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*Why Some Are So Rich
and Some So Poor*

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Winners and Losers: The Balance Sheet of Empire

The discovery of America, the rounding of the Cape, opened up fresh ground for the rising bourgeoisie. The East-Indian and Chinese markets, the colonization of America, trade with the colonies, the increase in the means of exchange and in commodities generally, gave to commerce, to navigation, to industry, an impulse never before known, and thereby, to the revolutionary element in the tottering feudal society, a rapid development.

—MARX and ENGELS, *Manifesto of the Communist Party*

The turn of the eighteenth century was both end and beginning. It saw the liquidation of the Dutch East India Company; the prohibition of the British Atlantic slave trade (but not the end of slavery);* the peak and decline of the sugar bonanza (including revolution and the fall of planters and plantations in Saint-Domingue [now Haiti]); an end to the Old Regime in France; an end to the period of Old Empire. The new era would see Europe lose formal control of territory overseas (Spain would be the big loser) but gain wider economic dominance. Europe would also force its way into territories previously seen as inaccessible and untouchable (China, Japan), while creating in others (India, Indonesia) a new kind of imperium in its own image.

The hinge of this metamorphosis was the Industrial Revolution, begun in Britain in the eighteenth century and emulated around the world. The Industrial Revolution made some countries richer and others (relatively) poorer; or more accurately, some countries made an industrial revolution and became rich; and others did not and stayed

* In places such as the Caribbean, however, where the pool of slaves could not maintain itself by natural reproduction, the interdiction of fresh supplies would kill the old plantation system.

poor. This process of selection actually began much earlier, during the age of discovery.

For some nations, Spain for example, the Opening of the World was an invitation to wealth, pomp, and pretension—an older way of doing things, but on a bigger scale. For others, Holland and England, it was a chance to do new things in new ways, to catch the wave of technological progress. And for still others, such as the Amerindians or Tasmanians, it was apocalypse, a terrible fate imposed from without.

The Opening brought first an exchange—the so-called Columbian exchange—of the life forms of two biospheres. The Europeans found in the New World new peoples and animals, but above all, new plants—some nutritive (maize [Indian corn], cocoa [cacao], potato, sweet potato), some addictive and harmful (tobacco, coca), some industrially useful (new hardwoods, rubber). These products were adapted diversely into Old World contexts, some early, some late (rubber does not become important until the nineteenth century).

The new foods altered diets around the world. Corn, for example, became a staple of Italian (polenta) and Balkan (mamaliga) cuisines; while potatoes became the main starch of Europe north of the Alps and Pyrenees, even replacing bread in some places (Ireland, Flanders). So important was the potato that some historians have seen it as the source and secret of the European population “explosion” of the nineteenth century.¹ But not only in Europe. Grown on poor, hilly soils, the potato, along with peanuts, sweet potatoes, and yams, provided a valuable dietary supplement for a Chinese population that in the eighteenth century began to outstrip the nourishment provided by rice.

In return, Europe brought to the New World new plants—sugar, cereals; and new fauna—the horse, horned cattle, sheep, and new breeds of dog. Some of these served as weapons of conquest; or like the cat and sheep, took over much of the land from its inhabitants. Worse yet by far, the Europeans and the black slaves they brought with them from Africa carried nasty, microscopic baggage: the viruses of smallpox, measles, and yellow fever; the protozoan parasite of malaria; the bacillus of diphtheria; the rickettsia of typhus; the spirochete of yaws; the bacterium of tuberculosis. To these pathogens, the residents of the Old World had grown diversely resistant. Centuries of exposure within Eurasia had selected human strains that stood up to such maladies. The Amerindians, on the other hand, died in huge numbers, in some places all of them, to the point where only the sparsity of survivors and some happy strains of resistance enabled a few to pull through.

Why the Eurasian biosphere was so much more virulent than the

American is hard to say. Greater population densities and frequency of contagion? The chance distribution of pathogens? Where were the Amerindian diseases? Only one has come down to us—syphilis, which the French called the Italian disease, the Germans the French disease, and so on as it made its way from seaports to the rest of Europe.*

Yet the invaders had their own weaknesses. American visitors to Mexico call travelers' diarrhea "Montezuma's revenge"; those to India speak of "Delhi belly." Such tags are supposed to be funny, but in fact, Europeans migrating to these strange lands in the early centuries fell easy victim to local pathogens and infections and died "like flies."² Depending on place. Climate and hygiene—modes of evacuation and waste disposal, water supply and run-off, personal habits, social customs—could make all the difference. Thus the Indian Ocean area was three to four times more virulent than the temperate zones; the West Indies and American tropics up to ten times more; and West Africa was a one-way door to death. Mortality rates there ran fifty times higher.³ Within these larger regions, higher densities made for festering pest-holes: Bombay in India, Batavia in Indonesia. A jacket illustration of Fernand Braudel's trilogy (*Civilisation matérielle*, etc.) shows a well-to-do Portuguese family in Goa dining in a water-covered room: the table stands in water; their feet rest in water. This no doubt kept crawlers from joining the repast, but it was an invitation to enemy swimmers. Forget about flyers.

Oceanic migrations, then, voluntary and involuntary (slaves), brought much death into the world and much woe. But also riches and opportunity for the Europeans, whether leavers or stayers. That is the law of migration in market societies: people go to improve their situation, and so doing, enhance the bargaining power of those left behind; while in their new home they create or seize wealth (food, timber, minerals, or manufactures) to ship or take back to the old country.

These gains were realized only slowly. Not until the nineteenth century did improvements in transport open the American Midwest to commercial agriculture. These same advances made immigration much cheaper and easier, just in time to tap an unprecedented upswing in European population. But even the smaller movements of the earlier pe-

* Some medical ethnologists question the American origin of syphilis, pointing to evidence of pre-Columbian venereal disease in Europe of somewhat similar course and effects. But similar is not identical, and there is no question that syphilis became an epidemic phenomenon only in the sixteenth century. Compare AIDS, which may be older than we know but surfaced as an epidemic disease only in the 1980s.

riod made possible a substantial North American contribution to the food supply of the colonial plantations and the mother countries; and all the rest was there in prospect. European economic and demographic growth in the eighteenth and nineteenth centuries had its strains and pains; but no continent ever modernized more easily. Much of that was due to the New World—was done on the backs of Amerindians, African slaves, indentured servants.

If Spain has neither money nor gold nor silver, it is because it has these things, and if it is poor, it is because it is rich. . . . One would think that one wanted to make of this republic a republic of enchanted people living outside the natural order.

—Martin Gonzales de Cellorigo, 1600⁴

Well before the agriculture and manufactures came the loot and booty. The Columbian exchange redistributed wealth as well as flora and fauna—a one-stage transfer from old rich to new. The primary economic significance of the influx of wealth from overseas, however, lay in its uneven effects. Some people got rich only to spend; others to save and invest. The same with countries: some were little richer in the end than at the beginning, while others used their new fortune to grow more money.

Ironically, the nations that had started it all, Spain and Portugal, ended up losers. Here lies one of the great themes of economic history and theory. All models of growth, after all, stress the necessity and power of capital—capital as substitute for labor, easer of credit, balm of hurt projects, redeemer of mistakes, great enterprise's second chance, chief nourisher of economic development. Given capital, the rest should follow. And thanks to empire, Spain and Portugal had the capital.

Spain particularly. Its new wealth came in raw, as money to invest or spend. Spain chose to spend—on luxury and war. War is the most wasteful of uses: it destroys rather than builds; it knows no reason or constraints; and the inevitable unevenness and shortage of resources lead to ruthless irrationality, which simply increases costs. Spain spent all the more freely because its wealth was unexpected and unearned. *It is always easier to throw away windfall wealth.*

Who got the money? Short of hoarding, money will be used somehow, go round and come round, for better or worse. Spain wasted much of its wealth on the fields of Italy and Flanders. It went to pay for soldiers and arms, including iron cannon from the English inter-

mitrent enemy; for provisions, many of them bought from the Dutch and Flemish intermitrent enemy; and for horses and ships.

In the meantime, the wealth of the Indies went less and less to Spanish industry because the Spanish did not have to make things any more; they could buy them.⁵ In 1545, Spanish manufacturers had a six-year backlog of orders from the New World. At that time, in principle, the overseas empire was required to buy from Spanish producers only. But customers and profits were waiting, and Spanish merchants turned to foreign suppliers while using their own names to cover the transactions. So much for rules. Nor did the American treasure go to Spanish agriculture; Spain could buy food. As one happy Spaniard put it in 1675, the whole world is working for us:

Let London manufacture those fabrics of hers to her heart's content; Holland her chambrays; Florence her cloth; the Indies their beaver and vicuna; Milan her brocades; Italy and Flanders their linens, so long as our capital can enjoy them. The only thing it proves is that all nations train journeymen for Madrid and that Madrid is the queen of Parliaments, for all the world serves her and she serves nobody.⁶

Such foolishness is still heard today, in the guise of comparative advantage and neoclassical trade theory. I have heard serious scholars say that the United States need not worry about its huge trade deficit with Japan. After all, the Japanese are giving us useful things in exchange for paper printed with the portrait of George Washington. That sounds good, but it's bad. Wealth is not so good as work, nor riches so good as earnings. A Moroccan ambassador to Madrid in 1690-91 saw the problem clearly:

... the Spanish nation today possesses the greatest wealth and the largest income of all the Christians. But the love of luxury and the comforts of civilization have overcome them, and you will rarely find one of this nation who engages in trade or travels abroad for commerce as do the other Christian nations such as the Dutch, the English, the French, the Genoese and their like. Similarly, the handicrafts practiced by the lower classes and common people are despised by this nation, which regards itself as superior to the other Christian nations. Most of those who practice these crafts in Spain are Frenchmen [who] flock to Spain to look for work... [and] in a short time make great fortunes.⁷

Reliance on metrics (outsiders) testifies to the inability to mobilize skills or enterprise.

Spain, in other words, became (or stayed) poor because it had too much money. The nations that did the work learned and kept good habits, while seeking new ways to do the job faster and better. The Spanish, on the other hand, indulged their penchant for status, leisure, and enjoyment—what Carlo Cipolla calls “the prevalent *hidalgos* mentality.” They were not alone. Everywhere in Europe, genteel living was honored and manual labor scorned; in Spain, however, more so, partly because a frontier, combative society is a poor school for patience and hard work, partly because the crafts and tasks of industry and agriculture were long especially associated with despised minorities such as Jews and Muslims. As the chronicler Bernaldez put it, writing of the Jews at the end of the fifteenth century:

... all of them were merchants, dealers, tax farmers; they were stewards of the nobility and skilled shearsers (*oficiales tonidadores*), they were tailors, shoemakers, tanners, beltmakers, weavers, grocers, peddlers, silkmakers, smiths, goldsmiths, and other like professions. None of them cultivated the land; none was a farm worker, carpenter, or mason. All of them looked for easy trades and for ways to make a living with little work.

What is accursed is left to pariahs; and what the pariahs do is accursed.⁸ Better to be poor and unemployed. The poor in Spain played a most important role: they helped the rich buy salvation.⁹

By the time the great bullion inflow had ended in the mid-seventeenth century, the Spanish crown was deep in debt, with bankruptcies in 1557, 1575, and 1597. The country entered upon a long decline. Reading this story, one might draw a moral: Easy money is bad for you. It represents short-run gain that will be paid for in immediate distortions and later regrets.*

The nations of northern Europe would have agreed. They threw on the opening of the world. They caught fish, tapped and refined whale oil, grew and bought and resold cereals, wove cloth, cast and forged iron, cut timber and mined coal.¹⁰ They won their own empires, fortunately not endowed with gold and silver. Looting and pillaging when the opportunity offered, they nonetheless built largely on renewable harvests and continuing industry (including the industry of slaves, but

* Ironically, the economists of today have adopted the term “Dutch disease” to describe this syndrome, from the response of the economy of Holland to the discovery and exploitation of natural gas under the North Sea. As though the Dutch did not know how to make the most of these new resources.

that was a negative) rather than on depletable minerals. They built on work.

Europe's shift in economic gravity northward obviously transcends the inglorious Spanish *fiasco*. The great old mercantile and industrial city-states of Italy—Venice, Florence, Genoa—also lost out. Italy had been at the forefront of the medieval commercial revolution and had led the way out of autarky into international trade and division of labor. As late as the sixteenth century, Italy was a major player, splendid in its manufactures, preeminent in the commercial and banking services rendered to Spain and northern Europe. Yet Italy never really seized the opportunities offered by the Great Opening: one does not find Italian ships in the Indian ocean or crossing the Atlantic. Italy was centered in, caught in, the great Inland Sea. Caught also by old structures: guild controls fettered industry, made it hard to adapt to changing tastes. Labor costs stayed high because manufacture was largely confined to urban, corporate workshops employing adult male craftsmen who had done their years of apprenticeship.²¹

The advance of North over South attracted notice. In the eighteenth century already, observers commented on the difference in psychological terms. Northerners were said to be dour, dull, and diligent. They worked hard and well but had no time to enjoy life. In contrast, the southerners were seen as easygoing and happy, passionate to the point of needing close watching, and given to leisure rather than labor. This contrast was linked to geography and climate: cloudy vs. sunny skies, cold vs. warmth. Some people even found analogous differences within countries: between Lombards and Neapolitans, Catalans and Castilians, Flemings and the *gens du midi*, Scots and Kentishmen.

These stereotypes held an ounce of truth and a pound of lazy thinking. It is easy to dismiss them. But that still leaves the question, why do some fall from high estate and others rise? The “decline and fall” of Spain is like that of Rome: it poses the fascinating problem of success vs. failure, and scholars will never get tired of it.

Probably the most provocative explanation is the one offered by the German social scientist Max Weber. Weber, who began as a historian of the ancient world but grew into a wonder of diversified social science, published in 1904–05 one of the most influential and provocative essays ever written: “The Protestant Ethic and the Spirit of Capitalism.” His thesis: that Protestantism—more specifically, its Calvinist branches—promoted the rise of modern capitalism, that is, the industrial capitalism that he knew from his native Germany. Protes-

tantism did this, he said, not by easing or abolishing those aspects of the Roman faith that had deterred or hindered free economic activity (the prohibition of usury, for example); nor by encouraging, let alone inventing, the pursuit of wealth; but by defining and sanctioning an ethic of everyday behavior that conduced to business success.

Calvinistic Protestantism, said Weber, did this initially by affirming the doctrine of predestination. This held that one could not gain salvation by faith or deeds; that question had been decided for everyone from the beginning of time, and nothing could alter one's fate.

Such a belief could easily have encouraged a fatalistic attitude. If behavior and faith make no difference, why not live it up? Why be good? Because, according to Calvinism, goodness was a plausible sign of election. Anyone could be chosen, but it was only reasonable to suppose that most of those chosen would show by their character and ways the quality of their souls and the nature of their destiny. This implicit reassurance was a powerful incentive to proper thoughts and behavior. As the Englishwoman Elizabeth Walker wrote her grandson in 1689, alluding to one of the less important but more important signs of grace, “All cleanly people are not good, but there are few good people but are cleanly.”²² And while hard belief in predestination did not last more than a generation or two (it is not the kind of dogma that has lasting appeal), it was eventually converted into a secular code of behavior: hard work, honesty, seriousness, the thrifty use of money and time (both lent us by God). * “*Time is short,*” admonished the Puritan divine Richard Baxter (1615–1691), “and *work is long.*”²³

All of these values help business and capital accumulation, but Weber stressed that the good Calvinist did not aim at riches. (He might easily believe, however, that honest riches are a sign of divine favor.) Europe did not have to wait for the Protestant Reformation to find people who wanted to be rich. Weber's point is that Protestantism produced a new kind of businessman, a different kind of person, one who aimed to live and work a certain way. It was the *way* that mattered, and riches were at best a by-product.

A good Calvinist would say, that was what was wrong with Spain: easy riches, unearned wealth. Compare the Protestant and Catholic

* The best analysis of the Weberian model is still Talcott Parsons's *Structure of Social Action*. Elaborating the paradigm, Parsons divides action into three categories: rational (appropriate to ends), irrational (unrelated to ends), and nonrational (action as an end in itself). A good example of this last: “Father, I cannot tell a lie; it was I cut down the cherry tree.” Weber's Calvinist ethic falls in the realm of the nonrational.

attitudes toward gambling in the early modern period. Both condemned it, but Catholics condemned it because one might (would) lose, and no responsible person would jeopardize his well-being and that of others in that manner. The Protestants, on the other hand, condemned it because one might win, and that would be bad for character. It was only much later that the Protestant ethic degenerated into a set of maxims for material success and smug, smarmy sermons on the virtues of wealth.

The Weber thesis gave rise to all manner of rebuttal. Roman Catholics did not know whether to accept it as praise or denounce it as criticism. Materialist historians rejected the notion that abstractions such as values and attitudes, let alone those inspired by religion, could motivate and shape the mode of production. This refusal was the stronger for Max Weber's explicit and sacrilegious intention to rebut Marx on this score. To get cart and horse in proper order, some argued that the rise of capitalism had generated Protestantism; or that Protestantism appealed to the kinds of people—tradesmen, craftsmen—whose personal values already led to hard work and business success.¹⁴

In an influential study called *Religion and the Rise of Capitalism*, the English social historian R. H. ("Harry") Tawney rejected the link between Protestantism and economic growth. The English economy, he said, took off in the sixteenth century only when religious influence diminished, to be replaced by secular attitudes. One thing he did grant to the Puritan-Dissenter ethic: it shielded tradesmen and manufacturers against the slings and arrows of genteel contempt. It gave them a sense of dignity and righteousness, armor in a world of anticommmercial prejudices. And so, not yielding to the temptation of a higher leisure, good Calvinists kept at their task from generation to generation, accumulating wealth and experience along the way.¹⁵

The same kind of controversy has swirled around the derivative thesis of the sociologist Robert K. Merton, who argued that there was a direct link between Protestantism and the rise of modern science. He was not the first to make this point. In the nineteenth century Alphonse de Candolle, from a Huguenot family of Geneva, counted that of ninety-two foreign members elected to the French Académie des Sciences in the period 1666–1866, some seventy-one were Protestant, sixteen Catholic, and the remaining five Jewish or of indeterminate religious affiliation—this from a population pool outside of France of 107 million Catholics, 68 million Protestants. A similar count of foreign fellows of the Royal Society in London in 1829 and 1869 showed equal numbers of Catholics and Protestants out of a pool in which

Catholics outnumbered Protestants by more than three to one.¹⁶

Much of this no doubt reflected the greater access of Catholics in Catholic countries to the older liberal professions and the governing bureaucracy, and hence their preference for a different kind of schooling. But much was dictated by the fears of the clerical hierarchy, by their distaste for the findings and paradigms of a science that negated religious doctrine. As the English chemist and Unitarian minister Joseph Priestley put it, the pope, in patronizing science, "was cherishing an enemy in disguise," for he had "reason to tremble even at an air pump, or an electrical machine."¹⁷

Against all of this, one scholar has categorically asserted that there is no empirical basis for the alleged link;¹⁸ that Weber's data on differential education of Catholics and Protestants in the Germany of the turn of the century (Protestants more inclined to commercial and scientific programs) are badly calculated; that Catholic and non-Calvinist businessmen did as well as Weber's ideal Calvinist types; that one might as well explain the differences between northern and southern Europe by geography or race; and that Max Weber is like the tailors who clothed the Chinese emperor, and his Protestant connection much ado about nothing.

Indeed, it is fair to say that most historians today would look upon the Weber thesis as implausible and unacceptable: it had its moment and it is gone.

I do not agree. Not on the empirical level, where records show that Protestant merchants and manufacturers played a leading role in trade, banking, and industry.¹⁹ In manufacturing centers (*fabriques*) in France and western Germany, Protestants were typically the employers, Catholics the employed. In Switzerland, the Protestant cantons were the centers of export manufacturing industry (watches, machinery, textiles); the Catholic ones were primarily agricultural. In England, which by the end of the sixteenth century was overwhelmingly Protestant, the Dissenters (read Calvinists) were disproportionately active and influential in the factories and forges of the nascent Industrial Revolution.

Nor on the theoretical. The heart of the matter lay indeed in the making of a new kind of man—rational, ordered, diligent, productive. These virtues, while not new, were hardly commonplace. Protestantism generalized them among its adherents, who judged one another by conformity to these standards. This is a story in itself, one that Weber did surprisingly little with: the role of group pressure and mutual scrutiny in assuring performance—everybody looking at everyone else and minding one another's business.

Two special characteristics of the Protestants reflect and confirm this link. The first was stress on instruction and literacy, for girls as well as boys. This was a by-product of Bible reading. Good Protestants were expected to read the holy scriptures for themselves. (By way of contrast, Catholics were catechized but did not have to read, and they were explicitly discouraged from reading the Bible.) The result: greater literacy and a larger pool of candidates for advanced schooling; also greater assurance of continuity of literacy from generation to generation. *Literal mothers matter.*

The second was the importance accorded to time. Here we have what the sociologist would call unobtrusive evidence: the making and buying of clocks and watches. Even in Catholic areas such as France and Bavaria, most clockmakers were Protestant; and the use of these instruments of time measurement and their diffusion to rural areas was far more advanced in Britain and Holland than in Catholic countries.²⁰ Nothing testifies so much as time sensibility to the "urbanization" of rural society, with all that that implies for rapid diffusion of values and tastes.

This is not to say that Weber's "ideal type" of capitalist could be found only among Calvinists and their later sectarian avatars. People of all faiths and no faith can grow up to be rational, diligent, orderly, productive, clean, and humorless. Nor do they have to be businessmen. One can show and profit by these qualities in all walks of life. Weber's argument, as I see it, is that in that place and time (northern Europe, sixteenth to eighteenth centuries), religion encouraged the appearance in numbers of a personality type that had been exceptional and adventurous before; and that this type created a new economy (a new mode of production) that we know as (industrial) capitalism.

Add to this the growing need for fixed capital (equipment and plant) in the industrial sector. This made continuity crucial—for the sake of continued maintenance and improvement and the accumulation of knowledge and experience. These manufacturing enterprises were very different in this regard from mercantile ones, which often took the form of ad hoc mobilizations of capital and labor, brought together for a voyage or venture and subsequently dissolved. (Recall that the English East India Company operated in this way in the early years, although there too it was soon apparent that a continuing mobilization would be necessary.)

For these requirements of a new kind of economy, the Weberian entrepreneur was specially suited by temperament and habit; and here the Tawney emphasis on the link between self-respect and continuity is es-

pecially pertinent. It is no coincidence that the French crown, always ready and willing to honor socially ambitious bourgeois (typically men of law) with patents of nobility—for a price, of course—began in the seventeenth century to permit noblemen to engage in wholesale (as opposed to retail) trade; and in the eighteenth century to impose on aspirants from industry a condition of continuity. The newly ennobled *négociant* or *fabriquant* was required to remain "in trade"²¹—a condition that would once have been perceived as inherently *deshonorable*, incompatible with such exalted status.²¹ The problem, as a good Calvinist would have seen it, was that honors and pretensions ill became men of the countinghouse and *fabrique*. They worked better and harder dressed in dark woolen cloth, without silk, lace, and wig.

However important this proliferation of a new business breed, it was only one aspect of shifting economic power and wealth from South to North. Not only money moved, but knowledge as well; and it was knowledge, specifically scientific knowledge, that dictated economic possibilities. In the centuries before the Reformation, southern Europe was a center of learning and intellectual inquiry. Spain and Portugal, because they were on the frontier of Christian and Islamic civilization and had the benefit of Jewish intermediaries; and Italy, which had its own contacts. Spain and Portugal lost out early, because religious passion and military crusade drove away the outsiders (Jews and then the *conversos*) and discouraged the pursuit of the strange and potentially heretical; but Italy continued to produce some of Europe's leading mathematicians and scientists. It was not an accident that the first learned society (the Accademia dei Lincei, Rome, 1603) was founded there. *

The Protestant Reformation, however, changed the rules. It gave a big boost to literacy, spawned dissents and heresies, and promoted the skepticism and refusal of authority that is at the heart of the scientific endeavor. The Catholic countries, instead of meeting the challenge, responded by closure and censure. The reaction in the Habsburg dominions, which included the Low Countries, followed hard on the heels of Luther's denunciation. The presence there of Marrano refugees, feared and hated as enemies of the true Church and accused of deliberately propagating the new doctrines, aggravated the hysteria. A rain of interdictions followed (from 1521 on), not only of publishing but of reading heresy, in any language. The Spanish authorities,

* Lincei = lynxes. The animal was chosen for its reputedly keen sight.

both lay and clerical, viewed Lutherans (all Protestants were then seen as Lutherans), not as dissenters, but as non-Christians, like Jews and Muslims enemies of the faith.²² Any thoughts of ending the Inquisition were shelved, and Church and civil authorities joined to control thought, knowledge, and belief. In 1558, the death penalty was introduced for importing foreign books without permission and for uncensored printing. Universities reduced to centers of indoctrination; unorthodox and dangerous books were placed on an *Index Librorum Prohibitorum* (1557 in Rome, 1559 in Spain), and safe books appeared with an official *imprimatur* ("let it be printed"). Among the books on the Spanish list: scientific works banned because their authors were Protestant. Despite smuggling, hazardous to the health, the diffusion of new ideas to society at large slowed to a trickle. (Recall the book review and purge at the beginning of *Don Quixote*. The point is not only the role of whim, but the absurd reasons—the trivia that brought risk in a fantasy-ridden, knowledge-starved society.)

Nor were Spaniards allowed to study abroad, lest they ingest subversive doctrine. That same year (1559), the crown forbade attendance at foreign universities, except for such safe centers as Rome, Bologna, and Naples. The effect was drastic. Spanish students had long gone to the University of Montpellier for medical training; they just about stopped going—248 students from 1510 to 1559; 12 from 1560 to 1599.²³ (One wonders about those dozen mavericks.) Subversive scientists were silenced and forced to denounce themselves. Regimes that exercise thought control and enforce orthodoxy are never satisfied with prohibitions and punishments. The guilty must confess and repent—both for their own and for others' salvation.

Persecution led to an interminable "witch hunt," complete with paid snitches, prying neighbors, and a racist blood mania (*impieza de sangre*). Judaizing conversos were caught by telltale vestiges of Mosaic practice: refusal of pork, fresh linen on Friday, an overheard prayer, irregular church attendance, a misplaced word. Cleanliness especially was cause for suspicion, and bathing was seen as evidence of apostasy, for Marranos and Moriscos alike. "The phrase 'the accused was known to take baths . . . ' is a common one in the records of the Inquisition."²⁴ Inherited dirt: clean people don't have to wash. In all this, the Spanish and Portuguese demeaned and diminished themselves. Intolerance can harm the persecutor more than the victim.

So Iberia and indeed Mediterranean Europe as a whole missed the train of the so-called scientific revolution. In the 1680s Juan de Cabriada, a Valencian physician, was conducting a running war with doctors

in Madrid, trying vainly to persuade them to accept Harvey's discovery of the circulation of the blood in the face of antique Galenist tradition. What, he asked, was wrong with Spain? It is "as if we were Indians, always the last" to learn of new knowledge.²⁵

The British historian Hugh Trevor-Roper has argued that this reactionary, anti-Protestant backlash, more than Protestantism itself, sealed the fate of southern Europe for the next three hundred years.²⁶ Such retreat was neither predestined nor required by doctrine. But this path once taken, the Church, repository and guardian of truth, found it hard to admit error and change course. How hard? One hears nowadays that Rome has finally, almost, rehabilitated Galileo after almost four hundred years. That's how hard.

The Condemnation of Galileo

Galileo Galilei was not a saint, but he was a genius and a treasure—for Florence, Italy, Europe, and the world. He was a pioneer of the experimental science, a keen observer (as befitted a member of the Academy of Lynxes), a sharp thinker, and a powerful polemicist and debater. Yet in 1633 he was condemned by the Roman Church for contumacy and heresy: "The opinion that the Sun is at the center of the world and immobile is absurd, false in philosophy, and formally heretical, because it is expressly contrary to Holy Scripture."

(Galileo was not the first; or the last. Equally momentous, if less remembered, was the burning in Rome in February 1600 of Giordano Bruno, ex-Dominican, a philosopher whose imaginary concept of the universe came far closer to what we now think than that of Copernicus or Galileo: infinite space, billions of burning stars, rotating earth revolving around the sun, matter composed of atoms, and so on. All heresies, linked to mysteries and magic. In effect, by burning Bruno, the Church proclaimed its intention of taking science and imagination in hand and leashing them to Rome.²⁷ But while Galileo worked and spoke, freedom still had room.)

That was the sentence. The confession of error by Galileo was some fourteen times as long. The point was not to pronounce dogma, but to denounce heresy and to display for all, in great detail, the admission of the sinner, his recognition and acceptance of the authority of the Holy Church, and his sincere promise of repentance.

Never again. That is the nature of thought control in infallible systems: these aim not so much to convict as to convince—both the guilty one and all other members of the system.

Why the Church chose to make an issue of geocentrism remains a puzzle. Nothing in holy scripture seems to require such belief. To be sure, the Bible does use images of the sun crossing the sky or stopping in its course, but it is not hard to treat those as expressions, sometimes metaphorical, of what the eye on earth perceives. The Roman Curia could have ignored the matter without rending the tissue of faith and obedience. Yet any church is tempted to rest its authority on doctrine and dogma, for these are the sign and instrument of rule, especially in troublous times.

Meanwhile Galileo, for reasons as much of temperament as of intellectual integrity, enjoyed doing battle. A redoubtable debater, he would not suffer fools and found them aplenty in clerical circles. This was a dangerous game in a Roman world of virtually unlimited authority, intrigue and ambition, slander and treachery. Byzantium on the Tiber: nothing in Rome made contenders happier than the early demise of the Holy Father, for every change of pope entailed a reshuffling of power and place. Here today, gone tomorrow; friend now, foe later. Galileo could count on no one.

Even worse, perhaps, Galileo's response to hints and warnings of disapproval was to "go public"—to publish in Italian rather than in Latin—and thereby go over the head of the insiders and appeal to a larger audience. In effect he was popularizing (vulgarizing) heresy, and that was intolerable.*

So Galileo confessed; and although he is said to have made one last, stubborn demurrer ("*Eppure si muove*" [Say what you will, it moves]), he went into a stultifying house arrest that ended his career as an effective, innovating scientist. And that was a catastrophic loss to Italian science, which, so long as the great man worked and thrived, had stood up to the growing constraint implicit in the Counter-Reformation.

And what about science in other lands? In the Protestant countries, the condemnation meant little. If anything, it confirmed

* Compare the long-standing Italian rule about publication of pornography: so long as the book was costly and appeared in a limited edition, it was tolerable; but no cheap editions could be allowed, for fear of corrupting those simple folk who did not have the cultural resources to resist temptation and sin. On the Church's fear of the vernacular, cf. the troubles of Giambattista della Porta in the 1580s. Eamon, "From the Secrets of Nature," p. 361, n. 41.

these rebels against Church authority in their scorn for the superstitions of Rome. Father Gassendi, professor at Aix-en-Provence and excellent observer of astronomical phenomena, went to Holland in 1632 and wrote back to a French colleague about attitudes toward the Copernican paradigm: "All those people there are for it."²⁸ That may have been an exaggeration, but it captures the contrast with what he had known at home. Holland, England, and the Protestant countries in general were a different state of mind.

In France, the savants swung between sense and sensibility, integrity and obedience. The same Gassendi, writing to Galileo, pleaded with him to make peace with Rome and his conscience—and both at the same time: "I am in the greatest anxiety about the fate that awaits you, O you, the great glory of the century! If the Holy See has decided something against your opinion, bear with it as suits a wise man. Let it suffice you to live with the conviction that you have sought only the truth."²⁹

Only the truth. But what was truth? Within the knowledge available at that time, Copernicus alone left much to be desired. The Copernican-Keplerian paradigm fitted the observations better, but did that prove that the earth went around the sun? Better and safer to stick to experiment and not ask why. Here lay a way of continuing observation while denying consequences, and this evasion found a welcome with some of the leading French scientists of the day.*

Thus Mersenne, prime communicator among European savants, wrote in 1634 that everything anyone had said about the movement of the earth did not prove the point; and he dropped plans to do a book on heliocentrism. Gassendi, the same. Descartes, the same. The great Descartes came up with his own twist: the heavenly bodies were not governed in their movements by some kind of pull, an invisible, magical attraction, but by whirling pools of force that bore them along. Attraction smacked of superstition, whereas whirlpools were somehow scientific. In the event, said Descartes, the earth was carried in its field of force like a passenger on a boat. The boat moved, but the passenger did not. So the earth did not move.

Q.E.D.

* As it did in Italy. Compare the short-lived Accademia del Cimento, organized and patronized by Duke Leopold of Tuscany, summoned at his beck and call and dissolved after his departure for Rome to pursue higher callings. No intellectual autonomy: the members reported on their experiments, but that was all—science, in other words, without *scientia*.

Even with such cleverness, Descartes found it hard to live in a France of Jesuitical subtleties. He moved to Holland and left no forwarding address, except with Mersenne. Meanwhile the French slowly, reluctantly, came around to his cosmology, and once there, clung to the Cartesian system by way of refusing Newtonian theories of motion and gravity. Better push than pull. For Newton was English, and the French, then as now, found it hard to learn from others (*moins n'arrons pas de leçons à recevoir* . . .), especially from their traditional enemy of Agincourt and Crécy. An outrageous instance of this intellectual chauvinism came in the 1980s, when French health authorities insisted on distributing contaminated blood rather than purchase American tests and decontaminating equipment. (The United States has replaced Britain as the Gallic *bête noire*, the worse for having helped in two world wars.) French authorities thereby condemned hundreds, maybe thousands, to AIDS and death.

When the French finally did reconcile themselves to Newtonian mathematics and physics, they did very well. They had talent and genius in abundance. But they lost several generations to pride.



The Tenacity of Intolerance and Prejudice³⁰

Fifteenth-century Sicily had the misfortune to owe allegiance to the crown of Castile; so when Ferdinand and Isabella in 1492 ordered the expulsion or conversion of the Jews of Spain, Sicily had to go along. Not that the island lacked anti-Jewish sentiment, as a number of earlier pogroms showed. But Jews had lived there for centuries and played a disproportionate role in Sicily's trade, to say nothing of their place as doctors and apothecaries. The Sicilian viceroy dithered, reluctant to issue the fateful decree; but a series of orders prepared the way by prohibiting Jews from selling their assets, compelling them to pay all debts outstanding, and—most ominous—barring them from bearing arms.

One need not go into detail. The Jews of the island won a short delay; they were also granted benevolent permission to take with them the clothes on their back, a mattress, a wool or serge blanket, a pair of sheets, and some small change, plus some food for the way.

We are told that many Sicilians were sorry to see them go. With reason. What was left of trade shrank almost to nothing; houses and even neighborhoods were left desolate; and we must assume that some people had the decency to feel ashamed.

Much later, toward the end of the seventeenth century, some Sicilians urged the king to do something to promote trade. Charles II granted Messina the privilege of a free port and gave Jews the right to trade there—on condition that they sleep outside the city and wear a distinctive sign on their clothing. Such ambiguous hospitality did not encourage Jews to come, so in 1728 the Jews were granted the right to trade anywhere on the island, to reside in Messina, to have a synagogue and cemetery, to own and dispose of property. Even this did not help, so in 1740 the king explicitly invited the Jews to return. A number of families accepted, but found themselves mistreated by a prejudiced populace. Then it happened that the queen had not succeeded in bearing a male heir to the throne, and the royal couple were persuaded by clerics that they would not have a son so long as they allowed the Jews to stay. So, after seven years, another expulsion.

Intolerance, superstition, ignorance—these are easier to acquire and cultivate than to uproot. The same iniquities and vices, perpetrated long ago by foreign (Spanish) rulers, have contributed to this day to Sicily's persistent backwardness.

26. Habib, *Agrarian System*, pp. 90, 350, 390. The latter story is from John Fryer, *A New Account of East India and Persia being Nine Years' Travels, 1672-81*. The whole is cited from Kautsky, *Politics of Aristocratic Empires*, p. 103, n. 14.
27. Thus Andre Wink affirms that "at the dawn of the Industrial Revolution income per capita was possibly higher in many parts of Asia than in Europe."—Wink, "Al-Hind," p. 65. Cf. Barroch, "Ecarters internationaux," and "The Main Trends in National Economic Disparities," p. 7. Also Parthasarathi, "Rethinking Wages."
28. Cf. Alam, "How Rich Were the Advanced Countries in 1760 After All?"
29. Macanabay, "Clive," p. 228.

CHAPTER 12

1. Thus Salaman, *History and Social Influence*; and Langer, "Europe's Initial Population Explosion."
2. And not only the early centuries. Cf. S. K. Coll, "Anti-Malaria Drugs Post Hard Choice for Parents," *Int. Herald-Tribune*, 18 October 1996, p. 11.
3. Curtin, "Epidemiology and the Slave Trade," Table 1, p. 203, cited in Sheridan, *Doctors and Slaves*, p. 12. These figures are based on the mortality of British military personnel, white and black, posted to different parts of the world, 1817-36. On the assumption of some learning, death rates were presumably lower than they had been in the seventeenth and eighteenth centuries.
4. Cited by Edwy Plenel, "Le conquérant oublié," *Le Monde*, 1-2 September 1991, p. 2. One can find similar orgies of destructive self-indulgence among the oil-rich countries of the late twentieth century.
5. Spanish industry was not equal to that of Italy or the countries of northwestern Europe; but neither was it negligible in the sixteenth century. Cf. Peyrefitte, *Société*, p. 134. On shrinkage in the seventeenth, see Lynch, *Hispanic World*, pp. 210 ff.
6. Alfonso Nuñez de Castro, quoted in Cipolla, *Before the Industrial Revolution*, p. 251.
7. Cited in Lewis, *Muslim Discovery*, p. 197. The Italian historian and statesman Francesco Guicciardini said much the same thing, though he put it in terms of who got the value added. Guicciardini, *Relazioni di Spagna*, p. 131, quoted in Cipolla, *Before the Industrial Revolution*, p. 250.
8. Bernaldez, ch. cxvii, p. 257, cited in Bernard and Gruzinski, *Histoire du nouveau monde*, I, 78-79, 643. Note that in some cultures, tanning and leather trades have been traditionally despised as intrinsically foul and degrading; thus Japan, which included such workers among the *eta*, a group of social untouchables that also included undertakers and gravediggers. In Ottoman Turkey, a society that like Spain cultivated the arts and habits of war, industrial crafts were primarily in the hands of religious minorities, notably the Armenians.
9. Cf. Peyrefitte, *Société*, pp. 141-42.
10. On the riches and trade of the North Atlantic, see Axtell, "At the Water's Edge: Trading in the Sixteenth Century," in his *After Columbus*, pp. 144-81. Of whale oil, he writes (p. 146), it was "as profitable as liquid gold" (but much less tempting to freebooters). "For whale oil lit the lamps of Europe, made soap and soup, lubricated everything from frying pans to clocks, and, since the whale was classified as a fish, served as *lard de carême*—Lenten fat—during holy days when meat products were prohibited."
11. On the decline of the Italian textile manufacture (far and away the principal branch of industrial production), see Cipolla, *Before the Industrial Revolution*, pp. 253-63. We have much to learn about new industries taking hold in smaller towns and even in the countryside. Cf. Ciriaco, "The Venetian Economy" and "Venise et la Vénétie." But the older urban centers seem to have used economic and political power to keep

- these in their modest place. See Sella, *Crisis and Continuity*, and Moioi, "De-Industrialization in Lombardy."
12. [Anthony Walker], *The Holy Life of Mrs Elizabeth Walker* (1690), cited in Thomas, "Cleanliness and Godliness," p. 56. Thanks to Keith Thomas for making this available in advance of publication.
 13. Baxter, "Of Redeeming Time," *Practical Works*, p. 228. Again, thanks to Keith Thomas.
 14. Cf. H. M. Robertson, *Aspects of the Rise of Economic Individualism*.
 15. On this older, defensive ethic of gentility, see the important article of Arthur Livingston, "Gentleman, Theory of the," in the *Encyclopedia of the Social Sciences*. Also Kautsky, *Politics of Aristocratic Empires*, pp. 177-97.
 16. Candolle, *Histoire des sciences et des savants*. Some have dismissed these figures on the ground that Candolle's counting starts in the 1660s, when the scientific revolution was already well under way. Cf. Smith, *Science and Society*, p. 48. Such an objection does not, of course, rule out the possibility that a similar survey of the earlier period might yield similar results; but the implication is that it would not. The point is that Candolle had countable data to work with after the founding of the scientific academies. It would seem unreasonable to dismiss them for the period they deal with, where Protestant leadership in science would seem to be a fact. Whether the explanation lies in Protestantism or Catholic hostility to the new science, or both, is another matter.
 17. Cited by Mason, "Scientific Revolution."
 18. This is the Swedish historian Kurt Samuelsson, in a slim monograph translated into English as *Religion and Economic Action*.
 19. Samuelsson's statistical critique of Weber's data on Baden, for example, is unpersuasive, although he makes the point that Protestants were likelier to live in urban areas where technical schools were invariably located. But that was no accident either.
 20. Landes, *Revolution in Time*, pp. 92-93. Cf. de Vries, *Dutch Rural Economy*, p. 219; on the basis of household inventories, possession of clocks in the Leewarderdel district rose from 2 percent in 1677-86 to 70.5 percent in 1711-50. Of course these were households sufficiently well off to make an inventory after death.
 21. Cf. Michaud, "Ohéans au XVIII^e siècle," p. 11. Even so, certain orders of chivalry were closed to such new men, and such exclusions worked against these efforts to honor business success, to the point where some argued for the creation of a new kind of order by way of raising the status of these underappreciated achievers. These protestations of esteem do not ring hollow; but they tell us that other people did not agree.
 22. Bernaldez, *L'Inquisition espagnole*, ch. viii: "Refus de la Réforme," especially pp. 289-90. Once again Spain's reaction was shaped, to its own cost, by its long history of uncompromising religious conformity and the passions it engendered. Cf. Goodman, "Scientific Revolution," pp. 163-64, who suggests that the dearth of Old Catholic physicians in sixteenth-century Spain may have reflected the racial (congenital) link that some Spaniards made between Jewishness and medicine. "It could well be that, in a society which gave esteem to those who could establish freedom from Jewish or Moorish descent, the Old Christians avoided the medical profession in case success there might arouse suspicions of Jewish blood." Poisoned bread upon the waters.
 23. Goodman, "Scientific Revolution in Spain and Portugal," in Porter and Teich, eds., *Scientific Revolution*, p. 172. Some Spanish historians, seeking to defend the indefensible, have argued that outside universities were so poor and hidebound that Spanish students were not missing much. Perhaps; although Protestant universities, in England and Holland for example, were substantially better. But drinking at the fountain of heresy was simply out of the question. Cf. Smith, *Wealth of Nations*, Book V, ch. i, Part 3, Article 3d, on the drain of talent from university teaching to the Church in Catholic countries.

24. Crow, *Spain: The Root and the Flower*, p. 149.
25. In his *Carta filosofica, medico-dynmica* (Madrid, 1687), cited by Goodman, "Scientific Revolution," p. 173.
26. Trevor-Roper, "Religion, the Reformation and Social Change," in the collection of essays of the same title. The paper was originally delivered in 1961 to the Fifth Irish Conference of Historians in Galway. It must have upset many listeners.
27. On Bruno and the Church campaign to domesticate science, see Minors, *L'Esprit et la science*, I, ch. ix: "Contre-Réforme et reprise en main des sciences." On the provocation of Bruno's "science," see Yates, *Giordano Bruno*, and the discussion in Coppenhaver, "Natural Magic."
28. Grenet, *Passion des astres*, p. 87.
29. *Ibid.*, p. 79.
30. See especially La Lumia, *Histoire de l'expulsion des Juifs de Sicile*.

CHAPTER 13

1. *OED*, s.v. Revolution, III, 6, b.
2. On the breast wheel: Mokyr, *Letter of Riches*, pp. 90–92. On waterpower vs. steam: Tunzelmann, *Steam Power*; and Greenberg, "Reassessing the Power Patterns."
3. This is the traditional explanation—see Ashton, *Iron and Steel*. Hyde, *Technological Change*, p. 40, argues that this was not the reason; rather that Darby succeeded because he knew how to cast thin-walled iron vessels using sand instead of loam, thereby saving one half the metal, and these could be more easily made from coke-blast pig.
4. John U. Nef, *Rise of the British Coal Industry*. The scholar who has argued most cogently for the importance of fossil fuel and steampower is E. A. Wrigley. See his *Continuity, Chance and Change* and his essay on "The Classical Economists, the Stationary State, and the Industrial Revolution," p. 31. Adam Smith, *Wealth of Nations*, Book V, ch. 2, Art. 4, notes the tendency of British industry to concentrate near coal deposits. He attributes it to the effect of cheap fuel on wages (they could be lower) and on the costs of such fuel-intensive (heat-using) industries as glass and iron. He does not speak of coal as fuel for engines and machines; for that matter, he does not speak of steam engines and says little about machines. Smith had his blind spots.
5. This is the estimate of A. P. Usher, *History of Mechanical Inventions*.
6. A. Rees, *The Cyclopaedia*, Vol. 38 (London, 1819), cited in Randall, *Before the Industrial Revolution*, p. 13.
7. Cited in Kindleberger, *World Economic Primacy*, viii, 6.
8. This sequence led A. P. Usher, the pioneer student of the links between technology and industry, to track the progress and timing of the Industrial Revolution by just these data—*Industrial History*, pp. 304–13.
9. *Ibid.*, p. 306.
10. Thus T. S. Ashton, whose classic and "classy" little handbook, *The Industrial Revolution*, takes as its terminal dates 1760 and 1830.
11. Compare the similar analysis by Christopher Freeman of the slowdown in productivity gains in advanced industrial countries in the 1970s and 1980s—*The Economics of Hope*, pp. 86–89.
12. Cf. Landes, "What Room for Accident in History?"
13. McCloskey, "Statics, Dynamics, and Persuasion."
14. Aldcroft, "Europe's Third World?" p. 2. The pioneer work on these historical comparisons comes from Paul Barroch; see his "Main Trends in National Economic Disparities."
15. Yet even in these apparently straightforward matters, one can make egregious mistakes. See the discussion in J. Cuenca Estebean, "British Textile Prices," of N. F. R.

- Crafts' and Knick Harley's cotton cloth prices, used in the calculation of British industrial growth. These latter purport to show increases (*sic*) or stability of cotton prices over the course of the Industrial Revolution. They were, unfortunately, badly chosen for the purpose (among other things, the indexes rest on contract rather than market prices), in part no doubt because of convenience and availability. Still, all kinds of alarm bells should have gone off. Numbers should make sense, and anyone who is ready to believe that yarn or cloth prices stood still or went up after the invention of the water frame, mule, and power loom is ready to believe anything. On the dangers and banality of numerical credulity, see Landes, "What Room for Accident in History?"
16. Theodore W. Schultz, "On Investing in Specialized Human Capital," p. 343.
 17. Jeffrey Williamson figures 0.3 percent—"New Views on the Impact," p. 1.
 18. Crafts, "British Industrialization in an International Context," p. 425. For a more reliable, empirical analysis of growth and gains across the industrial board, see Temin, "Two Views."
 19. See the article, "The Price of Light," *The Economist*, 22 October 1994, p. 84.
 20. For an early example of such avoidance, see Youngson, *Possibilities of Economic Progress*, ch. viii: "The Acceleration of Economic Progress in Great Britain, 1750–1800," especially p. 117: "... nothing can be proved or disproved about the economy as a whole." Youngson avers there that "progress was never constant" and that the respective contributions of different sectors were always changing. Result: many trees, no forest.
 21. Ward, "Industrial Revolution and Imperialism," p. 58, commenting on Cain and Hopkins, "Gentlemanly Capitalism," pp. 510–12. It does not seem to me that Cain and Hopkins quite say that.
 22. Eric Jones in *Growth Recurring*, p. 19. See Landes, "The Fable of the Dead Horse," which deals with the larger debate.
 23. Cited in Massie, *Dreadnought*, p. 475.

CHAPTER 14

1. As cited in McCloskey, "1780–1860: A Survey," p. 243.
2. As cited by White, "Cultural Climates and Technological Advance," in *Medieval Religion and Technology*, p. 221, n. 16. The sermon, it should be noted, was delivered in the vernacular. I have slightly modified the White translation of the original.
3. In his *Coloquios dos simples e drogas he consas medicinaes da India* [Dialogues on the Simples, Drugs, and Materia medica of India] (Goa, 1563), cited in Goodman, "Scientific Revolution," pp. 168–69.
4. Quoted in Smith, *Science and Society*, p. 51. Cf. today's version of this dependence on mathematics, this time in the field of cosmology: "... supergravity theory, Kaluza-Klein theory, and the Standard Model [work], but we are at a total loss to explain why... String field theory exists, but it taunts us because we are not smart enough to solve it. The problem is that while 21st-century physics fell accidentally into the 20th century, 21st-century mathematics hasn't been invented yet." Michio Kaku, *Hyperspace* (New York: Oxford, 1993), cited *New York Times*, 20 March 1994, "Book Review," p. 21.
5. The reference here is to the work of Frances Yates: *Giordano Bruno* and "The Hermetic Tradition." Yates suggests that the scientific revolution may well be seen as a two-step process: "the first phase consisting of an animistic universe operated by magic, the second phase of a mathematical universe operated by mechanics"—"The Hermetic Tradition," p. 273.
6. Hansen, "Science and Magic," p. 495.
7. Cf. Edward Rosen, "Was Copernicus a Hermetist?" in Roger H. Stuewer, ed., *Historical and Philosophical Perspectives of Science*, pp. 163–71: "... out of Renaissance