Review: The Factual Sensibility
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REVIEWS ON ARTIFACT AND EXPERIMENT

The factual sensibility

Oliver Impey; Arthur MacGregor (Editors). *The Origins of Museums: The Cabinet of Curiosities in Sixteenth- and Seventeenth-Century Europe*. xiii + 335 pp., illus., bibl., index. Oxford: Oxford University Press, 1985. $105.

Arthur MacGregor (Editor). *Tradescant's Rarities: Essays on the Foundation of the Ashmolean Museum, 1683; with a Catalogue of the Surviving Early Collections*. xiii + 382 pp., illus., apps., microfiches, bibl., index. Oxford: Oxford University Press, 1983. $105.

R. F. Ovenell. *The Ashmolean Museum, 1683–1894*. vii + 276 pp., illus., index. Oxford: Oxford University Press, 1986. $48.

In 1683 the English polymath Elias Ashmole, charter member of the Royal Society, Comptroller of the Excise, student of alchemy, numismatics, history, botany, anatomy, and logic, officially made Oxford University a gift of the choicest collection of natural and artificial rarities then extant in the British Isles. In the preamble to the 1686 regulations for the museum built to house these objects Ashmole explained his donation:

> Because the knowledge of Nature is very necessarie to humane life, health, & the conveniences thereof, & because that knowledge cannot be soe well & usefully attain'd, except the history of Nature be knowne and considered; and to this [end], is requisite the inspection of Particulars, especially those as are extraordinary in their Fabrick, or useful in Medicine, or applyed to Manufacture or Trade: I Elias Ashmole, out of my affection to this sort of Learning, wherein my self have taken & still doe take the greatest delight; for which cause also, I have amass'd together great variety of natural Concretes & Bodies, & bestowed them on the University of Oxford, wherein my selfe have been a Student & of which I have the honor to be a Member. (Quoted in Impey and MacGregor, p. 152.)

In this mixture of alumnal loyalties, Baconian pieties befitting a Fellow of the Royal Society, and, especially, relish for the "Particulars" of nature, Ashmole shows himself to have been well attuned to the collecting spirit of his age. It is therefore fitting that the editors and authors of the books under review have made the tercentenary of the Ashmolean Museum in Oxford the occasion for a full-dress examination of that institution in the context of both natural philosophy at Oxford and the cabinet of curiosities in early modern Europe.

Yet despite the inscription in gold letters over the door of the old Ashmolean —"MUSAEUM ASHMOLIANUM: SCHOLA NATURALIS HISTORIAE: OFFICINA CHIMICA"—the history of science is meagerly represented. These handsomely (and, in the case of the MacGregor anthology, lavishly) produced volumes were assembled largely by and for art historians, or intended, in Ovenell's case, as institutional history. Although the Ashmolean was meant to be a center for natural philosophy, with a lectureship in that subject and a chemical laboratory attached to it, its collection of wampum belts, portraits, intaglios, lathe-turned ivory, ornate weapons, Oriental footware, Palissy-ware, and carved alabaster panels,

alongside the stuffed dodoes and armadillos, seem in retrospect to connect it more directly with the latter-day museum of art or ethnography than with latter-day science. Indeed, the authors of these and earlier studies of the cabinets of curiosities have usually been at pains to distinguish the "genuine" science of the period from the distinctly unnatural natural history pursued by the typical collector of *naturalia*. Even the more sober, academic collections of Ulisse Aldrovandi in Bologna and Olaus Worm in Copenhagen, both eminent naturalists, featured the rare, the bizarre, and the monstrous too prominently to be comfortably included in a mainstream history of sixteenth- and seventeenth-century science. Nonetheless these studies of European collecting do indeed carry implications for the history of the Scientific Revolution, or so I shall argue.

First, the studies themselves. R. F. Ovenell was Librarian of the Ashmolean Museum for twenty-five years, and his thorough, balanced study of its history through 1894, when the move to its present quarters was completed with "no losses and no breakages" (Ovenell, p. 264), is replete with citations of the correspondence, budgets, and inventories that record the intimate life of the museum over some two centuries. After a brief prehistory of the museum, including a detailed account of how Ashmole acquired the rarities of the gardener John Tradescant and of the circumstances surrounding his donation of them to his alma mater, Ovenell organizes the subsequent chapters by the tenures of the line of curators that began with the naturalist and chemist Robert Plot, F.R.S. Ovenell has his favorites among the curators, preferring, for example, the scholarly Edward Lhwyd to the "cold and calculating" Plot, but his major theme is the daily business of keeping the museum running in fat times and lean. We learn of the eighteen gold medals filched by a German visitor who spoke "tolerable good English & Latine" (quoted on p. 66), the decaying stuffed dodo (p. 143), the donations of everything from miscellaneous kidney stones to a picture of the Crucifixion done in hummingbird feathers (pp. 137–138), and the financial worries that were relieved only in 1774, when the Keeper of the Ashmolean was finally made a paid official of Oxford University.

Ovenell's study is particularly valuable for its minute portrait of the museum during its eighteenth-century slide into decay, after the heyday of curiosity collecting was over and before the energetic Duncan brothers restored the museum along more respectable lines in the early decades of the nineteenth century. Before the Duncans bought new display cases, varnished the crocodiles, deleted most of the curiosities from the catalogue, and rearranged the zoological collection "to attempt a slight & very general illustration of Paley and Cuvier" (quoted on p. 190), the Ashmolean had become a symbol of science without its substance. Natural philosophy had parted ways with Bacon's tripartite vision of natural history—natural, preternatural, and artificial—that had made sense of the Ashmolean's holdings, and collecting had become the hobby of wealthy dilettantes with considerably less interest in matters scientific than the virtuosi had evinced a generation or two before. Even the Royal Society, though still in the hands of gentlemanly amateurs, had allowed its "Repository" to go to rack and ruin. (The Paris Académie des Sciences had never seen fit to have one at all.) Yet to the cultivated public, both foreign and domestic, who visited the Ashmolean in droves during the eighteenth century, its "great variety of natural Concretes & Bodies" was the visible face of science. Ovenell himself has little sympathy with what the Ashmolean represented during this period, but he has nonetheless provided the raw materials for an analysis of the cultural meaning of science in the eighteenth century that would be difficult to come by in other extant museum histories.

Just what did the Ashmolean's early visitors come to see? Arthur MacGregor's

catalogue and the accompanying articles by various authors in *Tradescant's Rarities* reconstruct the original collection in painstaking detail.[1] The catalogue itself describes all extant items with texts, photographs, and, in many cases, line drawings; Appendix 4 presents a concordance of this catalogue with all previous catalogues, from that of the *Musæum Tradescantianum* of 1656 to the most recent Ashmolean catalogue of 1980; and the five microfiches attached to the book provide facsimiles and translations of the Ashmolean Museum Book of Benefactors of the "Liber Dñi Decani Ædis Christi," of the 1685 Ashmolean manuscript catalogue, and of the 1656 *Musæum Tradescantianum* catalogue. Each catalogue entry is a minor research project in itself, tracing not only the provenance of the object at hand but also that of comparable objects in contemporary collections. Item 210, for example, a wrought-iron cradle that allegedly once held the infant Henry VI, is the occasion for an erudite short essay on the construction of late medieval cradles. Separate and ample bibliographies supplement both the introductory essays and the catalogue itself; additional brief essays are devoted to special topics such as "Coins and Medals" and, of particular interest to historians of biology, "Zoological Specimens" (by Keith Davies, corresponding to nos. 393–432 of the catalogue). Taken together, the catalogue, appendixes, microfiches (a most welcome innovation in scholarly publishing), and explanatory apparatus are a monument to thorough, fastidious, unstinting scholarship.

The nearly 450 items catalogued (all that survives of the twelve cartloads Ashmole originally shipped from London to Oxford in 1683) run the gamut from Roman jars to an Indian deerskin mantle alleged to be that of Powhatan, to an illuminated manuscript bestiary, to the upper jaw of a walrus, plus numerous portraits, coins, and medallions. (The remains of the Tradescant collection have been on display in a special room at the Ashmolean since 1976.) As the introductory essays make clear, the range, if not the richness, of what was once known as "Tradescant's Ark" was typical of contemporary European collections north of the Alps. (The Italian cabinets tended to specialize in antiquities, the fine arts, or natural history.) MacGregor's essay "Collectors and Collections of Rarities in the Sixteenth and Seventeenth Centuries" situates the Tradescant collection within this international context and is indeed perhaps the best short overview of the entire subject. The Tradescants, father and son, were unusual only in their occupation, being gardeners *extraordinaires* rather than princes or wealthy gentlemen or academics. John Tradescant senior was an indefatigable traveler as well as the greenest of thumbs, and his expeditions to Russia, Algiers, France, Virginia, and other far-flung destinations supplied his English clients with a bevy of new flowers, vines, and fruit trees (it was he who cultivated the first lilac and acacia in England [2]), and his own collection with all manner of natural and artificial rarities. By the 1630s the "Ark" at the Tradescant home in South Lambeth was a tourist attraction, open to the public for a small entrance fee. April London shows in her essay "*Musæum Tradescantianum* and the Benefactors to the Tradescant Museum" that the publication of the 1656 catalogue, financed by Ashmole, not only spread the collection's fame but also attracted numerous gifts, supplementing those already donated by Tradescant's aristocratic patrons and their friends. Martin Welch's two essays on the foundation and early days of the Ashmolean dissect the tangled relationships, personal and legal, of Ashmole and the Tradescant family and offer a vivid picture of the Ashmolean Museum through the eyes of its first visitors.

[1] Also reviewed in *Isis*, 1985, *76*:600–602.

[2] Keith Thomas, *Man and the Natural World: Changing Attitudes in England, 1500–1800* (London: Allen Lane, 1983), p. 227.

Many of these visitors, like the eagle-eyed German Zacharias Conrad von Uffenbach, came from abroad. By the early seventeenth century visits to local cabinets, private as well as institutional, were already *de rigueur* for gentlemen making the Grand Tour, as John Evelyn's diary and travel guides like Maximilian Misson's *A New Voyage to Italy* (1699) or B. de Monconys's *Journal des voyages* (1665–1666) reveal. By Evelyn's time there were enough cabinets to sate even his voracious appetite for the strange and wondrous; he could barely manage a yawn for the Oxford Anatomy School, "adorn'd with some rarities of natural things; but nothing extraordinary."[3] Uffenbach was similarly jaded by the time he arrived in England and sneered at the pretensions of the Ashmolean and Royal Society museums; he had already seen bigger and better elsewhere (Impey and MacGregor, p. 167). The culture of cabinets was a cosmopolitan one, and travel—travel with open eyes, open notebook, and open purse—was its leitmotif. Travel was the alpha and omega of collecting, being both the source of the bulk of the objects—the voyages of exploration and subsequent trade with newly discovered lands created a steady flow of exotica—and the occasion for inspecting them in Amsterdam, Oxford, Venice, Paris, Augsburg, Uppsala, or wherever the curious and peripatetic tourist might land. By the late sixteenth century celebrated collections like that of Ferdinand II of Tirol at Ambras or Ulisse Aldrovandi at Bologna already belonged to the major sights of their regions. Montaigne paid a visit to the castle at Ambras in 1580 and was piqued when he was turned away without a tour: "Ceste fredur [i.e., froideur] . . . offença un peu M. de Montaigne," he confided to his travel journal.[4] The rarities housed in the cabinets embodied the escapism and thirst for novelty that were the *raison d'être* of recreational travel, and their more subdued descendants, museums, have remained a staple of tourism ever since.

Oliver Impey and Arthur MacGregor's anthology of thirty-three essays on the European cabinets of the early modern period attempts to capture the pan-European scope of the collecting phenomenon, from Rome to St. Petersburg, from Prague to Copenhagen; only French cabinets are oddly neglected. It is, *in toto,* also the most conceptually sophisticated study of the subject to appear since the pioneering works of David Murray and Julius von Schlosser, published at the turn of this century.[5] Yet as the title, *The Origins of Museums,* suggests, editors and contributors still approach their subject with Murray and Von Schlosser's interest in anticipations and forerunners of modern museum practice. Because of this present-pointed vector, perhaps too much is made of exceptional instances of public admission to collections, well-lit galleries, and rational classification, and too much opprobrium heaped on the pronounced taste for the singular and the bizarre. These reservations aside, the essays are noteworthy for their attention to the artistic, intellectual, and social milieus in which collecting took place and to intriguing regional differences. Although only a quarter of the essays address themselves directly to the scientific content of the cabinets, the historian of

[3] John Evelyn, *The Diary of John Evelyn,* ed. E. S. de Beer, 6 vols. (Oxford: Oxford Univ. Press, 1955), Vol. III, p. 108.

[4] Michel de Montaigne, *Journal de voyage en Italie par la Suisse et l'Allemagne en 1580 et 1581,* ed. Maurice Rat (Paris: Éditions Garnier Frères, 1955), p. 54. The remains of the collection can still be seen on display at the Schloss Ambras. Many pieces were transferred to the Kunsthistorisches Museum in Vienna in the nineteenth century; see the catalogue by Elisabeth Scheicher, Ortwin Gamber, Kurt Wegerer, and Alfred Auer, *Kunsthistorisches Museum, Sammlungen Schloss Ambras: Die Kunstkammer* (Innsbruck: Kunsthistorisches Museum, 1977).

[5] David Murray, *Museums: Their History and Their Use* (Glasgow: James MacLehose, 1904), 3 vols.; and Julius von Schlosser, *Die Kunst- und Wunderkammern der Spätrenaissance: Ein Beitrag zur Geschichte des Sammelwesens* (1908; Braunschweig: Klinkhardt & Biermann, 1978) (new edition from unpublished manuscript revisions).

science would be well advised to read more broadly in the other essays on specific collections in, say, Basel or Milan, for mineralogical and zoological collecting almost never occurred in isolation from accumulation of other sorts of objects, both natural and artificial. Even collections devoted almost exclusively to natural history, like that of Conrad Gesner in Zurich, owed much in their inspiration, orientation, and organization to the more encyclopedic collections.

Who collected what, when, where, and why? Although the cabinets of the sixteenth and seventeenth centuries stem from a common source, the treasuries (*Schatzkammern*) of medieval monarchs and churches, these essays testify to their branching diversity. Renaissance humanism endowed Roman and Greek antiquities with a certain cachet; ethnographic items from both the West and East Indies complemented those from nearby Turkey and Lapland; technical innovations in the lathe produced objects of labyrinthine intricacy; the post-Vesalian vogue for anatomy conjoined with the popular "Vanitas" theme posed skeletons in arresting *memento mori* tableaux; new and mythical creatures like the unicorn and the equally wondrous bird of paradise were represented by a claw or horn; fruits and flowers from far-off lands bloomed in the decorative gardens and grottoes so often attached to the cabinets. These new categories swelled the older treasuries of gold, gems, relics, and the occasional secular marvel—it was not unusual for churches to hang up "giants' bones" by the entrance to boost attendance—and linked collecting to learning and connoisseurship as well as wealth. By 1600 aristocrats, professors, and, particularly in the Netherlands and southern Germany, merchants, lawyers, and doctors of means were avid for fossils, antique coins, coral, *chinoiserie,* ostrich eggs, bits of the true cross,[6] South American featherwork, cherrystones artfully carved with a hundred facets or more, portraits of historical personages, scientific instruments of handsome workmanship, monsters both animal and human, and "Any thing that Is Strang," as the Duke of Buckingham instructed his purchasing agent Balthasar Gerbier (quoted in MacGregor, p. 20).

What did all of these objects have in common, to make them so coveted? The collections were miscellanies, but they were not arbitrary miscellanies; only a very few objects qualified for membership. The lowest common denominator was value: indeed, the contents of the cabinets could be read as incarnating the history of economic theories of value. Gems, gold, and silver exemplified value derived from precious materials; exotica and natural history oddities exemplified value derived from rarity or dearth; works of craft virtuosity exemplified value as crystallized labor. Diverse as the objects were, they were alike in all being precious and suited for trumpeting or raising the owner's status. Although Nehemiah Grew, cataloguer of the Royal Society collection, hoped for common as well as rare additions, no one followed his lead, not even the Royal Society itself, as Michael Hunter shows in his essay on the Royal Society "Repository" (Impey and MacGregor, pp. 159–168). To have done so would have been to betray the fundamental principle of collecting.

At another level many of the objects resembled one another in blurring the boundary between art and nature and in playing on the echoes between one form and another. Giuseppe Olmi remarks on the typically Mannerist juxtaposition of

[6] The attachment to relics survived the transition from ecclesiastical treasury to secular cabinet: the Ashmolean, for example, possessed a piece of St. Augustine's pastoral crook (Ovenell, p. 37); the Ambras collection boasted "ain gross schens Stuckh von der Archen Noe," according to the 1621 inventory (Sammlung für Plastik und Kunstgewerbe des Kunsthistorischen Museums, Vienna, No. 6654; and Landesregierungsarchiv für Tirol, Innsbruck, No. A 40/13). I am grateful to Dr. Elisabeth Scheicher for making a typescript of part of this manuscript inventory available to me. Relics related to famous persons (e.g., the stirrups of Henry VIII) also turn up in many collections.

Figure 1. *Domenico Remps?* Scarabottolo, *seventeenth century, courtesy of the Museo dell'Opificio delle Pietre Dure di Firenze, Florence.*

naturalia and artificialia in Italian cabinets and on Aldrovandi's use of pictures in place of naturalia (Impey and MacGregor, pp. 5, 7); Elisabeth Scheicher flags the "ambiguity of status between art and nature" in Ferdinand II of Tirol's penchant for corals arranged in scenes of mountains or forests, or fragments of marble and coral incorporated into paintings as clouds or water (p. 33); Lorenz Seelig makes a similar observation on "those natural objects which retained their original form but which were assembled into artificial formations" like the *lapides manuales* [7] in the Munich collection of Duke Albrecht V of Bavaria (p. 82); John Dixon Hunt interprets the conjunction of gardens and cabinets as a play on the commonplace Renaissance oppositions of art and nature, rivalry and imitation (p. 194). Remarkable works of art and nature were frequently displayed side by side, especially in cabinets north of the Alps, regardless of whether they were called *Kunstkammer* or *Raritätenkammer* (see Figure 1). In an age steeped in Ovid's *Metamorphoses* (few books turn up so frequently in sixteenth-century notarial library inventories), the themes of transformation and mimickry bristled with literary associations and symbolic meanings (see Figure 2). I shall return to this theme in the more specific context of seventeenth-century natural philosophy shortly.

Finally, the objects collected were alike in being all unlike. The cabinets were visual tributes to the variety and plenitude of art and nature, albeit very partially represented. Laura Laurenich-Minelli shrewdly observes that the ordering of catalogues is no reliable guide to a cabinet's physical arrangement, as a careful

[7] *Lapides manuales* or *Handsteine* derive their name from their size, a handful; they were tableaux and landscapes fashioned from strangely formed stones.

comparison with contemporary engravings of several collections makes clear. Although objects may have been listed systematically, they were often displayed to maximize heterogeneity in what Laurenich-Minelli labels " 'alternate microsymmetry,' in which items of similar appearance are never displayed next to one another but invariably alternate with other, dissimilar objects" (Impey and MacGregor, p. 19).[8] The reigning interpretation of this deliberate hodgepodgery, expressed most often in connection with Rudolf II's collection at Prague, is that it was intended to represent the universe in microcosm (Impey and MacGregor, pp. 50–52). This view has some textual backing in the Flemish physician Samuel Quiccheberg's sketch of a "theatrum sapientiae"[9] but is belied by the contents of the collections themselves. Far from recreating the entire universe by token or in miniature, Rudolf II's vast collection was almost wholly devoid of exotica and naturalia (Impey and MacGregor, p. 44).

Even collections that repaired these omissions could in no way be said to do justice to the complete cosmos, for they ignored 99.9 percent of it in favor of the singular and the anomalous. The very portraits in the collections, when not of the collector himself and his family, paid tribute to a vision of history forged by unique individuals. (Bourgeois cabinets imitated this self-aggrandizing taste in portraiture: Ashmole collected portraits of fellow astrologers John Dee and William Lilly; collector-doctors included portraits of famous physicians and anatomists.) The singularity need not have been praiseworthy—portraits of perpetrators of horrendous crimes and of human monstrosities were also displayed—only rare, approaching unique. Like the marvels of art and nature, these objects came close to being sui generis, at least in the ethnocentric European setting in which they were admired. (Birds of paradise of course constituted an entire species, and kayaks were thick on the ground in North American Eskimo settlements, but to the European collector they were almost ones-of-a-kind.) Hence the futility of looking for implicit classifications in most of the cabinets, for they were constituted in such a way as to defy classification in principle. (Catalogues were another matter, for promiscuously displayed objects did not preclude organized inventories, but these latter were largely *post hoc*.) The genuinely interesting puzzle posed by these collections is not internal organization, however, but entrance criteria. The reality they depict is a nominalist one of individuals instead of categories, of cases that break the rules of the normal and predictable, of irreducible diversity.

The aesthetic that informed these collections was one of cornucopia-like bounty and startling variety, a visual tribute to the exuberant creativity of nature and art. The objects are improbable, chosen less for intrinsic beauty or scientific significance than for sheer contrast with the prosaic and mundane. The wonder-weary reactions of Evelyn and Uffenbach cited above show how quickly overexposure could blunt the edge of this contrast. Collectors carefully selected and arranged their objects to hone that edge; to draw a gasp of surprise from even the most well-traveled visitor. It was not the objects themselves but rather the response they were intended to evoke that impressed the contents of the cabinet with a certain unity. Wide-eyed with wonder and open-mouthed with surprise, the admiring visitor paid the collector the sincerest compliment of speechlessness. The collections were the standing proof of Hamlet's reproach that "There are more things in heaven and earth, Horatio,/Than are dreamt of in your philos-

[8] There are a few notable exceptions: the Ambras collection was largely ordered by materials (gold, silver, iron, wood, etc.), and there is good evidence that the Medici collection was patterned on a theater of memory (Impey and MacGregor, pp. 7, 31).

[9] Samuel Quiccheberg, *Inscriptiones vel tituli theatri amplissimi, complectentis rerum universitatis singulas materias et imagianes eximias . . .* (Munich, 1565).

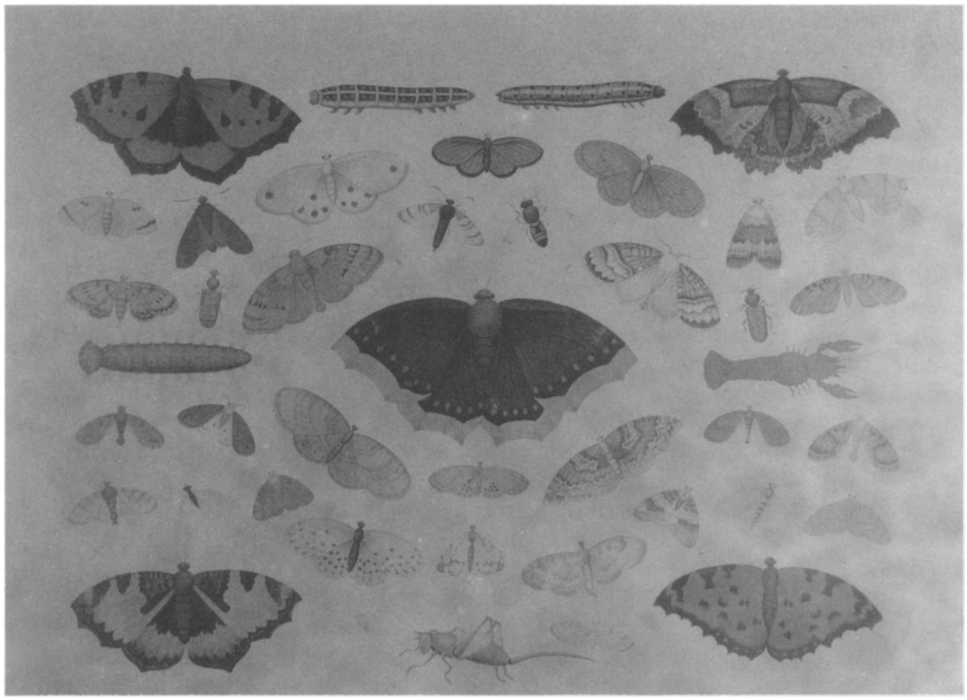

Figure 2. *Maria Sibylla Merian,* Insekten und Schmetterling, *seventeenth century, courtesy of Herzog Anton Ulrich Museum, Braunschweig.*

ophy" (1.5), but they were not necessarily thus reproaches to philosophers. Although we identify stupefied wonder with the untutored layman, in the sixteenth and early seventeenth centuries it was still a suitable response for the scholar as well. As William Schupbach points out apropos of the cabinet associated with the physic garden at Pisa, "wonder was a proper reaction for the learned as well as the uninstructed: wonder, paraphrased perhaps as inquisitive delight in novelty, mingled with awe and gratitude, was part of the natural history and natural philosophy of the time" (Impey and MacGregor, p. 170). Writing in the mid-seventeenth century, Descartes was considerably more wary of the excesses of wonder, but he still made it the first of the passions and the fount of all science. It was in the pursuit of wonder (and perhaps in the flight from boredom) that the deliberate diversity of the objects in the cabinets found its rationale.

The motives for collecting were nearly as diverse as the objects collected. In the case of royalty and noblemen the cabinets served the ends of princely display of wealth and splendor. Olmi traces the transformation of the private *studiolo* of Francesco I de'Medici into the dramatically public Uffizi gallery when Francesco became the Grand Duke of Tuscany, for "his deeds and the power of his family had constantly to be exposed to the eyes of all, and to be strongly impressed on the mind of every subject" (Impey and MacGregor, p. 10). The Ambras, Prague, and Munich collections followed this latter model, albeit with less flamboyance. The privacy suggested by the very word *cabinet* also had its adherents, as Francis Bacon makes clear in his recommendations for setting up library, garden, menagerie, cabinet, and laboratory, thus "to have in small compass a model of universal nature made private" (*Gesta Grayorum,* 1594; quoted in Impey and MacGregor, p. 1). But privacy gave way to publicity in the early seventeenth

century, when collections gave the wealthy bourgeois a boost up the social ladder. Their cabinets not only emulated those of aristocrats and princes; they provided an occasion for rubbing shoulders with the same. A famous collection could draw crowned heads to one's doorstep for a tour, and published catalogues were often frank advertising, sent to various celebrities. Occasionally the stratagem was wildly successful, as in the case of Robert Hubert, alias Forges, whose collection was eventually purchased by the Royal Society: in his published catalogue of 1664 he could boast of "things that hath been seen by Emperors, Empresses, Kings and Queens and many other sovereign princes" (quoted in Impey and MacGregor, p. 153). Hubert's collection was aggressively public, but private collections were also open to visitors with the proper pedigree. Not only the leisure and wherewithal but also the erudition required to assemble a must-see cabinet were social ornaments, a recognized part of polite learning.[10]

The cabinets specializing in natural objects constitute a separate but not entirely distinct category. Here "useful in medicine", as Ashmole put it, was key, although "extraordinary in their Fabrick" could also have been their motto. The vast majority of both private and institutional naturalia collections were linked in some way to medicine. Ulisse Aldrovandi, Olaus Worm, Conrad Gesner of Zurich, Michele Mercati of Rome, and Felix Platter of Basel were all physicians by training; Francesco Calceolari of Verona and Ferrante Imperato of Naples both owned pharmacies. The physic garden and the anatomy theater were the primary loci of university collections, as in Pisa, Leyden, and Oxford. These were primarily reference collections for naturalists, physicians, apothecaries, and students, and their catalogues at least, if not the actual displays, aimed at systematization by the biological canons of the day, as H. D. Schlepern points out in the case of Worm and Olmi in that of Aldrovandi (Impey and MacGregor, pp. 127, 7).

However, these collections also partook of the general culture of collecting. Almost all contained artificialia as well as naturalia, usually but not always with an emphasis on exotica, as in the case of the Worm collection. This emphasis was partly a financial matter—the gems and orfevrerie of the *Schatzkammer* were beyond the means of the average professor or doctor—and perhaps partly a matter of ambiguous definition. Ethnographic items and the peoples who made them, particularly in the Americas, apparently struck some Europeans as closer to nature than to art.[11] In any case the Pisa physic garden and attached gallery boasted Mexican idols, distorting mirrors, and Flemish landscape paintings in addition to materia medica (including bezoars and unicorn horns, both reputed to be effective against poisons), animal remains, and "a petrified human skull with coral growing out of it"; the Leyden physic garden included a banknote from the siege of the city and a Sinhalese medical book, as well as a polar bear, a hippopotamus, and various Brazilian objects; Aldrovandi collected clocks and sculptures as well as plants and animals. The arrangement of the naturalia cabinets was barely distinguishable from that of the more compendious cabinets of curiosities, with objects overflowing from cupboards onto walls and ceiling and promiscuously mixed to display nature's (and art's) fecundity and ingenuity to best advantage (see Figure 3).

These specialized collections were permeable not only to the influence of a more eclectic culture of cabinets; they also registered that of the ambient culture

[10] See, e.g., Henry Peacham, *The Compleat Gentleman,* 2nd ed. (London, 1634), p. 64; see also Schlosser, *Die Kunst- und Wunderkammern* (cit. n. 4), pp. 218–219.

[11] See, e.g., Robert Boyle, "General Heads for the Natural History of a Country, Great or Small, Drawn Out for the Use of Travellers and Navigators" (1692), in *The Works of the Honourable Robert Boyle,* ed. Thomas Birch, 5 vols. (London, 1744), Vol. V, pp. 191–197, esp. p. 192.

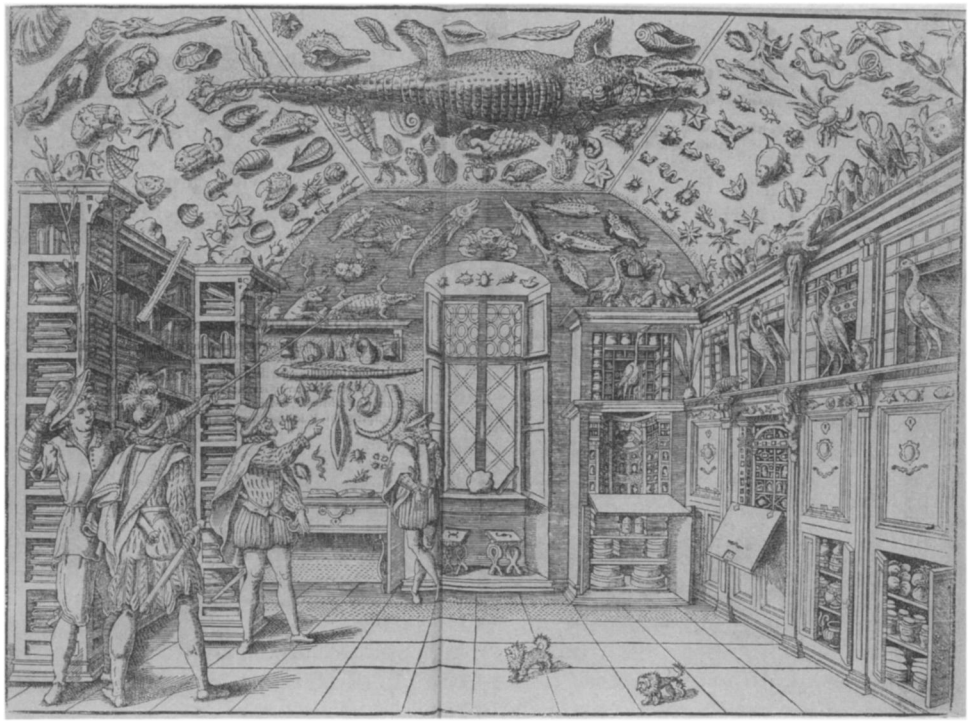

Figure 3. *Frontispiece of Ferrante Imperato,* Dell'historia naturale di Ferrante Imperato Libri XXVIII *(Naples, 1599); by permission of the Houghton Library, Harvard University (also in Impey and MacGregor, pages 28, 186).*

at large. The *Naturalienkabinett* of the orphanage at Halle established by the pietist August Hermann Francke aimed to educate missionaries with "irrefutable knowledge of the natural world," so as to win credit among the Russians and Chinese for their theology (Impey and MacGregor, p. 176). William Schupbach describes how the Leyden professor of medicine Pieter Paaw arranged the anatomy theater into "a kind of Museum of Mortality," in which skeletons draped with banners bore inscriptions like "pulvis et umbra sumus" and male and female skeletons dubbed Adam and Eve were featured on the central dissecting table (see Figure 4.) Such macabre moralizing may be chalked up to the Calvinist temper of Dutch society at the time; more difficult to explain are the distinct national preferences for various sorts of creatures noted by Wilma George, the Dutch preferring mammals, the French fish, and the English quite alone in their affection for insects (Impey and MacGregor, pp. 182–183).

Above all, the natural history cabinets resembled other contemporary cabinets (and contrasted with later natural history collections) in their decided preference for the singular and the anomalous. George reports that of the thirteen cabinets and two menageries she analyzed, almost all contained monsters, including a two-headed calf in the Royal Society collection and an "ovum magicum" in that of Worm. John Evelyn's description of Imperato's collection (see Fig. 3, especially the two-tailed lizard, upper right) also fixes upon the "incomparable rarities." These include "the Male & female Manucodiata [bird of paradise], the Male having an hollow on the back in which 'tis reported [the female] both layes, and hatches her Eggs: The Mandragoras also of both Sexes . . . a Chrystal that had a prety quantity of uncongeal'd water within its cavity: a petrified fishers

net."[12] MacGregor attributes Albert V's portrait gallery of monsters to a "personal obsession" (MacGregor, p. 74) but elsewhere admits the universality of the taste for abnormalities and *Naturspiele* in almost every land and type of collection (p. 92). Most of the essays in the Impey and MacGregor collection bear witness to it, the only notable exception discussed being the monastic collection at Ste. Geneviève in Paris, which professed an "abhorrence of the bizarre and an indifference to gratuitous marvels" (Impey and MacGregor, p. 174). Certainly a good measure of the appeal of such marvels derived from the relics they replaced, and the numinous quality with which both were invested. It is speculative yet plausible that the medical setting of so many of the naturalia collections may have also strengthened this penchant for the *lusus naturae,* for physicians then as now set much store by the close clinical examination of a single instance of a strange pathology, in defiance of the canons of induction over many like cases.

What have two-headed calves and uncongealed crystals to do with the developments conventionally abbreviated as the Scientific Revolution? At first glance their contribution appears to have been marginal. True, academic collections like those of Aldrovandi, Worm, and Gesner promoted the cause of natural history by providing reference materials; John Ray consulted Tradescant's dodo in his preparation of Francis Willoughby's *Ornithologia* (1676) and the Royal Society's antelope for his own *Synopsis quadrupendum* (1693). But the difficulties of preservation meant that the specimens were as often as not fragments—a claw, a feather, a horn—from which the naturalist evoked the creature in mind's eye, filling in the missing details from Pliny and emblematic bestiaries (Impey and MacGregor, p. 10). George credits the exotic flora and fauna beloved of seventeenth-century collectors with raising classificatory quandaries that eventually bore fruit in the work of Linnaeus, Buffon, and Lamarck, although the classifications of the collections themselves were for the most part either traditional, crude, or alphabetical (Impey and MacGregor, pp. 185–187). Scientific instruments, clocks, and automata were well represented in the cabinets at Ambras, Dresden, Milan, Uppsala, Kassel, and elsewhere, but aside from Dresden, where the Elector Augustus took an earnest and informed interest in a vast array of tools (Impey and MacGregor, pp. 69–75), the balance of evidence is that they were prized as pieces of craft virtuosity and as mechanical wonders rather than for their utility and precision.

Contemporaries did couple the cabinets with the new philosophy: Anthony Wood, the Oxford chronicler, commented apropos of the opening of the Ashmolean that "many that are delighted with the new phil. are taken with them [the objects]; but some for y^{e} old ——— look upon them as ba[u]bles" (quoted in MacGregor, p. 59); and Robert Hooke, first curator of the Royal Society collection, hoped that it would allow the inquirer to "peruse, and turn over, and spell, and read the Book of Nature" (quoted in Impey and MacGregor, p. 211). However, Michael Hunter and Gerard l'E. Turner, writing respectively on the Royal Society repository and the cabinet of experimental philosophy, doubt that these collections in fact did much to further the cause of the new philosophy. Turner traces the cabinets of experimental philosophy to the same mixture of aesthetic, social, economic, and intellectual impulses that animated all collections and links them more to the popularization of science than to its advancement. Hunter has harsh words for the Royal Society repository, which was never able to shake free of the fascination with the rare and curious that had stamped the original Hubert collection. If anything, this tendency became more pronounced, for whereas Hubert's cabinet had at least been restricted to natural rarities, Nehemiah Grew's

[12] Evelyn, *Diary* (cit. n. 3), Vol. II, pp. 330–331.

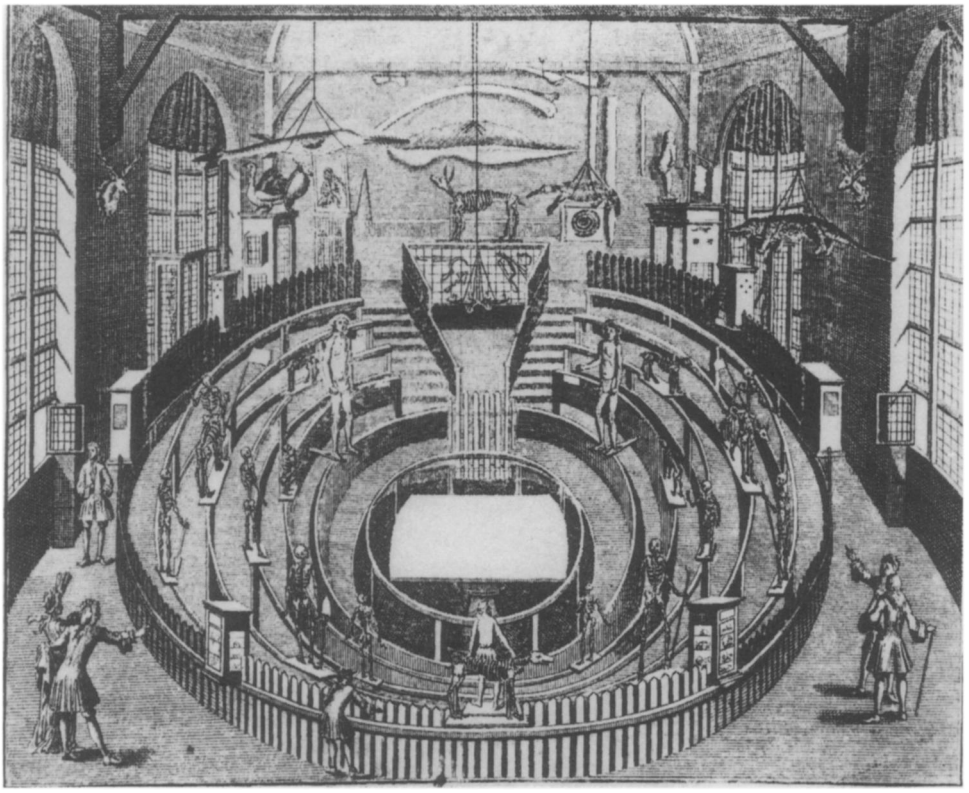

Figure 4. *Willem Swaneburgh,* Theatrum anatomicum Leidense *(1644), courtesy of the Wellcome Institute (also in Impey and MacGregor, page 171).*

1681 catalogue of the Royal Society repository also included gifts of ethnographic and artificial curiosities. Try as he might to systematize the collection with reference to the latest sources in natural history and to offer explanations for odd phenomena, Grew was saddled with a regulation-issue cabinet: "It is almost as if the 'scientific' characteristics of Grew's catalogue were imposed on a collection which remained inspired by the criteria of rarity and curiosity typical of virtuoso cabinets" (Impey and MacGregor, p. 165). Following Walter Houghton's classic article on the virtuoso sensibility,[13] Turner blames the unsteady administration of, and undue virtuosi influence in, the early Royal Society for perverting the Baconian aims of Hooke, Grew, and other serious members.

Setting aside the question of whether a sharp separation of the serious sheep from the giddy goats in the Royal Society is in fact possible, and whether its repository really strayed so far from Bacon's program, one might still wonder whether the Royal Society repository and its kindred cabinets of curiosities were quite so alien to the new synthesis in natural philosophy that triumphed in the late seventeenth century. Appearances are certainly against any connection except enmity: nature circa 1700 was as orderly, uniform, and regular as the cabinets were jumbled, heteroclite, and singular. Moreover, the image of plastic nature molding minerals, petrifying lizards, and carving corals that had rendered

[13] Walter E. Houghton, "The English Virtuoso in the Seventeenth Century," *Journal of the History of Ideas,* 1942, *3*:51–73, 190–219.

the metaphors of metamorphosis, mimickry,[14] and ingenious workmanship so plausible had by then collapsed. Robert Boyle was only the most influential of the mechanists to take aim at the "strange care and skill of that questioned being called nature" as an explanatory principle in science, as much on religious as on scientific grounds.[15] Nature was now stupid, passive, and inert, if not, in a post-Newtonian world, unexceptionably mechanical. And it emphatically did *not* play, as Bernard de Fontenelle tartly put it upon the receipt of yet another report of a monstrous birth by the Académie des Sciences.[16] Sports of nature might exist, but they were no longer the stuff of which natural philosophy was made.

Yet appearances can deceive. The cabinets bequeathed two enduring legacies to the natural philosophy that eventually scorned them: the assimilation of art to nature and the ideal of factuality. High Renaissance commonplaces concerning art and nature relate the two in counterpoint: art may imitate nature; art may modify nature; art may assist and improve nature; art may create its own objects.[17] But in order to be so opposed art and nature must be conceived as distinct entities. The insight that art was merely a part of nature, governed by the same rules, was of cardinal importance to the early stages of the Scientific Revolution. The mechanics of pseudo-Aristotle and Archimedes had been about machines; that of Galileo, Descartes, Huygens, Newton,and Leibniz was about all natural motion, including machines as a special case. The central precept of the mechanical philosophy, that nature was actually composed of microscopic machines, presupposed the destruction of the boundary between works of nature and handiwork, as did Bacon's glorification of the mechanical arts.[18]

The first intimations that nature and art belonged to the same realm, and that there was an underlying identity between the two, occur in the context of wonders, both natural and artificial. Bacon was the most provocative and influential writer to assert that nature and art were one, embracing art, or "nature wrought," within his natural history. Art and nature approached one another most closely at their extremes, in the most curious and ingenious products of each: "Now it is an easy passage from miracles of nature to miracles of art."[19] Although both Bacon and Descartes cast a jaundiced eye upon marvel-mongering for its own sake,[20] they were nonetheless indebted to the collections that merged art and nature in the "insolitum, bellum, mirabile, rarum" (quoted in Impey and MacGregor, p. 85). Not only did the collections systematically efface the distinction between art and nature in the choice and juxtaposition of objects; they also drew attention to particular kinds of objects. Automata, clocks, and other elaborate machines figured prominently among the artificial rarities displayed in the cabinets, and when Descartes wished to underscore the similarities of works of

[14] On nature repeating forms and motifs see, e.g., Francis Bacon, *The Advancement of Learning* (1605), in *The Works of Francis Bacon,* ed. James Spedding, Robert Leslie Ellis, and Douglas D. Heath, 15 vols. (Boston, 1863), Vol. VIII, pp. 473–475; see also Ambroise Paré, *Des monstres et prodiges* (1573), ed. Jean Céard (Geneva: Librairie Droz, 1971), p. 102.

[15] Robert Boyle, *A Free Inquiry into the Vulgarly Received Notion of Nature* (1685), in *Works* (cit. n. 11), Vol. IV, p. 398.

[16] *Histoire de l'Académie Royale des Sciences,* 1703, p. 28.

[17] See, e.g., George Puttenham, *The Arte of English Poesie* (1589), ed. Gladys D. Wilcock and Alice Wheeler (Folcroft: Folcroft Press, 1936), pp. 303–304.

[18] Francis Bacon, *Advancement of Learning,* in *Works* (cit. n. 14), Vol. VIII, p. 410; see also Paolo Rossi, *Francis Bacon: From Magic to Science,* trans. Sacha Rabinovitch (London: Routledge & Kegan Paul, 1968), p. 26.

[19] Francis Bacon, *Novum organum* (1620), 2.29, in *Works* (cit. n. 14), Vol. VIII, p. 238.

[20] *Ibid.;* and René Descartes, *Passions de l'âme* (1649), arts. LXXVI–LXXVIII, in *Oeuvres de Descartes,* ed. Charles Adam and Paul Tannery, 11 vols. (Paris: Librairie Philosophique Vrin, 1964–), Vol. XI, pp. 385–386.

art, particularly machines, to those of nature, he turned to automata to make his point. Bacon and Descartes despised the emotional complexion of the collector, with his tendency to prefer wonder and surprise to explanations and predictions. Yet by dramatizing the resemblances between art and nature, the collectors promoted the cause of the reformed philosophy. We see the unmistakable traces of their influence in the wondrous examples adduced to argue for the unity of what had traditionally been opposed.

Bacon is also our most articulate witness for the second legacy of the cabinets to natural philosophy. In the *Novum organum* he called for a "particular natural history" of all that "which is new, rare, and unusual in nature," with the aim of correcting generalizations based on too few instances. Bacon was confident that these so-called miracles of nature would eventually "be reduced and comprehended under some Form or fixed Law" and was contemptuous of those who "go no further than to pronounce such things the secrets and mighty works of nature, things as it were causeless, and exceptions to the general rules."[21] But for the interim this natural history of "Singular Instances" was to be a compilation of counterexamples, of anomalies that challenged existing theories. Here the playful side of the cabinet of curiosities was put to work, its nominalism and diversity turned to scientific ends.

Bacon thus redefined the traditional relationship between natural history and natural philosophy. Natural history had long been the handmaiden of natural philosophy, but as propadeutic and resource rather than corrective. Aristotle had understood his *Historia animalium* as a preliminary to a genuinely philosophical zoology, as he makes clear in the introduction to *De partibus animalium:* particulars are of interest only insofar as they lead to generalizations and the discovery of causes (639a13–640a10). (Indeed, Aristotle deemed poetry to be closer to philosophy than history, for it treats universals rather than singulars: *Poetics,* 1451b1–7.) The pseudo-Aristotelian *De mirabilibus ausculationibus,* Pliny's *Natural History,* and pseudo–Albertus Magnus's *Book of Secrets* belonged to the literature of wonders rather than of natural philosophy, although Bacon attempted to redeem them for his reformed philosophy in his *Sylva sylvarum.* Nicole Oresme had attempted to explain the marvels retailed by Pliny and his successors by recourse to existing theories, not by inventing new ones.[22] Above all, natural philosophers had not dwelt upon phenomena and objects that did not fit within extant theories. Their works were empirical but not factual: observations of nature occurred aplenty, but they were firmly lodged in the context of confirmation or instruction. Observations proved or illustrated or even contradicted a given theory but were never presented naked on their own, to await some future, as-yet-unformulated theory. Galileo's dialogues, for example, belong to the older tradition of scientific exposition. Although observations about ships, statues, fire, the moon, and so forth, overflow the pages, all are mustered in support of theoretical or at least explanatory points. Objects and events do not dangle; "facts," in the sense of nuggets of experience detached from theory, are absent.

Bacon's "history of marvels" made facts out of experience by isolating them from the continuum of sensation and by uprooting them from conventional generalizations about nature. However skeptical Bacon might have been of the mentality that informed the cabinets of curiosity and wonder books that were their literary counterpart,[23] he took his granular view of experience and of theory-free

[21] Bacon, *Novum organum,* 2.28–29, in *Works* (cit. n. 14), Vol. VIII, pp. 236–238.

[22] Bert Hansen, *Nicole Oresme and the Marvels of Nature: The* De causis mirabilium (Toronto: Pontifical Institute of Medieval Studies, 1985).

facts from their fascination with anomalies, their deliberate severing of connections by display, and their obsession with the brute "thing-ness" of the objects. The fragmentary syntax of the travelers' accounts and of the inventories—"mysterious padlocks . . . Stones which represent Trees, Fruits, Shells, and Animals . . . the Horn of an Oxe, which is almost six inches in diameter"[24]—mirrored both the theoretical and physical isolation of the items listed. The mummy and the winged cat placed next to it had as little to do with one another as either had to do with explanations of any kind whatsoever. Bacon transformed this splendid aesthetic isolation into splendid scientific isolation; this is why the first facts were marvels.

Bacon's legal training may also have played its part in this transformation. The word *fact* derives from the Latin *facere,* "to do" (cf. French *fait;* German *Tatsache*), and the *Oxford English Dictionary* informs us that in the sixteenth century the word still meant an action or deed, particularly a crime, a meaning now preserved in the legal phrase "after the fact." Bacon himself used the word in this manner, and more specifically to denote a deed with legal issue. By emphasizing workmanship, both of nature and of art, the cabinets of curiosities may have imparted to their treasures an element of the activity and performance inherent in the root meaning of the word. (One of the contemporary senses of *curiosity* was "proficiency attained by careful application," with similar overtones of scrupulous, skillful labor.) Bacon was more likely to have been directly influenced by the "facts" of legal evidence, based on personal observation or unimpeachable witness, which were presumed independent of the interests of both sides of the case. These etymological filiations must remain speculative; what can be established is that the more familiar sense of *fact* as "a datum of experience, as distinguished from the conclusions that may be based upon it," emerges in English only in the early decades of the seventeenth century, contemporary with Bacon's own writings.

We must bear in mind how novel the notion of neutral facts was when it was introduced. Sophisticated seventeenth-century philosophers of science were no more comfortable with it than sophisticated twentieth-century philosophers of science. Although Descartes saw a role for experiment in natural philosophy, he only trusted his own and those performed at his instance, because those of others were badly explained or false, obliged as they were to make the results "conform to their principles."[25] Bacon may have been the father of facts in natural philosophy, but he thought they were hard won. His method as set forth in the *Novum organum* is principally a way of combating the mind's natural tendency to leap to conclusions prematurely and to refract all experience through a theoretical lens. Avoiding abstract terms, weighting negative instances as heavily as positive ones, and patiently compiling and sifting through tables—all these techniques were meant to discipline minds bent on infusing observation with theory. Unvarnished facts did not come naturally; it took training and tricks.

Something as striking and intractable as the cabinet anomalies was required to make the idea conceivable. Robert Boyle's experimental creed and John Locke's nominalist philosophy broadened and established it only with difficulty.[26] Facts

[23] For Bacon's links to this tradition see Katharine Park and Lorraine J. Daston, "Unnatural Conceptions: The Study of Monsters in Sixteenth- and Seventeenth-Century France and England," *Past and Present,* 1981, *92*:20–54, esp. pp. 43–46.

[24] Maximilian Misson, *A New Voyage to Italy: With Curious Observations on Several Other Countries, as, Germany, Switzerland, Savoy, Flanders, and Holland* (London, 1699), p. 113.

[25] René Descartes, *Discours de la méthode* (1637), in *Oeuvres* (cit. n. 20), Vol. VI, p. 73.

[26] Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton Univ. Press, 1985).

prior to conjecture and individuals prior to categories still depended on the wonders of the cabinets to make themselves credible even late in the seventeenth century. Boyle appended "A Small Collection of Strange Reports" to his *Experimenta et observationes physicae* (1691), including a cyclone and a piece of glass that could be hammered without shattering; Locke appealed to monsters when he wanted to argue the futility of classification.[27] However implausible we may now find the doctrine of theory-free facts and the associated ideas of crucial experiments and a neutral observation language, they stamped the characteristic new methods of science that emerged with the culmination of the Scientific Revolution. The Royal Society repository may have failed as a way station between field observation and laboratory experiment, intended to provide the means for studying natural objects with the care, leisure, and individual focus not possible in the field, if still short of the probing analysis of the laboratory. But the collectors did nonetheless make a signal contribution to the faith of the laboratory. Their passionate "inspection of Particulars" and their pointillistic vision of reality created the factual sensibility.

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[27] Robert Boyle, *Experimenta et observationes physicae* (1691), in *Works* (cit. n. 11), Vol. V, pp. 102–105; and John Locke, *Essay Concerning Human Understanding* (1690), 3.6.23, ed. Peter H. Nidditch (Oxford: Oxford Univ. Press, 1975), pp. 451–452.

Experimental probability

Allan Franklin. *The Neglect of Experiment.* xiii + 290 pp., figs., index. Cambridge/London/New York: Cambridge University Press, 1986. $42.50.

For years philosophers have been praising, then burying, experiments. Until the 1950s it was popular to grant observation a primary role in the generation and testing of theories; in the later 1950s and 1960s critics wanted to topple the authority of experiments by exposing them as "theory contaminated" or "theory laden." Whether attacking or defending observation, both sides ignored the nitty-gritty of laboratory work. More recently, historians, sociologists, and philosophers have tackled the problem of the function of experiment with considerably more attention to practice—some want to bolster a realism about subvisible entities, some wish to establish experimental conclusions as "social constructions," while others seek to explore the effects of theoretical orientations. Together these studies have made the history and philosophy of experimentation one of the most exciting recent lines of inquiry in the history of science.

Allan Franklin's interest in these problems takes several forms. Above all, he hopes to reveal the quirky byways of modern physical experimentation while salvaging the notion that there is a rationality to the laboratory-based choice between theories. The historical core of *The Neglect of Experiment* is an analysis of a fascinating set of particle physics experiments conducted in the 1950s and 1960s on parity conservation and its generalization, charge-parity conservation (in addition Franklin considers some earlier studies, including Robert Millikan's oil-drop experiment). Each set of investigations destroyed a deeply held belief about physical laws. Of these, Franklin's best and most dramatic study sketches