he spoke from Europe's northernmost university (excepting Åbo), separated from the Arctic tundra only by a drawn-out conifer forest. His talk was infused with that anxiety which comes from sensing, within and without, a proximate wilderness.

One imagines Linnaeus spoke slowly at first. His speech was in Swedish, and French was the language of his courtly audience. He began with a homely simile: "Only the Sciences distinguish Wild people, Barbarians and Hottentots, from us; just as a thorny sour Wild apple is distinguished from a tasty Renette only through cultivation."[73] Warming to his topic, he projected how natural history would reproduce imperial economies within the home country: "Lesser knowledge of science by us still cause . . . Tea, Quinine, and Cochineal to be bought yearly for great sums of money, that could be planted in Europe as easily as ever . . . Rhubarb." Moreover: "Without science our Herrings would still be caught by foreigners, our Mines be mined by foreigners, and our Libraries be weighted down by foreign works."[74]

Probably frightening princess Sofia Albertina (the sister of the future Gustav III was only six years old), Linnaeus went on in a heightened pitch: "Yes, Demons of the forest would hide in every bush. Specters haunt every dark corner. Imps, Gnomes, River spirits, and the others in Lucifer's gang would live among us like gray cats, and Superstition, Witchcraft, Black Magic, swarm around us like Mosquitoes."[75]

The pastor's son exorcised these river and forest spirits, as much a part of Scandinavian rural life as "gray cats" and "Mosquitoes," by citing a biblical image that is usually read as heralding the coming of the Messiah: "The sciences are thus the light that will lead the people who wander in darkness."[76]

CHAPTER 5

"A New World—Pepper, Ginger, Cardamon": Economic Theory

In his *Culina mutata* of 1760, a tract on the changes in European foods over time, Carl Linnaeus described some ingredients from "a new world: pepper, ginger, cardamon, cand. nutmeg, and whatever all the kinds are called." "Not to mention sugar," he added thoughtfully.[1]

Linnaeus (born in 1707) had grown up in an impoverished northern Baltic province, Småland, at a time when the Carolingian empire was collapsing, and its heartlands were swept by famines and plagues. In 1760, ensconced at Uppsala University as Sweden's first ennobled naturalist, he noted with wonder that global trade now supplied European city dwellers with once fabled glories—Asian spices, cloths, drugs, medicines, and manufactures. As *Culina mutata* and similar tracts such as *De potu chocolatae* reveal, however, Linnaeus deeply worried over the natural cornucopia of the "new world" of Asia and the Americas.[2] He even urged Scandinavians to return to the old "Gothic foods," such as acorns, pork, and mead.

To Linnaeus, the word "economy" meant both an eternal natural order and a new human science.[3] This chapter turns from his conception of the economy of nature to his view of the economies of man. In particular, it looks at how, from his assumption of an Edenic nature operative in the present, he derived the more stringent hypothesis that every country possesses all the natural resources necessary for a multifunctional economy. Linnaeus' natural theology underwrote his prophesied Swedish autarky: his assumed prelapsarian nature provided a broad cosmological frame supporting his more narrow cameralist argument that nations prosper in commercial quarantine.

Linnaeus' applied science—a new natural knowledge for the state—was inspired not only by the instrumental utilitarianism general to the early Enlightenment, but also by his adherence to the older economic doctrine of

cameralism. At the same time, he framed cameralism less as a fiscal doctrine and more as a recipe for human welfare. For example, in contrast to most Swedish economic writers of the period, Linnaeus did not espouse the classic slogan of seventeenth-century German cameralism, as it was received in Sweden: "a poor people, a rich country" (*fattigt folk landets rikedom*).[4] In this rejection of workhouses and subsistence wages and his pursuit of schemes for general prosperity, Linnaeus' personal Enlightenment, such as it was, rests.

Yet if we address how Linnaeus thought that the human economy actually operated, we must return to seventeenth-century fiscal theory. Indeed, his understanding of German cameralism, while largely second-hand, was entirely orthodox. Like the German cameralists before him, he was suspicious of money. He exclaimed that the Aztecs—who used cacao beans as a currency—were "innocent people. If they didn't have anything to eat, they ate their money."[5]

Like the German cameralists, too, Linnaeus was obsessed by gold. "Does it not make all things into slaves? And where it is missing, is not everything missing?"[6] He loved handling gold coins, and was fond of displaying his hoard to his penniless students. Being innumerate, he counted great sums by one measure only: "a barrel of gold."

As a unit of account, Sweden used copper until 1766. The Hat party (*hattarna*), which formed in the second half of the 1730s at the same time as the rival Cap party (*mössorna*), and ruled Sweden between 1739 and 1765, financed Sweden's wars and its industrial subsidies by borrowing abroad and by printing paper money. The government thus engineered hyper-inflation. By the early 1760s, and despite Sweden's great copper mines, there was no metal money left in the country. People reverted to barter and to local, home-made moneybills.[7] Under such circumstances, Linnaeus' ambitious yet prudent metal measure of value, gold, makes sense.

No wonder, too, that Linnaeus felt that his worst fears about economic mismanagement by the state were confirmed when his first student traveling abroad wrote from Cadiz in 1746 that seventy silver chests were carried aboard his East India ship to pay for Chinese tea.[8] Indeed, Linnaeus "considered no thing more important than to close that gate through which all the silver of Europe disappears."[9] In classic cameralist fashion, he celebrated Sweden's one gold mine, which yielded two pounds of metal a year, but he never understood the importance of her iron industry, which represented seventy-five percent of the value of Sweden's exports.[10]

Linnaeus was a state interventionist, too. Without pondering the matter deeply, he supported tariffs, levies, export bounties, quotas, embargoes, navigation acts, subsidized investment capital, ceilings on wages, cash grants, state-licensed producer monopolies, and cartels. To use modern analytical terms, he supported legislated market imperfections favoring domestic producers over foreign competitors and local consumers.[11] This was so even when such laws affected his science. Thus in 1757, together with an entomologist, Count Charles de Geer of Leufsta, Linnaeus pleaded with the Swedish king to be allowed to import yearly 30 pitchers of *spiritus vini*, or else to distill spirits themselves. The problem was that the monopoly on aquavit production and the consequent ban on home distillation (*hembränning*) threatened to ruin these men as they bottled their zoological specimens.[12]

Eighteenth-century economic thinkers regarded the trade balance as "the infallible centre of interest for politicians."[13] They differed, however, on how to manage it. At times, Linnaeus embraced the English mercantilists' goal of a positive trade balance even if arrived at by means of international trade. Broadly, this was also the Hats' goal. Their 1739 table of custom dues encouraged imports of raw materials and exports of finished goods. In turn, however, this *tulltaxa* was overlayered by import and export licenses. Here more cameralist turns of thoughts came into play. The Hats typically banned several hundred types of goods entering the country. More often, like the German cameralists in their uncompromising moments, Linnaeus felt that states should be autarkies, withdrawing altogether from the commercial bonds tying them to peoples and places not politically subjugated to them. He artlessly elaborated his reasoning on this to the Academy of Science in 1746: "Everything that we buy from abroad is therefore more expensive, since we must fetch it from far away, and pay others who harvest it."[14]

On a philosophical level, too, Linnaeus argued that international trade was superfluous. He even posited a kind of divine geographic distribution of equivalent goods. In his most intricate and ornate program statement of his natural theology, the *Oeconomia naturae* of 1750, he noted that though "foreigners" owned goldfish, lemons, peacocks, and gold, Scandinavians possessed herrings, cloudberries, black grouse, and iron. In the same breath, this Northern naturalist conceded that Southerners had more "green things," as well as "beautiful turkeys" and other useful animals. Yet this was only because God so compensated them for their diseased air, putrid waters, ill health, and "snakes, lions, tigers, crocodiles, etc."[15]

As Linnaeus saw it, this divine replication of functional types of *naturalia* across political boundaries supported him in his goal to maximize national economic self-sufficiency. In the 1740 program of his science, he admitted that "Nature's Master has given each and every country its own special advantages, so that what is lacking in one, can be won in the other." But he immediately added: "a wise Inhabitant, Owner and Economist knows how to use this to his own advantage, so that he and no one else gains that which is lacking."[16]

At other times, Linnaeus miniaturized such comparative advantage into a question of regions within countries. In his Dalarna *resa* of 1732, he aimed to "see how each province has its advantage; see how it can be improved . . . see how one province can be helped by the practice of another."[17] His Uppsala colleague Anders Berch expressed the same thought in a letter to the Academy of Science in 1759. If naturalists directed the domestic economy, he wrote, they could "work out a general method, according to which political values [*politiska värderingar*] could be employed, not only in farming but also in mining, manufactures, trade." In this way, he continued, "each county could have its own main occupation, one grow grains, another keeps cows, butter and cheese, leather, a third takes care of sheep, a fourth rears horses: another grows linen and hemp, another fishes, another works wood, builds barrels, burns tar, saws [timber], and so on."[18]

Linnaeus' cameralism also colored his understanding of tribal people and non-European societies. Generally, he invoked the customs and habits of foreign cultures, as we moderns do, to widen and expand his own culture's sense of the natural and the proper. "All four-footed animals can be eaten," he asserted, "as the Chinese prove with their own Example. The most cruel snakes are Americans' food."[19] As we saw earlier, Linnaeus also described Scandinavia's indigenous nomads as "happy Lapps" or ideal cameralists, whom other Europeans would do well to emulate. Linnaeus' students, too, attempted to pinpoint an ideal cameralist state to a real place and time. Most often, they chose China and Japan as their examples. When Carl Peter Thunberg returned from Japan in 1779, he gave a speech at the Swedish Royal Academy of Science. Thunberg, who was the only European naturalist to have investigated the country since the late seventeenth century, fashioned his report as a panegyric to "a foreign most respected Nation."[20] At the same time, he prefaced the account of what he had learned during his six months in Japan by condemning the practice of traveling. His speech makes

clear that he disapproved of all contacts, and especially trade links, between nations.

In 1775 Thunberg had taught the Shogun's physicians and Dutch translators European medicine in his hotel rooms in Jedo (present-day Tokyo) and in Nagasaki. These hotel sessions marked a turning point for Occidental medicine in Japan: they were elaborated by Yoshio Nagaakira in *Komohijiki* (Secrets about the Red-Haired Ones), *Komoryukoyakukata* (On Western Ointments), and *Thunberg koden* (The Oral Traditions Surrounding Thunberg).[21] Thunberg had seen how painstakingly these learned men wrote Dutch, in watercolor and with paintbrushes. He knew how keen they were to get hold of European books, and how they had learnt by heart the few seventeenth-century medical texts they did possess. He had been overwhelmed by their questions, delivered in rudimentary Dutch. (Some translators spoke no Dutch at all. Others had generated Dutch from old books, and spoke a home-made version only tenuously related to the spoken language of Holland.)

Yet Thunberg by no means lamented the isolation in which his Japanese friends found themselves. Rather, he told his listeners that he brought no economical or ethnographical objects to demonstrate, because the Japanese had wisely forbidden such exports. He strewed on the table a few small coins instead, as his only souvenirs and mementos. As Thunberg explained to his audience, the Japanese had long ago expelled the "immeasurably greedy" Portuguese. After they "happily had rooted out, wholly and completely with its roots, this countrywide malignant canker, a wise, sensible and clever Government" forbade Japanese to travel abroad, and Chinese and Dutch merchants to travel within the country.[22]

Thunberg admitted that the Japanese traded copper and raw camphor for raw materials such as sugar, tropical hardwoods, ivory, tin, lead, and tortoise shells. He passed in silence over manufactured imports (which indicate a technological lag), such as eyeglasses, mirrors, pocket watches, and medicines.[23] Instead, he stressed that apart from a few imported trinkets, the Japanese were economically self-sufficient, and thus politically independent. "No Nation in the Indies more guards its freedom than the Japanese, and none is more free from the Europeans' violence, crookery, and force that is so commonly practiced in the Indies."[24]

Thunberg also admired Japanese medicine and politics. He claimed that the Japanese drank no alcohol, used tobacco only sparingly, and hardly knew even the term for coffee. They cared nothing for fashions. As he saw

it, all Japanese dressed in a "National dress, with consists in one or several foot-length Nightgowns."[25] This would have interested his Swedish audience in 1779. To improve the Swedish trade balance, and to discourage vanity and social differentiation by rank and degree, Gustav III had legislated a "national costume" made from all-domestic materials. The same idea moved Linnaeus to suggest that Uppsala students wear uniforms, "be they Counts, Barons, Nobility or sons of Landless Peasants."[26] Japan provided a model. Their "Nightgown," Thunberg improbably claimed, "is so commonly worn and so alike for the entire nation, that there are no differences, even from the Emperor, unto the lowliest Fisherman."[27]

Another of the Linnaeans' favored example of a cameralist nation was China. Consider, for example, a 1762 verse lecture, written by a student of Linnaeus, "on the necessity and utility of plantations." As this student saw it,

> The Chinese urges us to follow his example,
> His industry and household sense can not be praised too highly.
> From travel books one sees, with great amazement, how they grow tea
> and rice and spices. . . .
> And tempt thousands of trading ships to their harbors. . . .
> I can predict with assurance, that it will be less a disgrace
> To learn how to behave from the Chinese and the Heathen,
> Than to pay fines to him, as we do now,
> And give him gold, for clay and toys.[28]

Despite the high moral tone of this Linnaean poem, its message is not merely one of renunciation (of a misplaced pride in one's own customs and ethnicity). It also offers a positive model of a unified economic order, where all hands are kept busy for the common weal. As we saw earlier, Europe had few manufactured goods to offer in return for Asian "clay and toys," or porcelains, spices, silks, and teas. It was to reverse this trade pattern that the Linnaeans held up the ideal Chinese, gleaned from travel accounts.

Historians have interpreted eighteenth-century European contacts with the non-European world as a prelude to the high imperialism of the late nineteenth century. The future of global relations, however, was not thus transparent and preordained to Europeans of the time. In the mid-eighteenth century, Europeans considered the Chinese their technological and economical equals. As the French historian Fernand Braudel has noted, "the gap between the West and the other continents appeared *late in time*."[29]

(Indeed it may be only a historical parenthesis, now vanishing.) As Linnaeans saw it, Europe should cut its links to Asia by modeling itself on Asia.

A student annotation from one of Linnaeus' lectures summarizes that political goal (at least as the student heard it): countries should "investigate what they themselves have and don't need to rely on the foreigner for . . . because this is the ground for [a good] economy."[30] This view also colored Linnaeus' visit of 1746 to the Alingsås textile factory, an enterprise founded with much fanfare in 1724. After twenty years of state subsidies and trade barriers, this family-owned garment industry loomed, cut, and sewed only a few pieces of badly made garments, unable to compete with either smuggled foreign goods or homespun peasant wares. Yet Linnaeus, who was a friend of the owner (a fellow member of the Swedish Academy of Science), saw no problems with the losing enterprise. He gloried in the fact that "our own countrymen"—or "Swedish hands in Sweden"—now produced cloth as good "as ever other nations abroad."[31]

In a speech delivered during Uppsala University's doctoral commencement of 1759, Linnaeus demonstrated how he defended this myopic productionism. After "greet[ing] all family fathers and inhabitants of this academy and city, both from the higher and lower estates," he deduced "the birth of that science, which is called Economics," from his natural theology—his fervent, if troubled, faith that nature still existed in a state of prelapsarian grace, and for the benefit of man.

As he explained to Uppsala's "family fathers," the science of economics derived from the truths of theology. "God has now given man for his needs and comforts everything under the Sun. . . . He can only sustain himself and thrive from their use, if he should take as his goal to use each one according to its correct purpose." The professor concluded triumphantly, if clumsily: "Therefore nothing else could have come about among mankind apart from the birth of that science, which is called Economics."[32]

To Linnaeus, then, "economics" did not mean the study of how most efficiently to allocate scarce resources given infinite demand. He viewed it instead as the discipline of how to husband the natural world. As he put it in 1740: "The science that teaches us to use *Naturalia* through the Elements (4) for our use is called Economics."[33] To Linnaeus, "economics" was a conglomerate of applied forms of natural knowledge. It was a technology, subdividable even into "mineral economics," "vegetable economics," and "animal economics."[34]

At the same time, Linnaeus did not import into his national economics the

concepts that he employed in his analysis of the divine economy. While in a general sense his human economics is predicated on the divine economy (and especially his conceptions of natural plenitude and prelapsarian nature), we do not find here the notions of equilibria we encountered in the previous chapter, such as checks-and-balances and feedback loops. He modeled the intermediate-sized unit of analysis, the economy of the nation, on mechanistic notions of force, even as he modeled global nature and individual households (and also the body and its health) around notions of equilibria.

Linnaeus' national economics is a machine. Nature itself existed in a state of harmony. But he denied a similar *harmonia praestabilita* in the economic realm. "Good economics" was not a matter of an initial calibration of balance. Rather, he imagined entirely different economic mechanisms and processes in the human realm. Its governing metaphor, as we may put it, was that of pulleys and levies, and its inherent tendency, again in our language, was reversion to entropy.

Linnaeus' economics was also an optimistic—even a Candidean—enterprise: "The most savage wilderness, where hardly a sparrow can feed itself, can through good economics become the most wonderful land."[35] Yet at every turn, his imaginary economy, his "most wonderful land," is seen to depend on the ongoing intercession of the naturalist civil servant. This also means that Linnaeus himself stands outside that more general reception of his thought when Adam Smith, upon reading the great botanist, imports the cybernetic concepts governing Linnaeus' natural theology into his human economics of the "invisible hand," and Charles Darwin in turn re-imports Linnaeo-Smithian conceptions of the economy and its self-regulatory features into the realm of nature.[36]

Linnaeus was under the sway of a fashion for economics that swept Sweden in the earlier part of the Era of Freedom (1718–1772). His Candidean cameralism, his views of how economics and the economy were related to the natural sciences, were widely shared by his countrymen. In the Great Northern Wars with Russia (1700–1718), Sweden had lost her Baltic colonies—Estonia, Stettin, Bremen, Verdun, Livonia, Ingria, and most of Pomerania and Karelia. Only Finland, Wismar, and Swedish Pomerania were left. Contemplating this defeat, the Swedish state elites determined to continue the imperial policies of their seventeenth-century forefathers by other means. Increased productivity would replace territorial conquest. Aided by

naturalists, Sweden's nobility thus hoped to exchange the sword for science, a Baltic empire for a Swedish nation, and military victories for manufacturing ingenuity.[37]

One of Linnaeus' colleagues at Uppsala University, Anders Berch, typically made the need for improving manufactures and agriculture the center of his teaching.[38] The first professor of cameralism in Sweden, Berch modeled his task on the first chairs in cameralism at Halle (1727), Frankfurt-am-Oder (1729), and Rinteln in Hessen (1730). In his teaching he merged law, physics, and natural history, in order that they be combined and applied to economics.[39] As Berch saw that task, it was a practical and concrete one. (His students complained bitterly about their "Dung-Exams.")[40] His 1747 textbook in economics—which upheld the dogma of seventeenth-century German cameralism—was used at Swedish universities until 1829. For over fifty years, it remained the only introduction to economics written in Swedish. Generally, too, the works of economics that were translated were German cameralist tracts. Adam Smith's *Wealth of Nations* of 1776 was first published in Swedish in 1800, and then only in the form of a translation of a short German summary.[41]

Another acquaintance of Linnaeus', the engineer and mathematician Christopher Polhem, argued upon the founding of the Swedish Academy of Science in 1739 that "the economy is the key goal" of the new institution, and that the academicians ought to work "as tireless servant maids in all areas that can help improve the economy." The Academy's secretary, the statistician Pehr Wargentin, more grandly claimed that its founding had inaugurated a new era, in which economics was "like a sea into which all rivers ought to flow."[42]

In his first sustained formulation of his view of economics, published in the first volume of the Academy's Acts in 1740, Linnaeus similarly stated: "No science in the world is more elevated, more necessary, and more useful than Economics, since all people's material well-being is based on it . . . thus, also the means of Physics and Natural sciences, without which no Economics can survive."[43] In a sermon of 1763, he elaborated: "nature's economy shall be the base for our own, for it is immutable, but ours is secondary. An economist without knowledge of nature is therefore like a physicist without knowledge of mathematics."[44]

Unsurprisingly, Linnaeus' students came to consider a knowledge of economics a useful credential. It was typical that, when Daniel Solander was about to embark on his foreign journeys in 1759, he asked Linnaeus for a

"certificate about his progress in those parts of Natural History which lay the grounds for economics."[45] Concerning another student, Eric Gustaf Lidbeck, Linnaeus approvingly noted that Lidbeck understood his task to be to "apply natural history to economics."[46] Yet another Linnaean student, Pehr Kalm, acknowledged to his teacher "that Natural History is the base for all Economics, Commerce, Manufacture . . . because to want to progress far in Economics without mature or sufficient insight in Natural History is to want to act a dancing master with only one leg."[47]

In the Uppsala University lectures Linnaeus gave after 1741, he underscored that "our own economy is nothing else but knowledge about nature adapted for man's needs."[48] In turn, this reading of economics was linked to the ambitions of the state and its tax-collecting organs. For example, the estates' committee on commerce and trade financed Linnaeus' 1741 voyage to look for herbs in the Baltic archipelago, so that the estates could continue to safeguard a healthy populace, while "restrict[ing] apothecaries' freedom from custom duties."[49]

Perhaps the farthest-reaching political reform suggested in Sweden during the Era of Freedom was a 1738 proposal to the estates made by the mathematician Anders Gabriel Duhre. He envisioned an Economic Society, or state department, that would be run by naturalists and would own all means of production—including manufacture, agriculture, fisheries, international trade, and shops.[50] Rather vaguely, Duhre suggested that in order to prevent bribery and corruption, the scientist managers should not be allowed to become "too" rich.

Less drastic suggestions for reforms that were still formulated upon this conception of state agencies controlling means of production were common in the period.[51] They often originated from supporters of the mercantilist, anti-Russian, and lesser nobility Hat party (*hattarna*). At the same time that modern party politics were emerging in Sweden in the 1730s, the participants in this novel experiment debated in an innovative spirit how to theorize the limits for state intervention. (One sign of this exploration is that Sweden was the first country in Europe to abolish censorship laws.)

Linnaeus never committed himself publicly to either the Cap or the Hat party. As a royalist and old-fashioned moralist, he was suspicious of Sweden's new-fangled party politics and the estates' near-absolutist powers. Such politics contrasted starkly with the royal absolutism under which he had grown up, and in celebration of which he may have received his Christian name, after the Carolingian kings. Nonetheless, he moved in Hat circles,

and his public career closely coincided with the Hats' parliamentary rule (1739–1765).

During 1739, when the Hats ousted Count Arvid Horn's cabinet, Linnaeus lived in the Stockholm palace of a leading Hat and future chancellor, Count Carl Gustaf Tessin. As he later remembered, "all the Hats called Linnaeus their chief doctor (jokingly)." That year, his practice "grew incredibly." As "Cleon" and "Seminte," Linnaeus and his young wife also joined a pastoral order in Stockholm which had many Hat members.[52] In the same spirit, he supported industrial ventures like Alingsås. These manufactures were favorite Hat projects (even though some had been started as early as the 1720s). Linnaeus deviated from the Hat party line only in that he was also concerned about agriculture (which employed about seventy-five percent of the Swedish work force). Unlike many Hats, he did not worry only about manufacturing (which employed less than a tenth the number of people).[53]

In 1739 Linnaeus was also one of the six founders of the Swedish Academy of Science. The Academy was widely assumed to be a Hat institution. Most early members were Hats. Obvious candidates who belonged to the rival Cap party were not elected. One prospective member, an Uppsala professor of mathematics, suspected that its catch phrase, "honest Swedish men," was a code for "Hat supporters," and therefore declined to join.[54]

At its outset, the Swedish Academy of Science narrowly valued utility over curiosity. It favored only those applied sciences which could be harnessed in a state-building effort. "Here only those sciences are dealt with which serve the Fatherland's development."[55] This patriotic cause also involved discarding ranks and degrees. The Academy emphasized the equality of a shared Swedish nationality among its members (while Sweden's territories encompassed several nationalities, most importantly Finns, the political nation during the Era of Freedom was largely ethnically Swedish). As one founder emphasized, at the Academy's meetings "a Chancellor will not consider himself too good to sit down next to an Artisan."[56]

This radicalism had precedents in the political movements of the 1730s, which challenged the Swedish state to provide a social order in which status would derive from state positions, not from family lineages. In that decade, the clergy, the parsons, the burghers, and the lower nobility (*ämbetsmannaadeln*), a permeable class of civil servants, seized the political powers previously held by the high nobility and the Wasa kings. But the academicians were even more radical levelers. Because of their egalitarian point of

view, Linnaeus could become their first president, even though in 1739 he was not yet a professor and was not yet ennobled. For the founders decided to award this honor by lottery, "since the Gentlemen had determined that no positions in this Academy should be distributed according to the dignity of position and profession."[57]

The founders of the Swedish Academy of Science also planned to publish their Acts (f. 1739–) "only on economic and practical matters, and this in the mother tongue."[58] Partly thanks to their new emphasis on the vernacular as a language of science, the Swedish language rapidly modernized during the 1740s into early new Swedish (*yngre nysvenska*). At the same time, Swedish printing was shifting from the Gothic to the Antiqua typeface. The type in which the Acts of the Academy of Science should be set was heatedly debated among the founders. Reflecting a typical cameralist worry over trade balances, as well as the prickly self-esteem of a small nation, the supporters of Antiqua type argued that because of Gothic script, foreigners "hold us to be an ignorant people, rarely read our books, hold our language in contempt, and thus ensure that we yearly have an incredibly negative balance [of payments] in the book trade with foreigners." The Gothicists responded, however, that "a large part of our women and ordinary farmers"[59] only read Gothic script—a valid objection, given the Academy's popularizing goals.

In the beginning, the founders of the Swedish Academy of Science called it the "Economic Society of Science." In their first protocoled meeting, chaired by Linnaeus, they changed the name to the grander-sounding "Academy." But they did so stressing that "for goodness' sake, no one will be admitted as a Member who does not love useful sciences and also does not have some insight into some part of them." Having settled on the name, "they also agreed that in order for the Public to understand more easily this institution's and its chosen name's *actual* intention, the title of its to-be-published Acts shall be as follows: 'The Academy of Sciences in Stockholm's Acts, containing new remarks, inventions, discoveries, and experiments, which will serve the growth and development of useful Sciences, Economy, Trade, Manufactures, and several publicly necessary Arts and Artisanal trades.'"[60]

After his call to a chair at Uppsala University in 1741, Linnaeus began to plan how to reform Baltic universities, too. In 1756, his student Pehr Kalm wrote to him from Philadelphia to describe the founding of the University of Pennsylvania: "Nat Hist and useful sciences are hardly mentioned; Latin, Greek, Logic, Rhetoric, etc., get first place, and those professors the highest salaries: never has the English nation embarrassed itself as much as in this . . . I think your stomach would ache, Sir, if you read" the university bylaws.[61]

It might indeed have ached. In 1746, Linnaeus had helped to compose a "pro memoria," submitted to the diet of the national estates by the chancellor of justice, which urged that all university students be compelled to study natural history—including the care of Spanish sheep and silk worms.[62] Theology students, he wrote, must be required to take a degree in medicine before they were admitted into the Church. "This whole science the students could easily learn . . . in eight days at the most."[63]

Two years earlier, Linnaeus had pleaded with the estates that university degrees only be granted after students passed exams in botany, "and especially, all its uses in *oeconomicis*." Taking the fir-tree (*tall*) as an example, he outlined the kinds of things a qualified graduate should know about it: how to harvest resin, how to produce rosin, pitch, tar, charcoal, firewood, and timber, how to bake bark bread, and how to use saps and shoots to cure scurvy. He closed his massive list by an off-hand remark. "And in the like manner with all other plants."[64]

For Linnaeus regarded the clergy as crucial mediators of his science. "The Gentlemen Graduates become most all of them Parsons, spread over the entire country, mostly in the Countryside. . . . The common Man's inclination and money don't allow him to do experiments; but [he] copies everything that he sees in his Church that his Parson succeeds with."[65]

When Anders Berch arrived at Uppsala University in 1741 to take up his position as Sweden's first professor in cameralism, he founded an "economic-mechanical theater"—at once a library, a collection of production samples, and an array of models of agricultural and manufacturing tools.[66] It complemented Linnaeus' collections of *naturalia*. The natural and the artificial were thus both represented at the little university, with its encyclopedic effort to catalogue and display all that people might grow or manufacture.

On Linnaeus' instigation, additional professorships were endowed in what he termed "practical economics, based on natural science."[67] Except for Greifswald University, every Swedish university received such a chair: Åbo University in 1747, Uppsala University in 1759, and Lund University in 1760. In their teaching, these chairs typically combined cameralist theory with the technologies of mining, manufacture, and agriculture. As Linnaeus defined the duties of the holders of these chairs, they should "apply Natural

history to private economics" by giving courses "in the mother tongue, . . . [in the] first year Earth and Minerals, care of Fields etc., second year Plants and their uses, Plantations, Dye Plants, Hedges, Forests, etc., third year the Animals: hunting, bird catching, fishing, silkworms, etc., and thus within three years all parts of economics."[68]

Already in 1758, a leading German cameralist claimed that Sweden taught economics better than the polities of his homeland.[69] In 1780, Pehr Kalm's funeral orator noted that the Era of Freedom was "the period, when Sweden's ancient pleasure in wars and battles turned instead . . . to peaceful achievements." "Economics was encouraged, and Sweden had the honor of being the first to transform it into a proper science, and graft it onto the Academic disciplines."[70] Yet the Linnaeans' rage for utility contained a fair dose of Romanticism. The Uppsala professor in "practical economics" was to live on an experimental farm, and his first three years were to be spent on voyages of discovery.[71] Because of the contingencies of eighteenth-century academic patronage, however, little came of this ambitious project. The Uppsala chair, for instance, was donated by an acquaintance of Linnaeus' and the owner of an iron works, Eric Ericsson Borgström. According to academic custom, Borgström could appoint its first holder. He settled on an obscure man, a certain Johan Andersson Låstbom, after having restricted the search to candidates born in Värmland, his own forested and sparsely settled home province.

Låstbom soon resigned and became a parson (1771), then a professor of the Uppsala theological faculty, and finally a dean of Uppsala cathedral (1790). Linnaeus had greater influence, however, on candidates for the Åbo chair of 1747. This position was given to one of his favorite students, Pehr Kalm. The second short-listed candidate was Pehr Adrian Gadd, also one of Linnaeus' followers. Like Kalm, Gadd specialized in botanic acclimatization experiments. Similarly, in 1760, the first holder of the Lund chair was Eric Gustaf Lidbeck, also one of Linnaeus' pupils and a keen experimenter with floral transplants.

In the field of economic science Linnaeus always favored those of his students who specialized in transmutationist botany, a science that assumed that nature was so malleable that by means of floral transplants naturalists could assure independent yet complete state economies. For he believed that in order to accommodate the political fact that nations prosper best in a state of self-sufficiency, God had so created the natural world that each principality duplicated in miniature the world economy. Nature provided all the ingredients necessary for a complex and complete economy within each geographic area constituting an independent commonwealth.

Linnaeus was also profoundly troubled by human suffering, by "little children's whimpering, suffering and death agonies" during famines, say. This is also why he coupled nature (*natura*) and nation (*patria* or *Faderland*). By using his natural knowledge to alleviate human suffering in nature, and by extension, in the cameralist state, he hoped to provide a material theodicy.

Through this intertwined understanding of nature and nation, Linnaeus questioned not only the mercantile imperial impulse, but also, in effect, what economists since Adam Smith have regarded as the engine of economic growth: international trade and its concomitant global specialization of labor (which we ground in nations' observably diverse natural and human resources).[72] Linnaeus' botanic transmutation provided an alternate reading of international economics. He suggested, for example, that growing tea in Sweden was equivalent to a war victory. "Imagine then what great provinces are not added through this to our land."[73]

Linnaeus held to this understanding of economics until his death. When as an old man he summarized his achievements, he only remembered his economic work. In 1775, on his election to the Royal Patriotic Society, he composed a "merit list": "to apply nature to economics and vice versa." Here he listed his travel journals and his cameralist pamphlets on topics such as "medicinal herbs that grow wild and that could be grown within the nation," "native plants that can be used for dye factories," and "plants that serve as food in times of famine." At the end of this list, in that shorthand that senility brings, Linnaeus appended his last words on the achievements of his science: "first produced rhubarb and 600." To fill in the blanks between memory, thought, and hand: "I first procured rhubarb in Sweden and 600 other plants."[74]

Yet Linnaeus' native ideas of "improvements," his notion of the technological, economic, and social benefits to be captured within his localized realm, or his *fädernesland*, were narrowly circumscribed. Obviously, he could not imagine chemical and electrical industries, precision engineering, or inanimate and nonrenewable energy sources. He had few notions of mechanized manufacturing of any kind, except for some mining machinery. He did not understand Newtonian sciences such as astronomy, mechanics, and mathematics. Mathematical analyses of inductions based on systematic experiments were foreign to him. Instead, he turned numbers themselves into mystical principles. "Nature is balanced between opposites and always di-

vides itself into quintuples." At other times he suggested that nature is organized around the number seven, or twelve. Invoking the rhetoric of a new and empirical science, he noted about his numerology: "with examples all this was proved. What can be more powerful?"[75]

Linnaeus' antiquated natural philosophy blended biblical creationism and Empedocles' and Aristotle's two thousand-year-old cosmology, with its four elements of water, earth, fire, and air.[76] It was a philosophy largely in place by the mid-1730s, and one Linnaeus would live to see outmoded. By the 1770s, students mocked the old professor, the Order of the Polar Star dangling from his soiled coat, repeating antiquity's zoological commonplaces about such things as swallows wintering at the bottoms of lakes.[77]

Even Linnaeus' living spaces resembled a Renaissance *Wunderkammer.* As he saw it, the dwelling reflected nature's harmony, which in turn was analogous to the orderings of his study. "The earth is then nothing else but a museum of the all-wise Creator's masterpieces, divided into three chambers."[78] From his student days on, he arranged around himself a microcosm of that world museum. "You ought to have seen, my reader, his museum, which was available to all his auditors, and you would have been overtaken by admiration for, a sense of well-being in, yes love for this home of his."[79]

In Linnaeus' house parrots and monkeys played among stuffed animals, potted plants, insect specimens, mineral samples, scientific instruments, and herbaria sheets. The walls of his rooms disappeared behind tangled branches—some thirty species of songbirds nested in them. Using fish-glue, Linnaeus pasted botanic prints as wallpaper. He also hung on the walls framed portrait engravings of botanists, sheets of paper with handwritten botanic annotations, and pressed plants (they looked like silhouette portraits). Shells and conches dangled from iron nails. Next to family portraits and plaster medallions of royalty, he arranged likenesses of guenon monkeys, a sketch of his tame raccoon, a drawing of a whale captured off Norway in 1719, and a porcelain and plaster double medallion of Solander and Banks, marked Wedgwood & Bentley.[80]

Over doorways Linnaeus pencilled Latin mottoes.[81] And on top of cabinets, he balanced pieces of china decorated with his own heraldic flower, *Linnaea borealis.* He added Chinese shell arrangements and Spanish cork statuettes of a type sold to sailors, depicting Africans covered by artfully arranged mussel-shells.[82] Over the sanded, broad-planked floors, he strewed his botanic manuscripts, which blinded nightingales splattered with droppings while raccoons played and clawed among them. He clad the ceilings in birdskins and hung his Lapp costume on the wall "together with other curiosities."[83]

In this emporium of art and organic nature, the materials and methods of what would come to be termed the 'hard' sciences found no place. Nor did Linnaeus interest himself in the instruments that excited so many in his generation, such as diving-bells, steam-engines, air pumps, telescopes or even, though he used them, microscopes.

When Linnaeus lectured in botany to the Swedish House of Nobility in 1739, he promised the listener "more profit in these [lectures] than [if] he learnt all logic, metaphysics, History, Poetry, rhetoric, Greek, Hebrew in the world."[84] He did not, however, compare his efforts to earlier lectures on natural philosophy given in the House, and especially not to those on "the new science" which Mårten Triewald had delivered there in 1728 and 1729. In these popular talks, Triewald had explained Newton's mechanics. He showed how it informed the machines he was then constructing: Sweden's first steam engine, and Sweden's first diving-bell. Triewald had also demonstrated his instrument collection, including an air pump, and performed chemical experiments.[85]

When Linnaeus spoke of economics as a conglomerate and all-encompassing technology, his vision of the potential of this technology was confined to the betterment of flora and fauna. And when he lobbied for educational reforms, he was concerned only with his amalgamation of economics and natural history. In many ways he was a typical Enlightenment improver. But he ignored the power of the physical sciences to improve society, never reflecting, for example, on the progress made during his life-time in ferrous metallurgy and hydrodynamics.

In the world of Linnaeus forces were animate (such as horsepower and human muscle) or renewable (such as wind and water). His shoes were stuffed with grass, his pillow filled with hay, and his clothes were woven from sheep wool and dyed with herbs. He rode horses, wrote with goose feathers, and read by the light of ox-tallow candles.

In turn, his understanding of economic "improvement" was confined to a qualitative elaboration of this living world which he inhabited. He wanted to perfect, not to break, what he saw as a God-ordained link between nature and man. In his projected future, shoes would be stuffed with cotton grass, pillows filled with eiderdown, and cloth woven from buffalo wool and dyed with tropical insects. He hoped to ride elks, write with swan feathers, and read by the light of seal-fat lamps.

Linnaeus simply could not envision economic growth. At times even his philosophizing about projects of improvement appears as a form of elegiac contemplation. For example, in his first cameralist program-statement, "Thoughts about the Foundation of the Economy" (1740), he began by pointing to the enormous potential of his knowledge of nature for generating wealth. Towards the end of the treatise, however, he retreated to the modest hope that he might alleviate Scandinavia's recurrent famines and epidemics by teaching his theology students about bark breads and herbal medicines.

If the rural clergy knew some botany, "the Farmer could be taught which [wild plants] can serve as bread during scarcity times; also he could more easily find during times of illness House Medicines growing by him." Linnaeus closed the essay yet more modestly. "But I wish for too much; for however small this matter may seem, there still does not exist a Polity in the world which has enjoyed this benefit"[86] of saving its people from plague and starvation.

CHAPTER 6

"Should Coconuts Chance to Come into My Hands": Acclimatization Experiments

Apart from his travels in the Scandinavian provinces, Carl Linnaeus only once embarked on an extended journey, at the time of his youthful sojourn in Holland, France, and England between 1735 and 1738. He passed up offers to explore the Cape, Pennsylvania, and Surinam. Starting in 1741, when he became a professor at Uppsala University, he chose instead to sponsor long-distance travels undertaken by his pupils—whom he called his "apostles" or "disciples."[1]

Between 1745 and 1792, nineteen first-generation students of Linnaeus' left on far-flung voyages of discovery that he helped arrange. With typical hyperbole, Linnaeus spoke of the voyage of discovery as a Swedish invention that was later copied by Joseph Banks (Australia and the Pacific), Johann Georg Gmelin (Siberia), Michel Adanson (Senegal), and José Celestino Mutis (South America).[2] Yet Linnaeus had reasons for boasting. Daniel Solander was Joseph Bank's botanist on Captain Cook's first circumnavigation of the globe (1768–1771). Anders Sparrman was the botanist for Johann Reinhold and Georg Forster on Captain Cook's second circumnavigation (1772–1775). Carl Peter Thunberg, working as a ship's surgeon in the Dutch East India Company, was the first Western naturalist in a century to visit and study Japan (1770–1779). Pehr Kalm, financed by the Swedish government, criss-crossed northeast America (1748–1751). Pehr Löfling, employed by the Spanish crown to revive natural history in Madrid, explored parts of Spain and Spanish South America (1751–1756). Pehr Forsskål took part in a Danish royal expedition through the Ottoman Empire and the Arabian peninsula (1761–1763). Johan Petter Falck, as part of the Russian imperial Orenburg expedition, explored the Caucasus, Kazan, and Western Siberia (1768–1774). Other, now obscure, Linnaean voyagers took the well-worn Guangzhou route, abandoned their science during their treks, returned insane or mortally ill, or died early on in their travels.