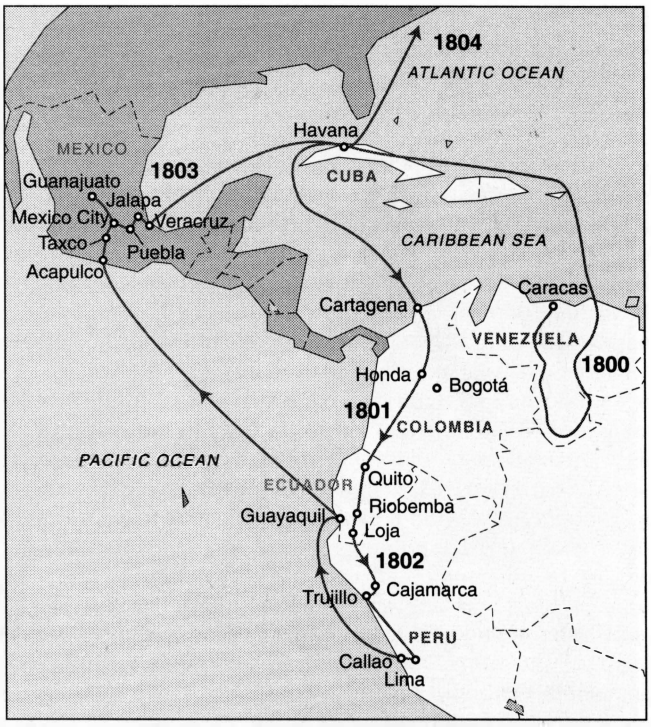
Humboldt and his companions (Carlos de Montúfar, the son of the Provincial Governor of Quito, had joined the expedition in the Andes) travelled relatively little in Mexico, in relation to the great distances of the earlier phases of the expedition. But Humboldt carried out the most thorough research of the entire journey, with unprecedented access to all the archives of the vice-royalty concerning natural resources, administration, income and expenditures, and much more. His personal tours took him to the centers of mining in Taxco, Real del Monte, and Guanajuato, in the company of his old friends from the Mining School of Freiburg.

And he could not pass up personal inspection of Mexico's great volcanoes, including the Jorullo volcano which had begun to surge upward from some cornfields only 40 years before. The result was a treatise in political geography which set a world standard for such writing at the time, *Political Essay on the Kingdom of New Spain*.

April 1804 to August 1804: Cuba and the United States

Humboldt had planned to continue westward from Mexico, to complete a circumnavigation of the globe. But instead, he headed back to Europe. His reasons, as expressed in a letter of the time: "The damaged state of our instruments, the futility of our efforts to replace them, the impossibility of meeting Captain Baudin, the lack of a ship that could bring us to the enchanted islands of the South Pacific, but, above all, the urgent need to keep pace with the rapid advancement of science which must have taken place during our absence, these are the motives for the abandonment of our project of returning via the Philippines and through the Red Sea to Egypt. . . ."

Instead, after a short repeat stop in Havana, he detoured to see his admired United States of America and its President, Thomas Jefferson. He would finally set sight on European shores again, August 3, 1804.

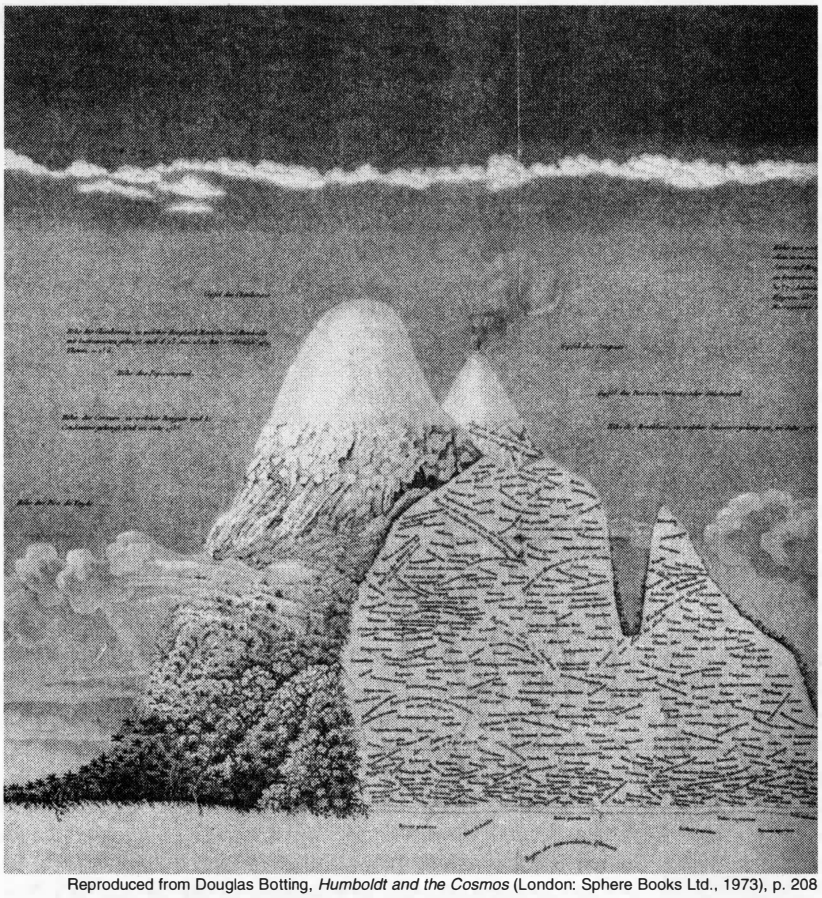


HUMBOLDT'S TRAVELS IN THE AMERICAS

Perhaps the most famous of these scientists was the monk José Celestino Mutis, sent to Bogota, capital of Nueva Granada (what is today Colombia, Venezuela, and Ecuador) in 1763. He became the pre-eminent botanist of the hemisphere, corresponding avidly with Linnaeus in Sweden, perfecting the study and the painstaking painting of botanic specimens, and founding the first astronomical observatory in Spanish America. In 1783, he led the legendary Expedición Botánica of the flora of northern South America, the largest such enterprise of its time. Usually forgotten, however, are two large-scale, companion botanical expeditions sponsored by the Spanish crown at the same time, the Ruíz-Pavón expedition to study plant life in Peru and Chile, and the expedition of Dr. Martín Sesse to Mexico, California, and Guatemala.

Humboldt was to pivot his work in Nueva Granada around an extended stay as Mutis's houseguest in 1801. He would befriend and correspond with Mutis's greatest protégé, Francisco José de Caldas.

No less notable was the Spanish crown's promotion of improved mining techniques, and the sciences of geology and metallurgy. Exemplary was the deployment of the two Elhuyar brothers, Fausto and José. Born in Spain of German parents, the brothers were sent in 1778 by the Count of Aranda to Paris, Mannheim, and Leipzig, to study the most advanced earth sciences of the time. Their researches in Upsaala, Sweden, in 1781 resulted in the discovery of tungsten, which brought the brothers renown throughout Europe. In 1785, Charles commissioned Fausto to organize a mission of German scientists and miners to introduce advanced mining techniques to all the colonies. Fausto was named the director general of Mexico's Royal Mining Corps in New Spain. By the time Humboldt reached Mexico in 1803, Humboldt's classmate at the



Reproduced from Douglas Botting, *Humboldt and the Cosmos* (London: Sphere Books Ltd., 1973), p. 208

Humboldt's profile of Mt. Chimborazo, showing different plants at different altitudes.

Freiburg mining school in 1792, Manuel del Río, had assumed the directorship.

Fausto's brother, José Elhuyar, was assigned to Peru, where he installed a team that included German botanist Count Nordenflict—Humboldt's hosts and collaborators when he reached Lima in late 1802.

All of these networks were, in turn, directly tied into Franklin and his American Philosophical Society. One of Franklin's little-known accomplishments is that he was a leading Hispanist, interested in encouraging companion republican currents in Spanish America. Franklin made a point of forming an extensive collection in Philadelphia of the writings of Spanish American scientists and intellectuals. Leading figures throughout the continent tirelessly sponsored the return flow of Franklin's works and those of the Philosophical Society to Spanish America, notably through Antonio Alzate's *Gazeta de Literatura* in Mexico, José de Caldas's *Semanario* in Bogota, and José Hipólito Unanúe's *Mercurio Peruano* in Lima. Alzate, the naturalist known as Mexico's first experimental scientist, translated and published Franklin's works on heat rays, optics, and waves, and later became an official correspondent of the American Philosophical Society.

In the succeeding years, Humboldt personally aided in getting papers, journals, and letters, of prominent U.S. figures, into Mexico, Caracas, Bogota, and Lima.

The Philadelphia High Point

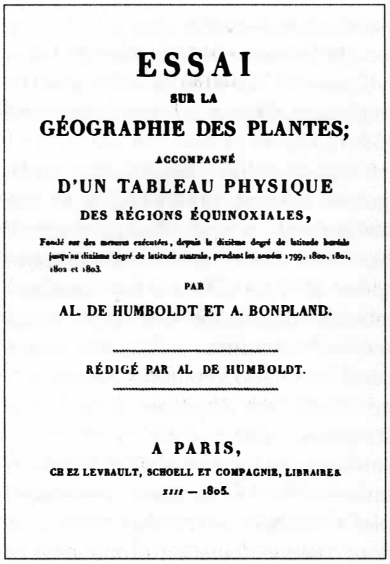
A high point in Humboldt's five years of travels was Franklin's Philadelphia itself, where he arrived in May of 1804. After writing President Jefferson that "for moral reasons, I could not resist seeing the United States," and requesting a meeting with the President, Humboldt threw himself into a dizzying round of meetings and activities with the surviving core of Franklin's collaborators at the American Philosophical Society, which Franklin (1706-1790) had founded in 1743. Humboldt's enthusiastic hosts included Dr. Benjamin Rush, eminent physician and signer of the Declaration of Independence; Dr. Benjamin Smith Barton, America's foremost botanist and an authority on American Indian culture; Dr. Caspar Wistar, holder of the chair of anatomy at the Franklin-founded University of Pennsylvania, and the foremost authority on fossils in America; and Andrew Ellicott, one of America's leading astronomers and mathematicians, based in Lancaster, Pennsylvania. Humboldt was elected a member of the Society on the spot, and sat for a full portrait by the celebrated Dr. Charles Wilson Peale.

Rush, Barton, Wistar, and Ellicott had all personally trained Meriwether Lewis exactly one year before, on the techniques of mapping, botany, astronomy, and medical science which Jefferson had mandated that his personal secretary receive before leaving on the famed Lewis and Clark Expedition. Lewis and Clark were already headed up the Missouri River on the first leg of their three years of travels when Humboldt arrived in the United States. If Humboldt's accounts of his travels and studies in Central and South America seemed heaven-sent to the Franklin Philadelphians who thrilled to Lewis and Clark's mission of unveiling the western continental expanses, even more did it appear so to the author of the Expedition himself, President Thomas Jefferson. Jefferson enthusiastically invited Humboldt to the White House for detailed conversations and consultations.

A Bountiful Scientific Harvest

Humboldt had left for the New World with no less than 40 crates of instruments. They were of the most advanced designs then available from the Ecole Polytechnique in Paris, and Humboldt was a master in their use.[9] Some of the descriptions Humboldt provided of his travels are at once hilarious and harrowing—one of the reasons for his great popular acclaim in later years.[10] But Humboldt's interaction with the Charles III-Franklin currents in Spanish America, produced an explosion of measurements and hypothesis, one of the great scientific treasure-harvests of all history.

Among his most notable achievements, developed in the 30 volumes which he either wrote, or had others elaborate, based on his and Bonpland's researches, are these:



ESSAI

SUR LA

GÉOGRAPHIE DES PLANTES;

ACCOMPAGNÉ

D'UN TABLEAU PHYSIQUE

DES RÉGIONS ÉQUINOXIALES,

Fondé sur des mesures exécutées, depuis le dixième degré de latitude boréale jusqu'au dixième degré de latitude australe, pendant les années 1799, 1800, 1801, 1802 et 1803.

PAR

AL. DE HUMBOLDT ET A. BONPLAND.

RÉDIGÉ PAR AL. DE HUMBOLDT.

A PARIS,

CHEZ LEVRAULT, SCHOELL ET COMPAGNIE, LIBRAIRES.

an XIII — 1805.

The title page from Humboldt and Bonpland's Essay on the Geography of Plants, published in Paris in 1805. Humboldt brought a new richness and breadth to the understanding that an increase in altitude mimicked the changes in climate, flora, and fauna of latitudes advancing to the poles.

• He developed the first graphic representations of cross-sectional altitude readings for large land masses.

• His writings and graphic schema presenting the spatial distribution of flora according to ecological zones, were revolutionary (see his illustration of the intricate mosaic of plant zones on the rising slopes of Ecuador's highest peak, Chimborazo, p. 22). He made more precise the insight that rising altitude in the tropics, mimicked increasing latitude toward the poles: Travelling 50 miles from the coast of Ecuador up to the top the Andes, was the equivalent, in terms of plant and animal zones, of travelling 5,000 miles to the north or south.

• Humboldt first developed the theory and rigorous use of isotherms and isobars, to present geographically extensive temperature and barometric readings over time.

• Among hundreds of other crucial geomagnetic readings, his discovery of the "magnetic equator" in Cajamarca, Peru (where the needle on his magnetometer swung from north to south), gave a root value for geomagnetic scalar measurements adopted worldwide until Gauss's development of an absolute scalar magnitude in laboratory conditions in the late 1830s. Gauss pored over the rich bounty of Humboldt's measurements; the two of them would later collaborate in setting up the first international organization for collecting geomagnetic data, the *Magnetische Verein* (Magnetic Union).

Humboldt equally opened up fruitful lines of *historical and cultural* investigation. He awakened Europe to the fact that pre-Columbian civilizations were advanced civilizations; that seemingly "primitive" peoples could well reflect merely the degeneration of previous higher cultures; that transoceanic contact, particularly between Asia and the Americas, was likely in periods reaching back many thousands of years. He rehabilitated the figure of Columbus, as a supreme navigator and explorer, while the "Enlightenment" salons of the time were denigrating the spread of Renaissance modes of statecraft and science as viciously as such modes are denigrated today.

Return to a Europe at War

Humboldt was 34 when he returned in 1804 from his five years of travels in the New World. He returned to a Europe which had pitched into war while he was gone, and which would not emerge from it for 10 long years more. After the Congress of Vienna in 1815, the reactionary regimes installed by Britain and Metternich's minions throughout continental Europe, were directed to crush any activity consistent with the ideals and example of the struggling United States republic.

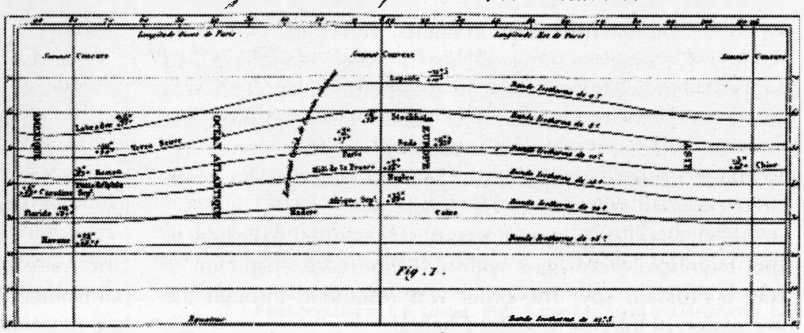
Humboldt had been lionized throughout Europe for the exotic locales and daring of his explorations (newspapers had reported his death many times over). He chose to make Paris his headquarters for the next 23 years, despite the imputation of disloyalty to Prussia it brought on him during the Napoleonic wars. But Humboldt needed the intellectual and institutional resources then concentrated in the Ecole Polytechnique circles of Paris to bring out his stupendous 30 volumes of the scientific and cultural discoveries of his travels.

Humboldt himself addressed a specially convened meeting of the Institute of France a few months after his return to Europe, and boldly proclaimed:

> I aim at collecting ideas rather than material objects. A private person who with moderate means undertakes a journey round the world, has to confine himself to matters of major interest. To study the formation of the Earth and its strata, to analyze the atmosphere, to measure with sensitive instruments its pressure, temperature, humidity, the electric and magnetic charge, to observe the influence of the climate on the distribution of plants and animals, to relate chemistry to the physiology of organized beings, there are the aims I have proposed to myself.[11]

Humboldt carried out his aims by publishing the results of his travels, including 1,425 illustrations and maps, many

World chart showing isothermal lines, first devised by Humboldt in 1817



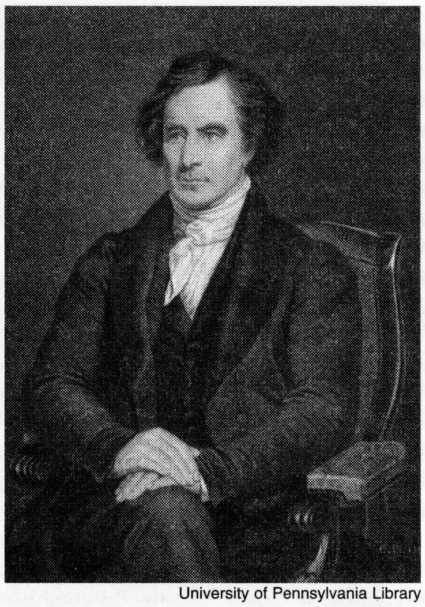
Reproduced from Douglas Botting, *Humboldt and the Cosmos* (London: Sphere Books Ltd., 1973), p. 209

Humboldt devised the concept of isothermal lines, a chart connecting equal mean temperatures, as a way of comparing different climate conditions around the world.

hand-colored. The effort cost Humboldt his entire remaining personal fortune.

Why Paris? It was a question his brother, Wilhelm, would pointedly ask as the Prussian Wars of Liberation against Napoleon's armies commenced after 1808, and Wilhelm's own son, Theodore, eventually went to the front lines. Why was Alexander in the enemy's capital?

Napoleon had styled himself a patron of science and had the means to keep the scientific institutions of France more richly endowed than they were in any other country of Europe at the time. But despite this nominal flourishing of science, there was in fact a campaign against *the key figure of republican statecraft and science, Lazàre Carnot* (1753-1823), the Ecole Polytechnique founder and "Architect of Victory" in saving France from invading armies in 1794. Nothing exemplified this more clearly than the election of members of the Institute of France's "First Class" Division in 1799. Carnot had been summarily expelled, and consigned to virtual internal exile for the next 15 years; Napoleon arranged to have *himself* elected to Carnot's vacant chair!



University of Pennsylvania Library

François Arago, Humboldt's great ally and close personal friend, in the French Ecole Polytechnique tradition. Humboldt and Arago, together with Fresnel and Ampère battled the stifling Newtonianism of Napoleon's scientific toadies.

Further, the Institute and a smaller steering committee that controlled all patronage in the French scientific establishment, the Arcueil Society, were run by a mafia of Napoleon sycophants and diehard Newtonians, headed by chemist Claude Louis Berthollet and astronomer Pierre-Simon Laplace (1749-1827).[12]

But Humboldt's genius was to use the facilities afforded in Paris (he became a full member of the Arceuil Society, and in 1810, a Foreign Associate of the Institute of France), to consolidate his own scientific eminence, while sponsoring scientific circles in both France and Germany that would break the noose of Enlightenment Newtonianism, and reassert the Cusa-Kepler-Leibniz method.

'You Are Interested in Plants, Monsieur?'

Certainly there was no love lost between Napoleon and Humboldt. In a famous meeting just before Napoleon was crowned as emperor in December 1804, Napoleon turned to him and asked, "You are interested in plants, monsieur?" Humboldt replied that he was. "Well, so is my wife," was Napoleon's curt reply before he turned away.

In 1810, Napoleon ordered Savary, the Minister of Police, to expel Humboldt from Paris within 48 hours, on suspicion of being a Prussian spy. The order was rescinded through the intercession of Interior Minister Chaptal.

Through most of his first decade in Paris, Humboldt lived in rooms at the Ecole Polytechnique. His closest circle of associates, one generation younger than he, were all among the first graduating classes of the Ecole (founded 1794), when Carnot's personal role was the greatest. Among these were the chemist Joseph Louis Gay-Lussac (1778-1850), and, especially important, Dominique François Arago (1786-1853).[13]

It was Arago's work, first with Augustin Fresnel (1788-1827) in the establishment of the wave theory of light, and then with André-Marie Ampère (1775-1837) in the development of electromagnetism, which overthrew the Newtonian straitjacket of the Arcueil circle and kept fundamental science alive in France during the Restoration.

Similarly, in Germany, Carl Friedrich Gauss (1777-1855) had reasserted Kepler's method over Newton's in his famous 1801 calculation of the orbit of the asteroid Ceres. As Arago was Humboldt's great collaborator and intimate friend in Paris, in the face of constant political and scientific hostility (Arago's republicanism was even more intransigent than Humboldt's), so was Gauss in Germany, where both faced the same hostile underlying conditions after 1815. In Humboldt's failed attempt to secure Gauss a professorship at the University of Berlin in 1824, Humboldt revealed that he had first intervened on Gauss's behalf with the King of Prussia as early as 1804. In 1827, Humboldt wrote Gauss, that a significant motivation for his decision to leave Paris and establish Berlin as his base of operations, was "the prospect of living near you and being able to join those who share my admiration for your great and varied talents. . . ."

In 1837, when Gauss's son-in-law was one of the "Göttingen Seven" professors expelled by order of the British overlords of the Brunswick Duchy, Humboldt stepped in quietly to eventually arrange Berlin University appointments for four of them. Humboldt's own mail was opened and his movements surveilled by secret political police in both the 1820s, in Paris, and in the 1840s and 1850s, in Berlin. Finally, he took to writing his most intimate comments in Hebrew or Sanskrit!

How precarious the survival of republican science was in these years, and how crucial Humboldt's personal role in saving it, is captured in two incidents from the period of the Napoleonic wars. In the winter of 1806-1807, after Napoleon had secured a crushing victory over the Prussian armies at Jena, and the Prussian court had fled to the east, Humboldt interceded with the French authorities on behalf of the University of Halle, which Napoleon wanted to destroy as punishment for the patriotic passions of its students, and, at the last moment, saved the university. The tables were turned seven years later, when the Allies triumphantly entered Paris in early 1814; it was Humboldt who interceded with the Prussian authorities, to save the French Museum of Natural History from being ransacked.

'From King to Bricklayers'

By the late 1820s, Humboldt had gathered such personal renown that he believed he could defy the post-Napoleon, Restoration repression of the republican development of science. In 1827, he returned to Prussia and immediately launched one of the cultural coups of the age. Within a few short months, he had organized a series of public lectures in one of the most prestigious halls in Berlin, the Singakademie, based on a concurrent, more extensive lecture series limited to Berlin University. The first of these 16 weekly lectures took place December 6, 1827, before a packed house that included members of the royal house, merchants, students, and—in a complete innovation for the time—women. Contemporary chroniclers exclaimed how everyone, "from King to bricklayers," was there.

That he set out to create a quality of citizenry that would be a medium for the defense and transmission of scientific progress, was already his declared aim from 30 years earlier. In a letter written by Humboldt to a friend, Johann Gabriel Wegener, in 1789, he declared:

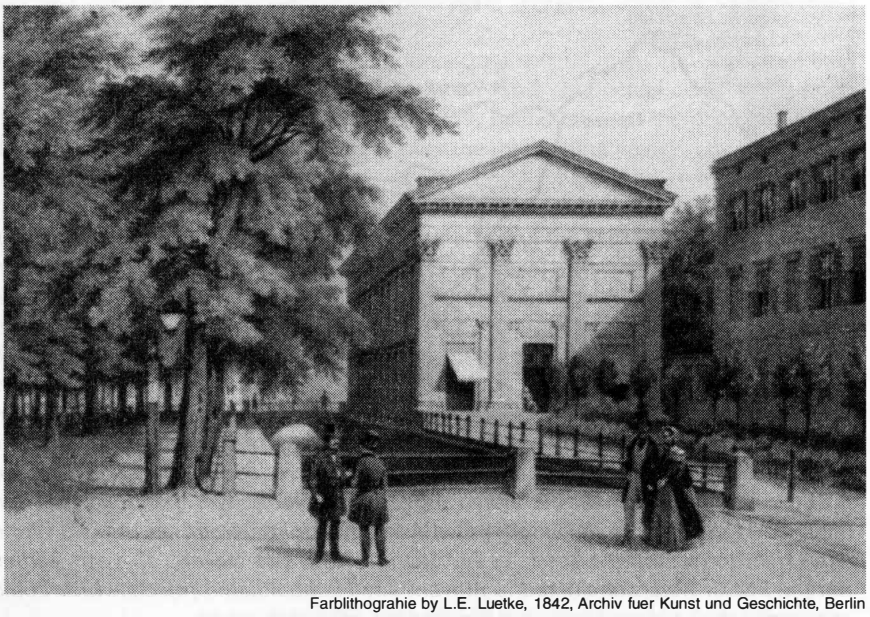
> I'm just coming back from a walk in the zoo. Quite surrounded by purest, the most innocent joy of thousands of creatures, who (happy memory of Leibniz's philosophy!) joy in their existence. . . . Would you believe it, that among the other 145,000 people in Berlin, there are hardly four to be found who cultivate this part of natural science—even if only as a hobby, for recreation. And for how many should this not lead to a vocation or profession, doctors and especially miserable students of economics. When population increases, and along with it, the price of consumer goods, when the people end up shouldering the burden of a shattered economy, all the more should we think about opening up new sources of food supplies for satisfying the wants afflicting us from all sides. Every day we tread on "resources" which we now import from distant parts of the world, until someone discovers them, after many decades, by accident; but then someone else comes along and buries the discovery again, or more rarely, spreads it widely. Everywhere I see the human understanding sunk in some error, everywhere he believes to have found the truth, and imagines that there is nothing left for him to improve, nothing left to discover. . . . This is true in religion, in politics, everywhere that popular opinion rules. . . . No, the great discoveries, which I myself have found buried in the writings of biologists from antiquity, which have been verified in modern times by learned chemists and technologists, have brought these thoughts to my mind. *What is the use of any discoveries, if there is no way to make them intelligible for the uninitiated* [emphasis added].[14]

Now, standing on the stage of the Singakademie, Humboldt developed the theme of the lectures in uncompromising words later set down in his great work, *Cosmos:* "In claiming the unity of the human race, we resist the unsavory assumption of higher and lower races." Some peoples are more exposed than others to education and "cultural ennoblement," but "there are no inferior races. All are destined equally to attain freedom."

It should not be surprising that the opposing view, typified by Charles Darwin, could not make headway in the 30 years in which the force of ideas launched by Humboldt in his Berlin lectures, and consolidated by the publication of *Cosmos,* took Europe by storm. Darwin only released his *On the Origin of Species, by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life,* in 1859, the year of Humboldt's death.

Humboldt's first lecture was on the ancient Greeks' view of the interdependent order of things, *Kosmos.* The second lecture, was on the contributions of the Arab renaissance. In a radical departure from conventional "descriptive geography," which took the surface of the Earth as its domain, Humboldt launched into a full description of the phenomena of the heavens as well. He dwelt on the then-newly-discovered phenomenon of double stars, the latest results of astronomical optics and interference phenomena, volcanoes on the Moon, meteors, and sunspots. His aim was truly to integrate the cosmos: In the work that the lectures gave birth to, he would write,

> By uniting, under one point of view, both the phenomena of our own globe and those presented in the regions of space, we embrace the limits of the science of the cosmos, and convert the physical history of the globe into the physical history of the universe.



Farblithograhie by L.E. Luetke, 1842, Archiv fuer Kunst und Geschichte, Berlin

Humboldt's 1828 lectures at Berlin's Singakademie were a revolution in statecraft. He was committed to imparting a passion for scientific inquiry to the humblest levels of society, and forging a citizenry around the appetite for scientific progress.

In *Cosmos,,* which emerged 18 years later, Humboldt dedicates a substantial part of the second volume, to examination of how mankind's interest in the study of nature is stimulated (he takes the work of landscape painters, natural history writers, and the use of exotic plants in gardens as exemplars of this process), and concludes with a survey of "the diversity of the means by which mankind attained to the intellectual possession of a great portion of the universe."[15]

In such a "history of the physical contemplation of the universe," Humboldt urges close attention to "the prescient fancy and the vivid activity of spirit which animated Plato, Columbus, and Kepler," and then identifies a three-part subject of investigation:

> (1) The independent efforts of reason to acquire a knowledge of natural laws, by a meditative consideration of the phenomena of nature. (2) Events in the history of the world which have suddenly enlarged the horizon of observation. [Here Humboldt takes Alexander the Great's conquests, and the explorations of Columbus, as paradigmatic.] (3) The discovery of new means of sensuous perception, as well as the discovery of new organs by which men have been brought into closer connection, both with terrestrial objects and with remote regions of space.

Here Humboldt delves into the history of the development of the telescope, the microscope, the compass, and

> the different contrivances invented for measuring terrestrial magnetism; the use of the pendulum as a measure of time; the barometer; the thermometer; hygrometric and electromagnetic apparatuses; and the polariscope.[16]

In sum, he writes,

> The history of the civilization of mankind comprises in itself the history of the fundamental powers of the human mind, and also, therefore, of the works in which these powers have been variously displayed in the different departments of literature and art.[17]

Goethe's friend Karl Friedrich Zelter wrote to him of Humboldt's sensational lecture series at the Singakademie: "Before me stood a man of my liking who gives what he owns without knowing to whom, a speaker devoid of tricks and nebulous thoughts. . . ." Another correspondent of Goethe, Karl von Holtei, was equally dumbstruck:

> Eight hundred people hold their breath so that they might hear one person speak. There is no more lofty impression, than seeing earthly power paying homage to the spirit; and already on that account, Humboldt's current activity in Berlin belongs to the most sublime phenomena of the age.[18]

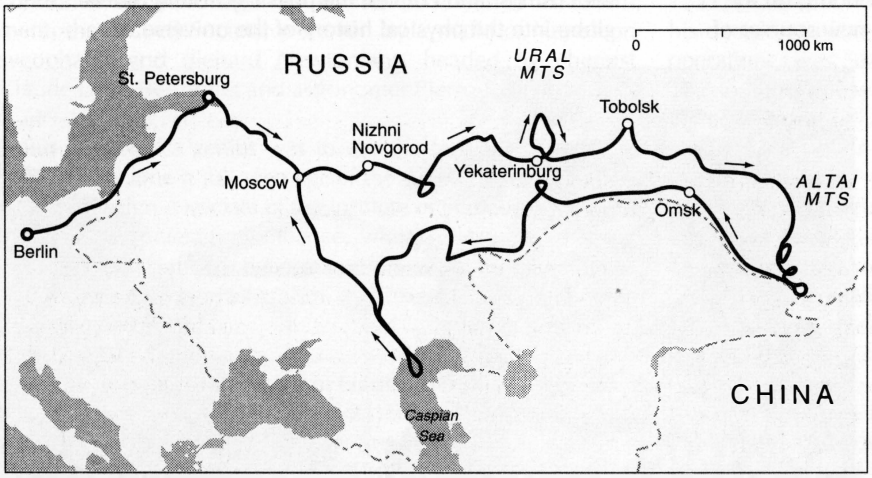
Return to America

During the period of the Napoleonic Wars and resultant constant sea blockades, there was little Humboldt could do to maintain his connection to the circles in the Americas he had so enthusiastically embraced. But the sentiments in his farewell letter to Jefferson in 1804, were never far from his mind. He had written then:

> I take leave in the consolation that the people of this continent march with great strides toward the perfection of a social state, while Europe presents an immoral and melancholy spectacle. I flatter myself in the expectation of enjoying this consoling experience again, and I sympathize with you in the hope . . . that humanity can achieve great benefit from the new order of things to be found here. . . .[19]

In the 1820s, he was able to reassert his personal commitment to the survival and prosperity of the new republics then emerging in all of the Americas. Humboldt's letter-writing energies were prodigious; he wrote as many as 3,000 a year, "dispatched to both hemispheres," as he stressed.

In 1821-1822, Humboldt was approached by a group of French financiers to act as their consultant on a large mining project in Mexico. Humboldt saw this as a springboard to larger



In 1829, Humboldt seized on an offer from the Russian government, finally to make a trip to the Central Asian heartland. He had eagerly sought backing from the British government, to visit the Indian subcontinent, cross over the Himalayas and the Hindu Kush, and thence into Russian Asia. Humboldt saw this as the Old World equivalent to the historic scope of his Spanish American travels, 25 years earlier. But the British were determined to prevent any Humboldtian projects which could undermine their colonial grip, and blocked his every request.

Humboldt's strenuous 5,000 miles of travel in one season, by carriage and boat, across the vast interior spaces of Russia, nevertheless yielded a rich storehouse of scientific knowledge, and foreshadowed the "Eurasian Land-bridge" development perspective of today.

things, and wrote his brother Wilhelm that the project

> . . .should prove useful for the best naturalists who, like myself, want to leave Europe. . . I have a big plan for a large Central Institute of Natural Science that would serve all of the liberated portion of America in Mexico. The viceroy will be replaced there by a republican government, and I have got it in my head to end my life in the most agreeable and, for science, most useful manner. . . . *This is my wish* [emphasis in original] . . . to gather a number of scholarly men around me, and *to enjoy the liberty of thought and feeling so indispensable to my happiness*. . . . You may laugh at my Mexican project, but owning neither family nor children, one should plan ahead on how to make one's old age as pleasant as possible. . . . All letters from Germany are censored.[20]

Political instabilities in Mexico, and a suspicious transfer of the mining syndicate to London, prevented the plan from coming to fruition. Humboldt instead shifted his energies to his return to Berlin, the launching of his "Cosmos Manifesto" at the Singakademie lectures, the hosting of 600 scientists at the first international scientific conference (a personal Humboldt project), and eight months of travel through Russian Asia.

American Science: Humboldt and Bache

From the 1830s, until his death in 1859, Humboldt directed his energies in a very special way to nurturing a next generation of U.S. scientists and intellectuals, capable of reigniting the promise of the early years of the American Republic, which had briefly re-emerged during the Presidency of John Quincy Adams. Now, in the run-up to the American Civil War, this generation faced adverse home conditions, and Restorationist government in Europe, uniformly hostile to the survival of the American republic.

The best lens through which to see the character of this period, is Humboldt's relationship with Alexander Dallas Bache (1806-1867), Franklin's great-grandson. Bache—who had graduated first in his class from West Point in 1825, and would later become head of the U.S. Coast and Geodetic Survey, and founder and first president of the National Academy of Sciences—was dispatched by the American Philosophical Society circles to Europe for two years of travel, 1836-1838, to bring the scientific work and teaching methods of the Gauss-Humboldt circles to the United States. (On his return, he founded the first public high school in the United States south of New England, Central High School of Philadelphia, on these principles.) In all, Bache visited 278 schools in seven countries, at the same time touring mines, quarries, iron works, dye works, gas works, and other establishments of industry and infrastructure.[21]

Bache's first visit to Humboldt, in early 1837, is recorded in the briefest of entries in Bache's diary:

> I went to see Baron Humboldt by appointment. And spent nearly two hours during which the variety of ideas and subjects was actually overwhelming and I left him with a head-ache[!].

NOAA Central Library

Alexander Dallas Bache in the field, ca. 1858. Bache, Franklin's great-grandson, was sent by America's beleaguered American System patriots to meet with Humboldt and Gauss, and reconnect America's scientific and educational direction with the Humboldt circle.

Humboldt put him in touch with the head of the Berlin Observatory to get better instruments for measuring terrestrial magnetism, and later, after Bache spent time with Gauss in Göttingen, Gauss personally designed some of these instruments.

In the keynote address to a special memorial session of the American Geographical and Statistical Society upon Humboldt's death in 1859, Bache conveys the deep influence Humboldt exerted over the intervening years:

> He loved to talk of the men he had met there [in Philadelphia, in 1804], and of the greatness of the country to which that city belonged. His scientific labors having been chiefly performed on this continent, he looked to this continent for his reward, and we feel that he was . . . almost an American.[22]

In the same address, Bache revealed that Humboldt and Arago had been instrumental in intervening to defend Bache's work at the Coastal Survey from political enemies in the United States in the mid-1840s.

Many Germans, fleeing the Prussia of the repressive Carlsbad Decrees to America, in the generation after 1815, brought Humboldt's writings and intellectual influence with them. With the opening of regular steamship travel between Europe and America in 1838, the trickle of Humboldt's American visitors going in the reverse direction, swelled to a stream. Among them were key figures in the group of American patriots acting as de facto intelligence agents on

behalf of the besieged American republic, such as Samuel F.B. Morse and Washington Irving.[23]

While supporting Friedrich List's *Zollverein* (Customs Union) and the related pioneering railway construction plans of Beuth and Rother in Germany (winning over King Friedrich Wilhelm IV to von Krupp's revolutionary cast-iron steel process), Humboldt assisted the first stage of the great U.S. transcontinental railway construction project, later taken up under Lincoln: the route-surveying expedition carried out by Lt. A.W. Whipple.

The 'Common Property of Mankind'

> Each age dreams that it has approximated closely to the culminating point of the recognition and comprehension of nature. . . . A more animating conviction, and one more consonant with the great destiny of our race, is, that the conquests already achieved constitute only a very inconsiderable portion of those to which free humanity will attain in future ages by the progress of mental activity and general cultivation. Every acquisition won by investigation is merely a step to the attainment of higher things in the eventful course of human affairs. . . .
>
> Forces whose silent operation in elementary nature, and in the delicate cells of organic tissues, still escape our senses, will, when recognized, employed, and awakened to higher activity, at some future time enter within the sphere of the endless chain of means which enable man to subject to his control separate domains of nature, and to approximate to a more animated recognition of the Universe as a Whole.[24]

Thus Humboldt concluded the second volume of his *Cosmos.* His life had radiated a most beautiful and generous quality of fostering and promoting the work of others, never viewing the accomplishments of someone else as a threat, but only another step in this larger enterprise. "Science is the labor of mind applied to nature," he wrote, and

> that which has been acquired by means so different—by the ingenious application of atomic suppositions, by the more general and intimate study of phenomena, and by the improved construction of new apparatus—is the common property of mankind.

Similarly, he had denounced the idea that other nations' prosperity would be a threat, rather than an asset, to one's own (an axiom of the British geopolitical school of Mackinder and Haushofer, which contributed enormously to the underlying British policies leading to World Wars I and II). "It were a pernicious prejudice, I would even say a godless one," he had once written, "to perceive the decline or ruin of old Europe in the increasing well being of any other region of our planet."[25]

The concluding words of the first volume of *Cosmos,* lead the reader from *that which is contemplated* to *that which contemplates:* from the domains of the inanimate and of the living, to the cognitive. Much as the final words of Bernhard Riemann's rehabilitation thesis of a few years later (which echoes Humboldt's phrasing), asserted the superior ontological character of unfolding physical processes to any formal mathematical representation of such processes, so Humboldt delivers the sum of all his work on nature and natural history, to the higher science of the human mind.

He began with a quote from his beloved brother Wilhelm:

> "If we would indicate an idea which throughout the whole course of history, has ever more and more widely extended its empire, or which, more than any other, testifies to the much-contested and still more decidedly misunderstood perfectibility of the whole human race, it is that of establishing our common humanity—of striving to remove the barriers which prejudice and limited views of every kind have erected among men, and to treat all mankind, without reference to religion, nation, or color, as one fraternity, one great community, fitted for the attainment of one object, the unrestrained development of the physical powers. This is the ultimate and highest aim of society, identical with the direction implanted by nature in the mind of man toward the indefinite extension of his existence. He regards the Earth in all its limits, and the heavens as far as the eye can scan their bright and starry depths, as

Stiftung Stadtmuseum Berlin, Graphische Sammlung, photo by Hans-Joachim Bartsch

Humboldt in his library, in the last years of his life. One of his legion of American visitors stated that he "went to Berlin, not to see its museums and galleries . . . its opera and theater; but to speak to the greatest living man in the world—Alexander von Humboldt."

inwardly his own, given to him as the objects of his contemplation, and as a field for the development of his energies. . . ."

Here Alexander continues:

> With these words, which draw their charm from the depths of feeling, let a brother be permitted to close this general description of the natural phenomena of the universe. From the remotest nebulae and from the revolving double stars, we have descended to the minutest organisms of animal creation, whether manifested in the depths of ocean or on the surface of our globe, and to the delicate vegetable germs which clothe the naked declivity of the ice-crowned mountain summit; and here we have been able to arrange these phenomena according to partially known laws; but other laws of a more mysterious nature rule the higher spheres of the organic world, in which is comprised the human species in all its varied conformation, its creative intellectual power, and the languages to which it has given existence. A physical delineation of nature terminates at the point where the sphere of intellect begins, and a new world of mind is opened to our view.[26]

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Bibliography

In addition to the obvious place to begin in appraising Humboldt's life and work, which is with his own writings, it is fortunate for the English reader that three current biographies in English all have merit, and complement each other, rather than overlap: See Botting, De Terra, and Kellner. For those first delving into Humboldt, I particularly recommend Botting, because of the magnificent illustrations. The definitive biography, however, remains one in German, in two volumes, by Hanno Beck.

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Notes

1. *Cosmos* I, p. 7. The many quotations from *Cosmos* in this article come, in the main, from the E.C. Otté translations of 1848-1865. This edition has been recently reissued in two paperback volumes by Johns Hopkins University Press. The inquiring reader will delight in the chance to delve into Humboldt's crowning work directly, without having to rely on snippets in secondary works. There are problems in the Otté translation, typically of the nature of dulling the liveliness of the original prose, and occasionally of content. For instance, in the very first paragraph of the introduction, Humboldt's cry of the heart, "Die Natur aber ist das Reich der Freiheit" ("Nature is above all the realm of freedom"), is rendered by Otté, "Nature is a free domain." But it was a contemporary, unexpurgated edition (see note 25 for British tampering with an earlier one), and will serve.
2. Brenner, p. 41.
3. Brenner, pp. 42-3.
4. See "The Franklin Circle Starts Modern England," by Anton Chaitkin, *Executive Intelligence Review,* Vol. 23, No. 7 (February 9, 1996), pp. 25-30, for the story of Franklin's work in fostering the industrial revolution in England—a revolution the British oligarchs tried to suppress.
5. Humboldt's close friendship with Goethe, which would continue without interruption until Goethe's death in 1832, is a study in itself. (See "The Natural Science of Wolfgang Goethe," by Ralf Schauerhammer, *21st Century,* Spring 2001, p. 12.) At several key points, especially in the 1797 period, it was contact with Humboldt that revived Goethe's interest in his natural science investigations. In 1816, Humboldt's final work on the geographic distribution of plants, dedicated to Goethe, arrived just when Goethe was grieving over the death of his wife. Goethe wrote to Alexander's brother, Wilhelm, "I owe to your brother, a sweet consolation, as his pamphlet reached me in one of the saddest moments. I like it so much that it came to be the daily text of my contemplations. Please forward the grateful note to him." (De Terra, p. 249).
6. This long and rich poem by Schiller, was written in 1795, in exactly the period when the contact between Schiller and Humboldt was at its height. It may be that Humboldt was privy to Schiller's creative process in writing the poem; it certainly summarized views that animated Humboldt for the rest of his life. It is notable, that in the section just before the line quoted so significantly by Humboldt, Schiller presents a string of powerful poetic images of expanding economic activity sustaining human life, and then extends this theme into the realm of the arts and sciences, in a way which must have entranced Humboldt: "There begets happy fortune the talents of heavenly children, / Nursed at freedom's fair breast, flourish the arts of delight. / Imitations of life by the sculptor give joy to the vision, / And the sensitive stone speaks, by the chisel besouled, / Heavens synthetic rest on slender Ionian columns, / And the Pantheon's walls all of Olympus contain. / Light as the the rainbow's vault through the air, as the cowherder's arrow, / bounces the bridge's yoke over the thundering stream. / But in the still of the room, outlining meaningful figures, / Brooding, the sage is in search, stalking the creative mind. / Matter's power he tests, the hatreds and loves of the magnet, / Follows the sound through the air, follows through aether the ray. / Seeks the familiar law in the awful wonders of hazard, / Seeks the immobile pole in the flight of appearances." (Translation by Marianna Wertz.)

   Humboldt's statement in the 1845 preface to *Cosmos,* that "In the late evening of an active life I offer to the German public a work, whose undefined image has floated before my mind for almost half a century," is a precisely dated reference to his years in Weimar with Schiller and Goethe.
7. Humboldt's published studies on the response of animal musculature to electrical stimuli, based on over 4,000 separate experiments in a one-year interval in the mid-1790s, converged on the design of a Voltaic battery, independent of Volta's own contemporary breakthrough in that field. He also published notable studies of the basalts of the Rhine Valley, and of plant growth underground in mines, without access to sunlight.
8. The material in this section is drawn from the superb book of Luis Vásquez, *El Mercantilismo Mexicano versus el Liberalismo Inglés,* and two groundbreaking unpublished manuscripts of 1982, "The Real Cultural History of Latin America: Charles III's Spanish Commonwealth," by Cynthia Rush; and "Contenido Político de la Expedición de Humboldt a America" by Sara Madueño de Vásquez. Their use is gratefully acknowledged by the author.
9. A partial inventory and description of these instruments is provided by Kellner, pp. 62-63.
10. One example from Humboldt's account: "We began to load the new pirogue. It was, like all Indian canoes, made from one tree trunk, hollowed out by axe and fire. It was 40 feet long and 3 feet wide. Three people could not squeeze together from one side to the other. . . . To make it wider at

the back of the boat we made branches into a kind of trellis, which stuck out on both sides. Unfortunately the leaf roof of this lattice-work was so low that you either had to lie down, and consequently saw nothing, or you had to stay hunched over. . . . The little cages with our birds and monkeys, increasing as we went on, were tied to the *toldo* and the prow. It was our travelling zoo. Despite losses due to accidents and sunstroke, we counted fourteen little animals when we came back from the Casiquiare. . . . In the overloaded pirogue, which was only three feet deep, there was no other room for the dried plants, trunks, sextant, compass and meteorological instruments but under the lattice of branches on which we were obliged to lie down for most of our trip. To take the smallest object from a trunk, or to use an instrument, we had to moor up and get ashore." (Humboldt, *Personal Narrative of a Journey to the Equinoctial Regions of the New Continent,* Penguin edition 1995, pp. 198-199.)

They lived on this pirogue in this manner for two months! Humboldt gamely observed, "With some gaiety of temper, with looking after each other and taking a lively interest in the majestic nature of these great river valleys, the travellers put up with the evils that became habitual," especially the "torment of mosquitoes that accumulate under the low roof, and the heat coming from the palm leaves continually exposed to the burning sun."

11. Kellner, p. 64.
12. An historian of the Arcueil circle writes, with unintended irony, that in those years, ". . . there was in the case of Laplace a more than common pliancy and understanding of political expediency," so that he could rise to Grand Officer of the Legion of Honor and Count of the Empire under Napoleon; and then Grand Cross of the Legion of Honor, and a marquis, in the following Restorationist regime of Louis XVIII. The same chronicler states that "The work of the Arcueil group was to represent almost a renaissance of Newtonianism. Much of this can be traced to the influence of Laplace. It is almost as though Laplace, hearing himself called the Newton of his age, accepted this title so literally and with such enthusiasm, that having successfully described the solar system, he turned to examine the numerous contributions to physics of the Great Man whose portrait hung in his study at Arcueil".
13. Arago, at age 20, had gone to Spain to help measure an arc of the terrestrial meridian, only to fall prisoner of the Spaniards when war broke out between France and Spain. Hiding the results of the survey on his body during two years in a Spanish prison and one year in an Algerian one, he finally returned to France in 1809 to duly hand over the results of the work. The first letter of congratulations to reach him was from Humboldt; this commenced a remarkable friendship which would last until Arago's death in 1853, at which time Humboldt personally wrote the preface to Arago's collected works, and saw them through to publication.
14. Brenner, p. 40.
15. Humboldt's emphasis on the role of landscape painting in developing popular enthusiasm for science, and his luminous descriptions of how only in the tropics, could one could find lush tropical vegetation directly adjacent to high mountain Arctic terrain (as in the equatorial Andes), inspired a group of mid-19th Century landscape painters, led by Frederic E. Church, to make pilgrimages to Ecuador and Peru, and paint from life, what Humboldt had painted in words. The resulting series of landscape masterpieces were the sensation of the New York salons on the eve of the Civil War. Church so revered Humboldt's vision, that he was preparing to send his huge "Heart of the Andes" painting directly to Humboldt in 1859, when word reached Church of Humboldt's death. (See catalog of the 1989 National Gallery of Art (Washington, D.C.) exhibit, *Frederic Edwin Church,* and the included essay by Stephen Jay Gould, "Church, Humboldt, and Darwin: The Tension and Harmony of Art and Science," p. 95.
16. *Cosmos* II, p. 117.
17. Brenner, p. 51.
18. De Terra, p. 269.
19. De Terra, p. 185.
20. De Terra, pp. 254-5.
21. Schoenwaldt, p. 432.
22. Bache told the 1859 Humboldt Tribute meeting in New York, that "It was to the letters of Arago that I owed the friendship of Humboldt. When the Coast Survey, of which I am superintendent, was attacked by one of. . . [the] strongest politicians of our day, Arago and Humboldt were the men to fly to the rescue of the work. They needed no preparation for this, and were ready at once with their letters expressing their sentiments as to the value of the work itself, and in regard to the way in which it had been executed; and it was to their testimony that the Secretary of the Treasury appealed, saying that the testimony of such men as Arago and Humboldt could not be set aside; and it was not set aside" (Schoenwaldt, p. 433).
23. Other visitors to Humboldt were the astronomer Maria Mitchell (whom Humboldt referred to in one of his letters as simply "Bache's friend"); Benjamin Silliman (close ally of Bache and key promoter of the Lincoln-era industrial breakout of the United States); George Ticknor (a graduate of Göttingen in the first group of Americans to pass through Gauss's home base in 1817, later to found the Boston Public Library); Charles Patrick Daly (later long-serving president of the American Geographical and Statistical Society); Dr. Joseph Green Cogswell (in 1823 founder of the first American school directly based on the German "Gymnasium" model developed by Wilhelm von Humboldt, and later commissioned by John Jacob Astor to scour Europe for the books to found the New York Public Library); Alexander Thayer, the biographer of Beethoven; and John Lloyd Stevens (founder of the first railway across the Panama Isthmus, and famous explorer of the Mayan ruins of Yucatán and Chiapas).

Bayard Taylor, translator of Goethe's *Faust* and later U.S. ambassador to Germany, expressed a veneration of Humboldt which appears as a leitmotiv in the diaries and letters of the Americans who visited Humboldt during these years: "I went to Berlin, not to see its museums and galleries, the beautiful avenues under the lindens, opera and theater; nor to enjoy the colorful life of its streets and salons, but to speak to the greatest living man in the world—Alexander von Humboldt" (Schoenwaldt, p. 445).

To the 1850 visit of Benjamin Silliman, we owe the following engaging account: In "a plain house in a quiet part of the city, [Humboldt] met us with great kindness in his library, a room of considerable size.... He has perfect command of English and speaks quite agreeably. There is no stateliness or reserve about him, he is as affable as if he had no claims to superiority. He conversed with an exceedingly musical voice, is animated and amiable, he stoops a little, has brilliant eyes, is of light complexion, his features and stature round but not fat, his hair thin and white, his conversation brilliant and sparkling with ideas. He was well acquainted with the *American Journal of Science,* with Col. Fremont, and Prof. Bache's coastal survey. He traced for us a canal project on a map, across the Isthmus at Darien.... He made some very interesting remarks about the present state of Europe, and on the impossibility of keeping down moral power by physical force." (De Terra, pp. 351-2).

24. *Cosmos* II, pp. 354-56
25. Humboldt had cordial relations with the handful of British scientists trying to revive any serious science in Britain, most notably Charles Babbage and John Herschel. One of Britain's leading Earth scientists, Edward Sabine, corresponded regularly with Humboldt, and later acknowledged that a crucial piece of his solution to the puzzle of the origin of magnetic storms (the sunspot cycle), came from a footnote in *Cosmos.* Sabine's wife, Elizabeth Juliana Sabine, was the first translator of *Cosmos* into English.

The British establishment, however, was deeply suspicious of, and at times openly hostile, to Humboldt, for the obvious reason that the thrust of his thinking and activity ran so directly counter to the British Empire's racism, and determination to keep its colonial areas backward. Humboldt's great desire, after the travels in the Andes, was to explore the other great "High Mountain" massif in the world, the Himalayas, and draw for Asia, the same enormous harvest of comparative measurements, which he had already done for South and Central America. To get there, he would have to gain permission from the British Government, and particularly from the British East India Company. Despite Humboldt's most determined personal intervention with British Prime Ministers Castlereagh and Canning, and a generous offer by Prussian King Friedrich Wilhelm III to cover the costs of the trip, the British door stayed firmly closed.

A reviewer for the British *Quarterly Review* in 1816, slammed Humboldt's investigations of the pre-Columbian civilizations of the Americas, with the following contemptuous words:

"We do not mean to deny that the first attempts, however rude, of an unenlightened people to register events, communicate ideas and render visible the operations of the mind, are void of interest; on the contrary, we consider them as so many landmarks by which we trace, in the most interesting manner, the progress of the intellectual faculties of man; but we wish to discountenance that perverse ingenuity which would mould and twist them to its own purposes and give them a meaning which they were never intended to bear.

"Neither do we mean to deny that this people had their calendar and their chronology.... [S]till, we cannot admit with our author that a nation so barbarous as the Mexicans had any knowledge of the *causes* of eclipses or the Metonic period of nineteen years. A picture language or such rude representations of the objects of sense as village children chalk on walls and barn-doors, are the first and rudest efforts to record ideas, and the ale-scores of a village landlady the first approach to symbolic writing, and with both of these even the wild Hottentots called bushmen, the very lowest perhaps of the human race, appear to be acquainted.... The Mexicans may have advanced but, we believe, not a great way, beyond the village children, the landladies and the bushmen." (Kellner, pp. 99-100)

Even the circles friendly to Humboldt in Britain, eventually reflected some of the racialist dogmas gripping the British oligarchy. The Sabine translation of *Cosmos* eliminated key passages which disputed British assertions of where the origins of Man were to be located. John Herschel criticized Humboldt for failing to agree that the center of the land mass of the Northern Hemisphere was in a small town in midlands England, and urged that Humboldt rewrite a section of *Cosmos,* in order to portray Kepler's work as at a lower conceptual level than Newton's.

26. *Cosmos* I, pp. 358-359.