(1)

Scientists long believed that two nerve clusters in the human hypothalamus, called suprachiasmatic nuclei (SCNs), were what controlled our circadian rhythms. Those rhythms are the biological cycles that recur approximately every 24 hours in synchronization with the cycle of sunlight and darkness caused by Earth's rotation. Studies have demonstrated that in some animals, the SCNs control daily fluctuations in blood pressure, body temperature, activity level, and alertness, as well as the nighttime release of the sleep-promoting agent melatonin. Furthermore, cells in the human retina dedicated to transmitting information about light levels to the SCNs have recently been discovered.

Four critical genes governing circadian cycles have been found to be active in every tissue, however, not just the SCNs, of flies, mice, and humans. In addition, when laboratory rats that usually ate at will were fed only once a day, peak activity of a clock gene in their livers shifted by 12 hours, whereas the same clock gene in the SCNs remained synchronized with light cycles. While scientists do not dispute the role of the SCNs in controlling core functions such as the regulation of body temperature and blood pressure, scientists now believe that circadian clocks in other organs and tissues may respond to external cues other than light—including temperature changes—that recur regularly every 24 hours.

(2)

In their study of whether offering a guarantee of service quality will encourage customers to visit a particular restaurant, Tucci and Talaga have found that the effect of such guarantees is mixed. For higher-priced restaurants, there is some evidence that offering a guarantee increases the likelihood of customer selection, probably reflecting the greater financial commitment involved in choosing an expensive restaurant. For lower-priced restaurants, where one expects less assiduous service, Tucci and Talaga found that a guarantee could actually have a negative effect: a potential customer might think that a restaurant offering a guarantee is worried about its service. Moreover, since customers understand a restaurant`s product and know what to anticipate in terms of service, they are empowered to question its quality. This is not generally true in the case of skilled activities such as electrical work, where, consequently, a guarantee might have greater customer appeal.

For restaurants generally, the main benefit of a service guarantee probably lies not so much in customer appeal as in managing and motivating staff. Staff members would know what service standards are expected of them and also know that the success of the business relies on their adhering to those standards. Additionally, guarantees provide some basis for defining the skills needed for successful service in areas traditionally regarded as unskilled, such as waiting tables.

(3)

One proposal for preserving rain forests is to promote the adoption of

new agricultural technologies, such as improved plant varieties and use of chemical herbicides, which would increase productivity and slow deforestation by reducing demand for new cropland. Studies have shown that farmers in developing countries who have achieved certain levels of education, wealth, and security of land tenure are more likely to adopt such technologies. But these studies have focused on villages with limited land that are tied to a market economy rather than on the relatively isolated, self-sufficient communities with ample land characteristic of rain-forest regions. A recent study of the Tawahka people of the Honduran rain forest found that farmers with some formal education were more likely to adopt improved plant varieties but less likely to use chemical herbicides and that those who spoke Spanish (the language of the market economy) were more likely to adopt both technologies. Non-land wealth was also associated with more adoption of both technologies, but availability of uncultivated land reduced the incentive to employ the productivity-enhancing technologies. Researchers also measured land-tenure security: in Tawahka society, kinship ties are a more important indicator of this than are legal property rights, so researchers measured it by a household's duration of residence in its village. They found that longer residence correlated with more adoption of improved plant varieties but less adoption of chemical herbicides.

(4)

The argument for "monetizing"—or putting a monetary value on—ecosystem functions may be stated thus: Concern about the depletion of natural resources is widespread, but this concern, in the absence of an economic argument for conservation, has not translated into significant conservational progress. Some critics blame this impasse on environmentalists, whom they believe fail to address the economic issues of environmental degradation. Conservation can appear unprofitable when compared with the economic returns derived from converting natural assets (pristine coastlines, for example) into explicitly commercial ones (such as resort hotels). But according to David Pearce, that illusion stems from the fact that "services" provided by ecological systems are not traded on the commodities market, and thus have no readily quantifiable value. To remedy this, says Pearce, one has to show that all ecosystems have economic value—indeed, that all ecological services are economic services. Tourists visiting wildlife preserves, for example, create jobs and generate income for national economies; undisturbed forests and wetlands regulate water runoff and act as water-purifying systems, saving millions of dollars worth of damage to property and to marine ecosystems. In Gretchen Daily's view, monetization, while unpopular with many environmentalists, reflects the dominant role that economic considerations play in human behavior, and the expression of economic value in a common currency helps inform environmental decision-making processes.

(5)

Much research has been devoted to investigating what motivates

consumers to try new products. Previous consumer research suggests that both the price of a new product and the way it is advertised affect consumers' perceptions of the product's performance risk (the possibility that the product will not function as consumers expect and/or will not provide the desired benefits). Some of this research has concluded that a relatively high price will reduce a consumer's perception of the performance risk associated with purchasing a particular product, while other studies have reported that price has little or no effect on perceived performance risk. These conflicting findings may simply be due to the nature of product advertisements: a recent study indicates that the presentation of an advertised message has a marked effect on the relationship between price and perceived performance risk.

Researchers have identified consumers' perception of the credibility of the source of an advertised message—i.e., the manufacturer—as another factor affecting perceived performance risk: one study found that the greater the source credibility, the lower the consumer's perception of the risk of purchasing an advertised new product. However, past research suggests that the relationship between source credibility and perceived performance risk may be more complex: source credibility may interact with price in a subtle way to affect consumers' judgments of the performance risk associated with an advertised product.

(6)

Historians remain divided over the role of banks in facilitating economic growth in the United States in the late eighteenth and early nineteenth centuries. Some scholars contend that banks played a minor role in the nation's growing economy. Financial institutions, they argue, appeared only after the economy had begun to develop, and once organized, followed conservative lending practices, providing aid to established commercial enterprises but shunning those, such as manufacturing and transportation projects, that were more uncertain and capital-intensive (i.e., requiring greater expenditures in the form of capital than in labor).

A growing number of historians argue, in contrast, that banks were crucial in transforming the early national economy. When state legislatures began granting more bank charters in the 1790s and early 1800s, the supply of credit rose accordingly. Unlike the earliest banks, which had primarily provided short-term loans to well-connected merchants, the banks of the early nineteenth century issued credit widely. As Paul Gilje asserts, the expansion and democratization of credit in the early nineteenth century became the driving force of the American economy, as banks began furnishing large amounts of capital to transportation and industrial enterprises. The exception, such historians argue, was in the South; here, the overwhelmingly agrarian nature of the economy generated outright opposition to banks, which were seen as monopolistic institutions controlled by an elite group of planters.

(7)

In recent years, Western business managers have been heeding the exhortations of business journalists and academics to move their companies toward long-term, collaborative "strategic partnerships" with their external business partners (e.g., suppliers). The experts' advice comes as a natural reaction to numerous studies conducted during the past decade that compared Japanese production and supply practices with those of the rest of the world. The link between the success of a certain well-known Japanese automaker and its effective management of its suppliers, for example, has led to an unquestioning belief within Western management circles in the value of strategic partnerships. Indeed, in the automobile sector all three United States manufacturers and most of their European competitors have launched programs to reduce their total number of suppliers and move toward having strategic partnerships with a few.

However, new research concerning supplier relationships in various industries demonstrates that the widespread assumption of Western managers and business consultants that Japanese firms manage their suppliers primarily through strategic partnerships is unjustified. Not only do Japanese firms appear to conduct a far smaller proportion of their business through strategic partnerships than is commonly believed, but they also make extensive use of "market-exchange" relationships, in which either party can turn to the marketplace and shift to different business partners at will, a practice usually associated with Western manufacturers.

(8)

In an effort to explain why business acquisitions often fail, scholars have begun to focus on the role of top executives of acquired companies. Acquired companies that retain their top executives tend to have more successful outcomes than those that do not. Furthermore, existing research suggests that retaining the highest-level top executives, such as the CEO (chief executive officer) and COO (chief operating officer), is related more positively to postacquisition success than retaining lower-ranked top executives. However, this explanation, while insightful, suffers from two limitations. First, the focus on positional rank does not recognize the variation in length of service that may exist in top executive posts across companies, nor does it address which particular top executives (with respect to length of service) should be retained to achieve a successful acquisition outcome. Second, the relationship between retained top executives and acquisition outcomes offered by existing research is subject to opposing theoretical explanations related to length of service. The resource-based view (RBV) suggests that keeping acquired company top executives with longer organizational tenure would lead to more successful outcomes, as those executives have idiosyncratic and nontransferable knowledge of the acquired company that would be valuable for the effective implementation of the acquisition. The opposing position, offered by the upper echelons perspective (UEP), suggests that retaining top executives having short organizational tenure would lead to more successful outcomes, as they would have the adaptability to manage most effectively during the uncertainty of the acquisition process.

Responding to these limitations, Bergh conducted a study of executive retention and acquisition outcome that focused on the organizational tenure of retained company top executives in 104 acquisitions, followed over 5 years. Bergh considered the acquisition successful if the acquired company was retained and unsuccessful if it was divested. Bergh's findings support the RBV position. Apparently, the benefits of long organizational tenure lead to more successful outcomes than the benefits of short organizational tenure. While longer tenured top executives may have trouble adapting to change, it appears that their perspectives and knowledge bases offer unique value after the acquisition. Although from the UEP position it seems sensible to retain less tenured executives and allow more tenured ones to leave, such a strategy appears to lower the probability of acquisition success.

(9)

When Jamaican-born social activist Marcus Garvey came to the United States in 1916, he arrived at precisely the right historical moment. What made the moment right was the return of African American soldiers from the First World War in 1918, which created an ideal constituency for someone with Garvey's message of unity, pride, and improved conditions for African American communities.

Hoping to participate in the traditional American ethos of individual success, many African American people entered the armed forces with enthusiasm, only to find themselves segregated from white troops and subjected to numerous indignities. They returned to a United States that was as segregated as it had been before the war. Considering similar experiences, anthropologist Anthony F. C. Wallace has argued that when a perceptible gap arises between a culture's expectations and the reality of that culture, the resulting tension can inspire a revitalization movement: an organized, conscious effort to construct a culture that fulfills longstanding expectations.

Some scholars have argued that Garvey created the consciousness from which he built, in the 1920s, the largest revitalization movement in African American history. But such an argument only tends to obscure the consciousness of identity, strength, and sense of history that already existed in the African American community. Garvey did not create this consciousness; rather, he gave this consciousness its political expression.

(10)

Arboria is floundering in the global marketplace, incurring devastating losses in market position and profits. The problem is not Arboria's products, but Arboria's trade policy. Arboria faces the prospect of continuing economic loss until Arborian business and political leaders recognize the fundamental differences between Arborian and foreign economic systems. Today the key trade issue is not free trade versus protectionism but diminishing trade versus expanding trade.

Arboria is operating with an obsolete trade policy, an artifact of the mid-1940s when Arboria and Whorfland dominated the global economy, tariffs were the principal obstacle to trade, and Arborian supremacy was

uncontested in virtually all industries. In the intervening decades, economic circumstances have shifted radically. Arborian trade policy has not.

Today, Arboria's trade policy seems paralyzed by the relentless conflict between proponents of “free” and “fair” trade. The free traders argue that Arborian markets should be open, and the movement of goods and services across national borders unrestrained. The fair traders assert that access to Arborian markets should be restricted until Arborian businesses are granted equal access to foreign markets. They contend that free trade is impossible while other nations erect barriers to Arborian exports.

Both are correct: fair trade requires equal access and equal access leads to free trade. But both sides base their positions on the same two outdated premises:

1. Global commerce is conducted under the terms of the General Agreement on Tariffs and Trade (GATT) and dominated by Arboria and similar economic systems abroad.
2. Multilateral negotiations are the most effective way to resolve pressing trade issues.

Both assumptions are wrong. The 40-year-old GATT now covers less than 7 percent of global commerce. World trade is no longer dominated by the free-trade economies; nearly 75 percent is conducted by economic systems operating with principles at odds with those of Arboria. Forging a multilateral trade policy consensus among so many diverse economic systems has become virtually impossible. And while multilateral talks drag on, Arboria misses opportunities for trade expansion.

(11)

In Winters v. United States (1908), the Supreme Court held that the right to use waters flowing through or adjacent to the Fort Berthold Indian Reservation was reserved to American Indians by the treaty establishing the reservation. Although this treaty did not mention water rights, the Court ruled that the federal government, when it created the reservation, intended to deal fairly with American Indians by preserving for them the waters without which their lands would have been useless. Later decisions, citing Winters, established that courts can find federal rights to reserve water for particular purposes if (1) the land in question lies within an enclave under exclusive federal jurisdiction, (2) the land has been formally withdrawn from federal public lands—i.e., withdrawn from the stock of federal lands available for private use under federal land use laws—and set aside or reserved, and (3) the circumstances reveal the government intended to reserve water as well as land when establishing the reservation.

Some American Indian tribes have also established water rights through the courts based on their traditional diversion and use of certain waters prior to the United States’ acquisition of sovereignty. For example, the Rio Grande pueblos already existed when the United States acquired sovereignty over New Mexico in 1848. Although they at that time became part of the United States, the pueblo lands never formally constituted a part of federal public lands; in any event, no treaty,

statute, or executive order has ever designated or withdrawn the pueblos from public lands as American Indian reservations. This fact, however, has not barred application of the Winters doctrine. What constitutes an American Indian reservation is a question of practice, not of legal definition, and the pueblos have always been treated as reservations by the United States. This pragmatic approach is buttressed by Arizona v. California (1963), wherein the Supreme Court indicated that the manner in which any type of federal reservation is created does not affect the application to it of the Winters doctrine. Therefore, the reserved water rights of Pueblo Indians have priority over other citizens' water rights as of 1848, the year in which pueblos must be considered to have become reservations.

(12)

In corporate purchasing, competitive scrutiny is typically limited to suppliers of items that are directly related to end products. With "indirect" purchases (such as computers, advertising, and legal services), which are not directly related to production, corporations often favor "supplier partnerships" (arrangements in which the purchaser forgoes the right to pursue alternative suppliers), which can inappropriately shelter suppliers from rigorous competitive scrutiny that might afford the purchaser economic leverage. There are two independent variables—availability of alternatives and ease of changing suppliers—that companies should use to evaluate the feasibility of subjecting suppliers of indirect purchases to competitive scrutiny. This can create four possible situations.

In Type 1 situations, there are many alternatives and change is relatively easy. Open pursuit of alternatives—by frequent competitive bidding, if possible—will likely yield the best results. In Type 2 situations, where there are many alternatives but change is difficult—as for providers of employee health-care benefits—it is important to continuously test the market and use the results to secure concessions from existing suppliers. Alternatives provide a credible threat to suppliers, even if the ability to switch is constrained. In Type 3 situations, there are few alternatives, but the ability to switch without difficulty creates a threat that companies can use to negotiate concessions from existing suppliers. In Type 4 situations, where there are few alternatives and change is difficult, partnerships may be unavoidable.

(13)

Carotenoids, a family of natural pigments, form an important part of the colorful signals used by many animals. Animals acquire carotenoids either directly (from the plants and algae that produce them) or indirectly (by eating insects) and store them in a variety of tissues. Studies of several animal species have shown that when choosing mates, females prefer males with brighter carotenoid-based coloration. Owens and Olson hypothesize that the presence of carotenoids, as signaled by coloration, would be meaningful in the context of mate selection if carotenoids were either rare or required for health. The conventional view is that carotenoids are meaningful because they are rare: healthier

males can forage for more of the pigments than can their inferior counterparts. Although this may be true, there is growing evidence that carotenoids are meaningful also because they are required: they are used by the immune system and for detoxification processes that are important for maintaining health. It may be that males can use scarce carotenoids either for immune defense and detoxification or for attracting females. Males that are more susceptible to disease and parasites will have to use their carotenoids to boost their immune systems, whereas males that are genetically resistant will use fewer carotenoids for fighting disease and will advertise this by using the pigments for flashy display instead.

(14)

Linda Kerber argued in the mid-1980's that after the American Revolution (1775-1783), an ideology of "republican motherhood" resulted in a surge of educational opportunities for women in the United States. Kerber maintained that the leaders of the new nation wanted women to be educated in order to raise politically virtuous sons. A virtuous citizenry was considered essential to the success of the country's republican form of government; virtue was to be instilled not only by churches and schools, but by families, where the mother's role was crucial. Thus, according to Kerber, motherhood became pivotal to the fate of the republic, providing justification for an unprecedented attention to female education.

Introduction of the “republican motherhood” thesis dramatically changed historiography. Prior to Kerber's work, educational historians barely mentioned women and girls; Thomas Woody's 1929 work is the notable exception. Examining newspaper advertisements for academies, Woody found that educational opportunities increased for both girls and boys around 1750. Pointing to "An Essay on Woman" (1753) as reflecting a shift in view, Woody also claimed that practical education for females had many advocates before the Revolution. Woody's evidence challenges the notion that the Revolution changed attitudes regarding female education, although it may have accelerated earlier trends. Historians' reliance on Kerber's "republican motherhood" thesis may have obscured the presence of these trends, making it difficult to determine to what extent the Revolution really changed women's lives.

(15)

In the Sonoran Desert of northwestern Mexico and southern Arizona, the flowers of several species of columnar cacti—cardon, saguaro, and organ pipe—were once exclusively pollinated at night by nectar-feeding bats, as their close relatives in arid tropical regions of southern Mexico still are. In these tropical regions, diurnal (daytime) visitors to columnar cactus flowers are ineffective pollinators because, by sunrise, the flowers' stigmas become unreceptive or the flowers close. Yet the flowers of the Sonoran Desert cacti have evolved to remain open after sunrise, allowing pollination by such diurnal visitors as bees and birds. Why have these cacti expanded their range of pollinators by remaining

open and receptive in daylight?

This development at the northernmost range of columnar cacti may be due to a yearly variation in the abundance—and hence the reliability—of migratory nectar-feeding bats. Pollinators can be unreliable for several reasons. They can be dietary generalists whose fidelity to a particular species depends on the availability of alternative food sources. Or, they can be dietary specialists, but their abundance may vary widely from year to year, resulting in variable pollination of their preferred food species. Finally, they may be dietary specialists, but their abundance may be chronically low relative to the availability of flowers.

Recent data reveals that during spring in the Sonoran Desert, the nectar-feeding bats are specialists feeding on cardon, saguaro, and organpipe flowers. However, whereas cactus-flower abundance tends to be high during spring, bat population densities tend to be low except near maternity roosts. Moreover, in spring, diurnal cactus-pollinating birds are significantly more abundant in this region than are the nocturnal bats. Thus, with bats being unreliable cactus-flower pollinators, and daytime pollinators more abundant and therefore more reliable, selection favors the cactus flowers with traits that increase their range of pollinators. While data suggest that population densities of nectar-feeding bats are also low in tropical areas of southern Mexico, where bats are the exclusive pollinators of many species of columnar cacti, cactus-flower density and bat population density appear to be much more evenly balanced there: compared with the Sonoran Desert's cardon and saguaro, columnar cacti in southern Mexico produce far fewer flowers per night. Accordingly, despite their low population density, bats are able to pollinate nearly 100 percent of the available flowers.

(16)

Manufacturers have to do more than build large manufacturing plants to realize economies of scale. It is true that as the capacity of a manufacturing operation rises, costs per unit of output fall as plant size approaches “minimum efficient scale,” where the cost per unit of output reaches a minimum, determined roughly by the state of existing technology and size of the potential market. However, minimum efficient scale cannot be fully realized unless a steady “throughput” (the flow of materials through a plant) is attained. The throughput needed to maintain the optimal scale of production requires careful coordination not only of the flow of goods through the production process, but also of the flow of input from suppliers and the flow of output to wholesalers and final consumers. If throughput falls below a critical point, unit costs rise sharply and profits disappear. A manufacturer’s fixed costs and “sunk costs” (original capital investment in the physical plant) do not decrease when production declines due to inadequate supplies of raw materials, problems on the factory floor, or inefficient sales networks. Consequently, potential economies of scale are based on the physical and engineering characteristics of the production facilities—that is, on tangible capital—but realized economies of scale are operational and organizational, and depend on knowledge, skills, experience, and teamwork—that is, on organized human capabilities, or intangible capital.

The importance of investing in intangible capital becomes obvious when one looks at what happens in new capital-intensive manufacturing industries. Such industries are quickly dominated, not by the first firms to acquire technologically sophisticated plants of theoretically optimal size, but rather by the first to exploit the full potential of such plants. Once some firms achieve this, a market becomes extremely hard to enter. Challengers must construct comparable plants and do so after the first movers have already worked out problems with suppliers or with new production processes. Challengers must create distribution networks and marketing systems in markets where first movers have all the contacts and know-how. And challengers must recruit management teams to compete with those that have already mastered these functional and strategic activities.

(17)

A small number of the forest species of lepidoptera (moths and butterflies, which exist as caterpillars Line during most of their life cycle) exhibit regularly recurring patterns of population growth and decline—such fluctuations in population are known as population cycles. Although many different variables influence population levels, a regular pattern such as a population cycle seems to imply a dominant, driving force. Identification of that driving force, however, has proved surprisingly elusive despite considerable research. The common approach of studying causes of population cycles by measuring the mortality caused by different agents, such as predatory birds or parasites, has been unproductive in the case of lepidoptera. Moreover, population ecologists' attempts to alter cycles by changing the caterpillars' habitat and by reducing caterpillar populations have not succeeded. In short, the evidence implies that these insect populations, if not self-regulating, may at least be regulated by an agent more intimately connected with the insect than are predatory birds or parasites.

Recent work suggests that this agent may be a virus. For many years, viral disease had been reported in declining populations of caterpillars, but population ecologists had usually considered viral disease to have contributed to the decline once it was underway rather than to have initiated it. The recent work has been made possible by new techniques of molecular biology that allow viral DNA to be detected at low concentrations in the environment. Nuclear polyhedrosis viruses are hypothesized to be the driving force behind population cycles in lepidoptera in part because the viruses themselves follow an infectious cycle in which, if protected from direct sun light, they may remain virulent for many years in the environment, embedded in durable crystals of polyhedrin protein. Once ingested by a caterpillar, the crystals dissolve, releasing the virus to infect the insect's cells. Late in the course of the infection, millions of new virus particles are formed and enclosed in polyhedrin crystals. These crystals reenter the environment after the insect dies and decomposes, thus becoming available to infect other caterpillars.

One of the attractions of this hypothesis is its broad applicability. Remarkably, despite significant differences in habitat and behavior,

many species of lepidoptera have population cycles of similar length, between eight and eleven years. Nuclear polyhedrosis viral infection is one factor these disparate species share.

(18)

Resin is a plant secretion that hardens when exposed to air; fossilized resin is called amber. Although Pliny in the first century recognized that amber was produced from “marrow discharged by trees,” amber has been widely misunderstood to be a semiprecious gem and has even been described in mineralogy textbooks. Confusion also persists surrounding the term “resin,” which was defined before rigorous chemical analyses were available. Resin is often confused with gum, a substance produced in plants in response to bacterial infections, and with sap, an aqueous solution transported through certain plant tissues. Resin differs from both gum and sap in that scientists have not determined a physiological function for resin.

In the 1950s, entomologists posited that resin may function to repel or attract insects. Fraenkel conjectured that plants initially produced resin in nonspecific chemical responses to insect attack and that, over time, plants evolved that produced resin with specific repellent effects. But some insect species, he noted, might overcome the repellent effects, actually becoming attracted to the resin. This might induce the insects to feed on those plants or aid them in securing a breeding site. Later researchers suggested that resin mediates the complex interdependence, or “coevolution,” of plants and insects over time. Such ideas led to the development of the specialized discipline of chemical ecology, which is concerned with the role of plant chemicals in interactions with other organisms and with the evolution and ecology of plant antiherbivore chemistry (plants' chemical defenses against attack by herbivores such as insects).

(19)

During the 1980s, many economic historians studying Latin America focused on the impact of the Great Depression of the 1930s. Most of these historians argued that although the Depression began earlier in Latin America than in the United States, it was less severe in Latin America and did not significantly impede industrial growth there. The historians’ argument was grounded in national government records concerning tax revenues and exports and in government-sponsored industrial censuses, from which historians have drawn conclusions about total manufacturing output and profit levels across Latin America. However, economic statistics published by Latin American governments in the early twentieth century are neither reliable nor consistent; this is especially true of manufacturing data, which were gathered from factory owners for taxation purposes and which therefore may well be distorted. Moreover, one cannot assume a direct correlation between the output level and the profit level of a given industry as these variables often move in opposite directions. Finally, national and regional economies are composed of individual firms and industries, and relying on general, sweeping economic indicators may mask substantial variations among

these different enterprises. For example, recent analyses of previously unexamined data on textile manufacturing in Brazil and Mexico suggest that the Great Depression had a more severe impact on this Latin American industry than scholars had recognized.

(20)

Among the myths taken as fact by the environmental managers of most corporations is the belief that environmental regulations affect all competitors in a given industry uniformly. In reality, regulatory costs—and therefore compliance—fall unevenly, economically disadvantaging some companies and benefiting others. For example, a plant situated near a number of larger non-compliant competitors is less likely to attract the attention of local regulators than is an isolated plant, and less attention means lower costs.

Additionally, large plants can spread compliance costs such as waste treatment across a larger revenue base; on the other hand, some smaller plants may not even be subject to certain provisions such as permit or reporting requirements by virtue of their size. Finally, older production technologies often continue to generate toxic wastes that were not regulated when the technology was first adopted. New regulations have imposed extensive compliance costs on companies still using older industrial coal-fired burners that generate high sulfur dioxide and nitrogen oxide outputs, for example, whereas new facilities generally avoid processes that would create such waste products. By realizing that they have discretion and that not all industries are affected equally by environmental regulation, environmental managers can help their companies to achieve a competitive edge by anticipating regulatory pressure and exploring all possibilities for addressing how changing regulations will affect their companies specifically.

(21)

Two works published in 1984 demonstrate contrasting approaches to writing the history of United States women. Buel and Buel's biography of Mary Fish (1736–1818) makes little effort to place her story in the context of recent historiography on women. Lebsock, meanwhile, attempts not only to write the history of women in one southern community, but also to redirect two decades of historiographical debate as to whether women gained or lost status in the nineteenth century as compared with the eighteenth century. Although both books offer the reader the opportunity to assess this controversy regarding women's status, only Lebsock's deals with it directly. She examines several different aspects of women's status, helping to refine and resolve the issues. She concludes that while women gained autonomy in some areas, especially in the private sphere, they lost it in many aspects of the economic sphere. More importantly, she shows that the debate itself depends on frame of reference: in many respects, women lost power in relation to men, for example, as certain jobs (delivering babies, supervising schools) were taken over by men. Yet women also gained power in comparison with their previous status, owning a higher proportion of real estate, for example. In contrast, Buel and Buel's

biography provides ample raw material for questioning the myth, fostered by some historians, of a colonial golden age in the eighteenth century but does not give the reader much guidance in analyzing the controversy over women's status.

(22)

Acting on the recommendation of a British government committee investigating the high incidence in white lead factories of illness among employees, most of who were women, the Home Secretary proposed in 1895 that Parliament enact legislation that would prohibit women from holding most jobs in white lead factories. Although the Women's Industrial Defense Committee (WIDC), formed in 1892 in response to earlier legislative attempts to restrict women's labor, did not discount the white lead trade's potential health dangers, it opposed the proposal, viewing it as yet another instance of limiting women's work opportunities.

Also opposing the proposal was the Society for Promoting the Employment of Women (SPEW), which attempted to challenge it by investigating the causes of illness in white lead factories. SPEW contended, and WIDC concurred, that controllable conditions in such factories were responsible for the development of lead poisoning. SPEW provided convincing evidence that lead poisoning could be avoided if workers were careful and clean and if already extant workplace safety regulations were stringently enforced. However, the Women's Trade Union League (WTUL), which had ceased in the late 1880s to oppose restrictions on women's labor, supported the eventually enacted proposal, in part because safety regulations were generally not being enforced in white lead factories, where there were no unions (and little prospect of any) to pressure employers to comply with safety regulations.

(23)

It is an odd but indisputable fact that the seventeenth-century English women who are generally regarded as among the forerunners of modern feminism are almost all identified with the Royalist side in the conflict between Royalists and Parliamentarians known as the English Civil Wars. Since Royalist ideology is often associated with the radical patriarchalism of seventeenth century political theorist Robert Filmer—a patriarchalism that equates family and kingdom and asserts the divinely ordained absolute power of the king and, by analogy, of the male head of the household—historians have been understandably puzzled by the fact that Royalist women wrote the earliest extended criticisms of the absolute subordination of women in marriage and the earliest systematic assertions of women's rational and moral equality with men. Some historians have questioned the facile equation of Royalist ideology with Filmerian patriarchalism; and indeed, there may have been no consistent differences between Royalists and Parliamentarians on issues of family organization and women's political rights, but in that case one would expect early feminists to be equally divided between the two sides.

Catherine Gallagher argues that Royalism engendered feminism

because the ideology of absolute monarchy provided a transition to an ideology of the absolute self. She cites the example of the notoriously eccentric author Margaret Cavendish (1626–1673), duchess of Newcastle. Cavendish claimed to be as ambitious as any woman could be, but knowing that as a woman she was excluded from the pursuit of power in the real world, she resolved to be mistress of her own world, the “immaterial world” that any person can create within her own mind—and, as a writer, on paper. In proclaiming what she called her “singularity,” Cavendish insisted that she was a self-sufficient being within her mental empire, the center of her own subjective universe rather than a satellite orbiting a dominant male planet. In justifying this absolute singularity, Cavendish repeatedly invoked the model of the absolute monarch, a figure that became a metaphor for the self-enclosed, autonomous nature of the individual person. Cavendish’s successors among early feminists retained her notion of woman’s sovereign self, but they also sought to break free from the complete political and social isolation that her absolute singularity entailed.

(24)

Frazier and Mosteller assert that medical research could be improved by a move toward larger, simpler clinical trials of medical treatments. Currently, researchers collect far more background information on patients than is strictly required for their trials—substantially more than hospitals collect—thereby escalating costs of data collection, storage, and analysis. Although limiting information collection could increase the risk that researchers will overlook facts relevant to a study, Frazier and Mosteller contend that such risk, never entirely eliminable from research, would still be small in most studies. Only in research on entirely new treatments are new and unexpected variables likely to arise.

Frazier and Mosteller propose not only that researchers limit data collection on individual patients but also that researchers enroll more patients in clinical trials, thereby obtaining a more representative sample of the total population with the disease under study. Often researchers restrict study participation to patients who have no ailments besides those being studied. A treatment judged successful under these ideal conditions can then be evaluated under normal conditions. Broadening the range of trial participants, Frazier and Mosteller suggest, would enable researchers to evaluate a treatment’s efficacy for diverse patients under various conditions and to evaluate its effectiveness for different patient subgroups. For example, the value of a treatment for a progressive disease may vary according to a patient’s stage of disease. Patients’ ages may also affect a treatment’s efficacy.

(25)

There are recent reports of apparently drastic declines in amphibian populations and of extinctions of a number of the world's endangered amphibian species. These declines, if real, may be signs of a general trend toward extinction, and many environmentalists have claimed that immediate environmental action is necessary to remedy this "amphibian crisis", which, in their view, is an indicator of general and catastrophic

environmental degradation due to human activity.

To evaluate these claims, it is useful to make a preliminary distinction that is far too often ignored. A declining population should not be confused with an endangered one. An endangered population is always rare, almost always small, and, by definition, under constant threat of extinction even without a proximate cause in human activities. Its disappearance, however unfortunate, should come as no great surprise. Moreover, chance events—which may indicate nothing about the direction of trends in population size—may lead to its extinction. The probability of extinction due to such random factors depends on the population size and is independent of the prevailing direction of change in that size.

For biologists, population declines are potentially more worrisome than extinctions. Persistent declines, especially in large populations, indicate a changed ecological context. Even here, distinctions must again be made among declines that are only apparent (in the sense that they are part of habitual cycles or of normal fluctuations), declines that take a population to some lower but still acceptable level, and those that threaten extinction (e.g., by taking the number of individuals below the minimum viable population). Anecdotal reports of population decreases cannot distinguish among these possibilities, and some amphibian populations have shown strong fluctuations in the past.

It is indisputably true that there is simply not enough long-term scientific data on amphibian populations to enable researches to identify real declines in amphibian populations. Many fairly common amphibian species declared all but extinct after severe declines in the 1950s and 1960s have subsequently recovered, and so might the apparently declining populations that have generated the current appearance of an amphibian crisis. Unfortunately, long-term data will not soon be forthcoming, and postponing environmental action while we wait for it may doom species and whole ecosystems to extinction.

(26)

While the most abundant and dominant species within a particular ecosystem is often crucial in perpetuating the ecosystem, a “keystone” species, here defined as one whose effects are much larger than would be predicted from its abundance, can also play a vital role. But because complex species interactions may be involved, identifying a keystone species by removing the species and observing changes in the ecosystem is problematic. It might seem that certain traits would clearly define a species as a keystone species; for example, Pisaster ochraceus is often a keystone predator because it consumes and suppresses mussel populations, which in the absence of this starfish can be a dominant species. But such predation on a dominant or potentially dominant species occurs in systems that do as well as in systems that do not have species that play keystone roles. Moreover, whereas P. ochraceus occupies an unambiguous keystone role on wave-exposed rocky headlands, in more wave-sheltered habitats the impact of P. ochraceus predation is weak or nonexistent, and at certain sites sand burial is responsible for eliminating mussels. Keystone status

appears to depend on context, whether of particular geography or of such factors as community diversity (for example, a reduction in species diversity may thrust more of the remaining species into keystone roles) and length of species interaction (since newly arrived species in particular may dramatically affect ecosystems).

(27)

Conodonts, the spiky phosphatic remains (bones and teeth composed of calcium phosphate) of tiny marine animals that probably appeared about 520 million years ago, were once among the most controversial of fossils. Both the nature of the organism to which the remains belonged and the function of the remains were unknown. However, since the 1981 discovery of fossils preserving not just the phosphatic elements but also other remains of the tiny soft-bodied animals (also called conodonts) that bore them, scientists' reconstructions of the animals' anatomy have had important implications for hypotheses concerning the development of the vertebrate skeleton.

The vertebrate skeleton had traditionally been regarded as a defensive development, champions of this view postulating that it was only with the much later evolution of jaws that vertebrates became predators. The first vertebrates, which were soft-bodied, would have been easy prey for numerous invertebrate carnivores, especially if these early vertebrates were sedentary suspension feeders. Thus, traditionalists argued, these animals developed coverings of bony scales or plates, and teeth were secondary features, adapted from the protective bony scales. Indeed, external skeletons of this type are common among the well-known fossils of ostracoderms, jawless vertebrates that existed from approximately 500 to 400 million years ago. However, other paleontologists argued that many of the definitive characteristics of vertebrates, such as paired eyes and muscular and skeletal adaptations for active life, would not have evolved unless the first vertebrates were predatory. Teeth were more primitive than external armor according to this view, and the earliest vertebrates were predators.

The stiffening notochord along the back of the body, V-shaped muscle blocks along the sides, and posterior tail fins help to identify conodonts as among the most primitive of vertebrates. The lack of any mineralized structures apart from the elements in the mouth indicates that conodonts were more primitive than the armored jawless fishes such as the ostracoderms. It now appears that the hard parts that first evolved in the mouth of an animal improved its efficiency as a predator, and that aggression rather than protection was the driving force behind the origin of the vertebrate skeleton.

(28)

Jon Clark’s study of the effect of the modernization of a telephone exchange on exchange maintenance work and workers is a solid contribution to a debate that encompasses two lively issues in the history and sociology of technology: technological determinism and social constructivism.

Clark makes the point that the characteristics of a technology have a decisive influence on job skills and work organization. Put more strongly, technology can be a primary determinant of social and managerial organization. Clark believes this possibility has been obscured by the recent sociological fashion, exemplified by Braverman's analysis, that emphasizes the way machinery reflects social choices. For Braverman, the shape of a technological system is subordinate to the manager's desire to wrest control of the labor process from the workers. Technological change is construed as the outcome of negotiations among interested parties who seek to incorporate their own interests into the design and configuration of the machinery. This position represents the new mainstream called social constructivism.

The constructivists gain acceptance by misrepresenting technological determinism: technological determinists are supposed to believe, for example, that machinery imposes appropriate forms of order on society. The alternative to constructivism, in other words, is to view technology as existing outside society, capable of directly influencing skills and work organization.

Clark refutes the extremes of the constructivists by both theoretical and empirical arguments. Theoretically he defines "technology" in terms of relationships between social and technical variables. Attempts to reduce the meaning of technology to cold, hard metal are bound to fail, for machinery is just scrap unless it is organized functionally and supported by appropriate systems of operation and maintenance. At the empirical level Clark shows how a change at the telephone exchange from maintenance-intensive electromechanical switches to semielectronic switching systems altered work tasks, skills, training opportunities, administration, and organization of workers. Some changes Clark attributes to the particular way management and labor unions negotiated the introduction of the technology, whereas others are seen as arising from the capabilities and nature of the technology itself. Thus Clark helps answer the question: "When is social choice decisive and when are the concrete characteristics of technology more important?"

(29)

Because the framers of the United States Constitution (written in 1787) believed that protecting property rights relating to inventions would encourage the new nation's economic growth, they gave Congress—the national legislature—a constitutional mandate to grant patents for inventions. The resulting patent system has served as a model for those in other nations. Recently, however, scholars have questioned whether the American system helped achieve the framers' goals. These scholars have contended that from 1794 to roughly 1830, American inventors were unable to enforce property rights because judges were "antipatent" and routinely invalidated patents for arbitrary reasons. This argument is based partly on examination of court decisions in cases where patent holders ("patentees") brought suit alleging infringement of their patent rights. In the 1820s, for instance, 75 percent of verdicts were decided against the patentee. The proportion of verdicts for the patentee began to increase in the 1830s, suggesting to

these scholars that judicial attitudes toward patent rights began shifting then.

Not all patent disputes in the early nineteenth century were litigated, however, and litigated cases were not drawn randomly from the population of disputes. Therefore the rate of verdicts in favor of patentees cannot be used by itself to gauge changes in judicial attitudes or enforceability of patent rights. If early judicial decisions were prejudiced against patentees, one might expect that subsequent courts—allegedly more supportive of patent rights—would reject the former legal precedents. But pre-1830 cases have been cited as frequently as later decisions, and they continue to be cited today, suggesting that the early decisions, many of which clearly declared that patent rights were a just recompense for inventive ingenuity, provided a lasting foundation for patent law. The proportion of judicial decisions in favor of patentees began to increase during the 1830s because of a change in the underlying population of cases brought to trial. This change was partly due to an 1836 revision to the patent system: an examination procedure, still in use today, was instituted in which each application is scrutinized for its adherence to patent law. Previously, patents were automatically granted upon payment of a $30 fee.

(30)

Jacob Burckhardt's view that Renaissance European women "stood on a footing of perfect equality" with Renaissance men has been repeatedly cited by feminist scholars as a prelude to their presentation of rich historical evidence of women's inequality. In striking contrast to Burckhardt, Joan Kelly in her famous 1977 essay, "Did Women Have a Renaissance?" argued that the Renaissance was a period of economic and social decline for women relative both to Renaissance men and to medieval women. Recently, however, a significant trend among feminist scholars has entailed a rejection of both Kelly's dark vision of the Renaissance and Burckhardt's rosy one. Many recent works by these scholars stress the ways in which differences among Renaissance women—especially in terms of social status and religion—work to complicate the kinds of generalizations both Burckhardt and Kelly made on the basis of their observations about upper-class Italian women.

The trend is also evident, however, in works focusing on those middle- and upper-class European women whose ability to write gives them disproportionate representation in the historical record. Such women were, simply by virtue of their literacy, members of a tiny minority of the population, so it is risky to take their descriptions of their experiences as typical of "female experience" in any general sense. Tina Krontiris, for example, in her fascinating study of six Renaissance women writers, does tend at times to conflate "women" and "women writers," assuming that women's gender, irrespective of other social differences, including literacy, allows us to view women as a homogeneous social group and make that group an object of analysis. Nonetheless, Krontiris makes a significant contribution to the field and is representative of those authors who offer what might be called a cautiously optimistic assessment of Renaissance women's achievements, although she also stresses the social obstacles Renaissance women faced when they sought to raise

their “oppositional voices.” Krontiris is concerned to show women intentionally negotiating some power for themselves (at least in the realm of public discourse) against potentially constraining ideologies, but in her sober and thoughtful concluding remarks, she suggests that such verbal opposition to cultural stereotypes was highly circumscribed; women seldom attacked the basic assumptions in the ideologies that oppressed them.

(31)

When asteroids collide, some collisions cause an asteroid to spin faster; others slow it down. If asteroids are all monoliths—single rocks—undergoing random collisions, a graph of their rotation rates should show a bell-shaped distribution with statistical “tails” of very fast and very slow rotators. If asteroids are rubble piles, however, the tail representing the very fast rotators would be missing, because any loose aggregate spinning faster than once every few hours (depending on the asteroid’s bulk density) would fly apart. Researchers have discovered that all but five observed asteroids obey a strict limit on rate of rotation. The exceptions are all smaller than 200 meters in diameter, with an abrupt cutoff for asteroids larger than that.

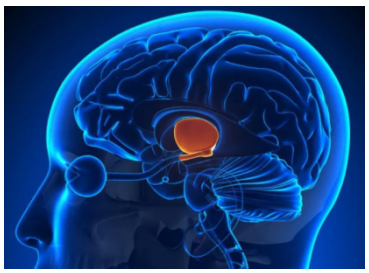
The evident conclusion—that asteroids larger than 200 meters across are multicomponent structures or rubble piles—agrees with recent computer modeling of collisions, which also finds a transition at that diameter. A collision can blast a large asteroid to bits, but after the collision those bits will usually move slower than their mutual escape velocity. Over several hours, gravity will reassemble all but the fastest pieces into a rubble pile. Because collisions among asteroids are relatively frequent, most large bodies have already suffered this fate. Conversely, most small asteroids should be monolithic, because impact fragments easily escape their feeble gravity.

(32)

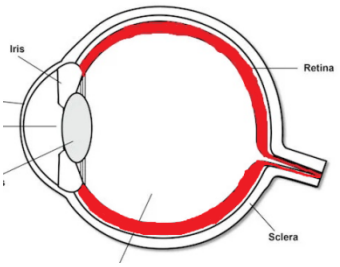
Most attempts by physicists to send particles faster than the speed of light involve a remarkable phenomenon called quantum tunneling, in which particles travel through solid barriers that appear to be impenetrable. If you throw a ball at a wall, you expect it to bounce back, not to pass straight through it. Yet subatomic particles perform the equivalent feat. Quantum theory says that there is a distinct, albeit small, probability that such a particle will tunnel its way through a barrier; the probability declines exponentially as the thickness of the barrier increases. Though the extreme rapidity of quantum tunneling was noted as early as 1932, not until 1955 was it hypothesized—by Wigner and Eisenbud—that tunneling particles sometimes travel faster than light. Their grounds were calculations that suggested that the time it takes a particle to tunnel through a barrier increases with the thickness of the barrier until tunneling time reaches a maximum; beyond that maximum, tunneling time stays the same regardless of barrier thickness. This would imply that once maximum tunneling time is reached, tunneling speed will increase without limit as barrier thickness increases. Several recent experiments have supported this hypothesis that tunneling

particles sometimes reach superluminal speed. According to measurements performed by Raymond Chiao and colleagues, for example, photons can pass through an optical filter at 1.7 times the speed of light.

(1)



(hypothalamus)

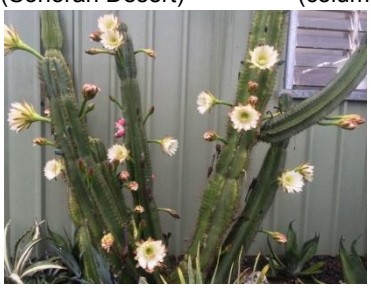


(retina)

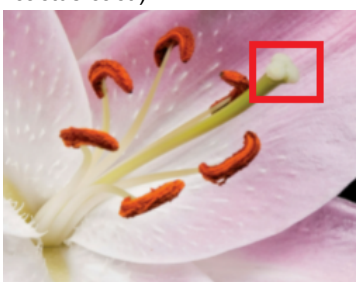
(15)

(Sonoran Desert)

(columnar cactus/cacti)



(cactus flowers)



(flower's stigma)

(18)

(amber)

(gum)

(sap)

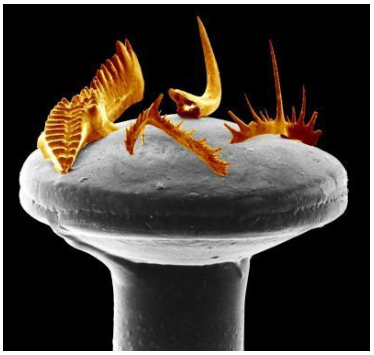
(20)

(older industrial coal-fired burner)

(26)

(Pisaster ochraceus) (mussel)

(27)



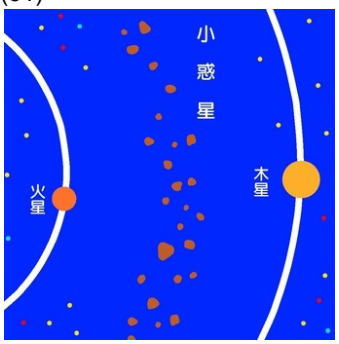
(Conodont 1) (Conodont 2)

(ostracoderm) (V-shaped muscle)

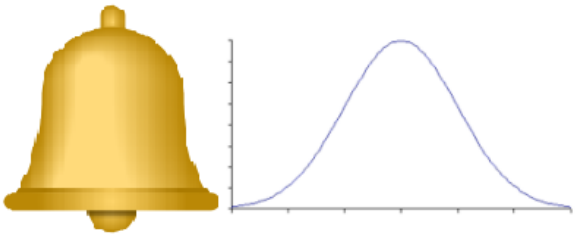
(28)

(telephone exchange)

(31)

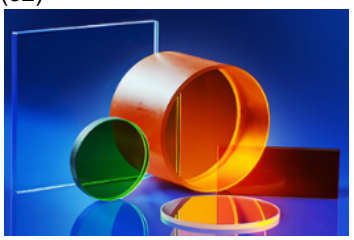


(asteroids)



(bell-shaped distribution)

(32)



(optical filter)