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PETER KNOX-SHAW

Abstract: While numerous sources have been found for the ideas expressed by Cleanthes and Demea in the *Dialogues*, Philo's thoughts have commonly been taken to originate with Hume. It is clear, however, both from internal and external evidence, that Hume drew for his (sometimes wayward) spokesman on that mid-century ferment in the life sciences that Denis Diderot described as a "revolution." The restoration of this context—obscured by the late publication of the *Dialogues*—suggests that Philo's celebrated critique of theism is merely one face of a discourse that centres in new ideas about generation and evolution. On this reading the *Dialogues* emerges as a conjectural as well as analytic work, one that offers in addition to its demolition of the argument from design an argument about design, built on the premise that natural order can be independent of a creator. The philosophical definition that Hume brings to ideas that first surfaced in the works of Maupertuis and Buffon makes the *Dialogues* the most potent pre-Darwinian work of its period.

When in the last of the *Dialogues* Philo begins to capitulate on his early arguments, and to assert that the existence of a supreme being can indeed be deduced from the order of the universe, he invokes the revelatory power of the new astronomy and glances at other developments in the physical sciences:

Peter Knox-Shaw is a Research Associate at the University of Cape Town, Private Bag, Rondebosch 7701, South Africa. E-mail: Peter.Knox-Shaw@uct.ac.za.

> One great foundation of the COPERNICAN system is the maxim, *that nature acts by the simplest methods, and chooses the most proper means to any end*: and astronomers often, without thinking of it, lay this strong foundation of piety and religion. The same thing is observable in other parts of philosophy.[1]

Relying on many of the same terms, a youthful Hume had cited the Copernican revolution as a model for the radical philosophical change that he aimed to effect through the *Treatise*,[2] but in place of a *theory* that is exemplary by virtue of its simplicity and economy, Philo postulates a *nature* that acts by the simplest methods, a maxim that, while conversant with Newton's "rules of reasoning," points to the influence of more recent science.[3] In 1744 Maupertuis, astronomer, physicist, and natural historian, launched his "principle of least action," framing it in the words: "*Nature always acts by the simplest means to produce its effects*."[4] Encouraged by its successful application to a variety of fields, ranging from optics to ballistics,[5] he identified his "metaphysical law" with a controlling intelligence, and attributed choice and parsimony to all material bodies in motion, remarking that objects can be depended on doing "what would be most appropriate for them to do."[6] Thus in the early essay, "Accord between different laws of nature," Maupertuis describes how he considered what options might be open to a ray of light on passing from one medium to another before recognizing that it was the "action" (the product of the respective distances and velocities) that would be kept to a minimum.[7] The principle was immediately taken further by his colleague Euler with a series of mathematical papers on extremum functions, culminating in an account of planetary motion.[8] This last paper was summarized, together with Maupertuis' two original ones, by d'Alembert in an article in the *Encylopédie* (1751) which declared the principle an eternal "geometric truth," a claim hardly extravagant in view of the afterlife it was to enjoy in spheres as diverse as evolutionary theory and quantum mechanics.[9]

Confronted with Philo's moment of apparent recantation at the start of part 12 of the *Dialogues*, readers have the choice of either supposing Philo sincere,[10] or "artfully" diplomatic as Hume, despairing of publication in 1776, urged of the work as a whole.[11] The former course seems preferable seeing that Philo's about-face vividly illustrates Cleanthes's idea that the perception of natural design involuntarily stirs religious belief: "Tell me, from your own feelings, if the idea of a contriver does not immediately flow in upon you with a force like that of sensation" (DNR 3.7; 154). But even if we understand that Philo is borne along by an access of fervour, the qualifications that are prompted by his irrepressible rationality allow Hume to set a trail of obstacles in his way. His leap from the "artifice of nature" to supernatural design instantly leads to a reminder that the discovery of order has often been made "without any religious purpose," that astronomers have often been unthinking in this regard, and that the authority of natural philosophers tends to be "the greater,

as they do not profess that intention" (DNR 12.2; 214–15). These caveats are all the richer in significance for appearing in the passage that houses the reference to the principle of least action, for Maupertuis was, from a religious point of view, notoriously Janus-faced. Though famed for erecting his formula into a theistic proof, and praised for this innovation by the *Monthly Review* (October 1750),[12] he was defamed for his demolition of the argument from design. Indeed his rejection of Newton's idea that the existence of a creator could be deduced from the near uniformity of planetary motion, on the grounds that a physical explanation might still be forthcoming, is very much in line with Philo's afterthought.[13] Maupertuis was himself vulnerable, however, to the charge that he allowed metaphysics to obtrude, even if it was more often his slighting of natural theology that came under fire. While Bolingbroke objected to his "deduction of a physical hypothesis" from a theistic premise in "Les loix de mouvement et de repos" (1748),[14] an article on least action in *A Supplement to Mr Chamber's Cyclopedia* (1753) attempted to correct the view that the principle supplied a "stronger proof" for the existence of God than "the other arguments commonly alleged, and deduced from the order of nature."[15] And Bolingbroke was also critical of Maupertuis' attack on the "true foundations" of theism, finding inconsistencies in his reasoning.[16] In fact, Philo's devastating rebuttal of natural theology owes little or nothing to Maupertuis' flawed line of attack, but that is not what matters here. By elevating the design argument from the material to the metaphysical plane, Maupertuis gave himself the freedom to speculate boldly on a range of "less high-flown things,"[17] and a number of these unholy speculations fuel Philo's brief.

The delayed, posthumous publication of the *Dialogues* (1779) has done much to conceal its ties with the period in which it was begun.[18] Hume first mentions the work in a letter written on 10 March 1751, by which stage at least three of the final twelve parts were drafted. In the same week the Advocates Library, which Hume on moving to Edinburgh was shortly to head,[19] acquired the *Mémoires* of the French Academy of Sciences for 1744, including the paper in which Maupertuis first set out the geometric demonstration of his principle, and twice declared that nature always acts in the simplest manner to produce its effects.[20] Soon the library also had the 1751 edition of the *Essai de cosmologie* (1750), the short but encyclopedic work in which Maupertuis, repeating and refining his earlier ideas, engagingly summarized his findings in both the physical and life sciences. Professing in 1755 to "have long been a great Admirer of Monsr Maupertuis," Hume shows broad knowledge of his work, including, in particular, the principle of least action, that cornerstone of the metaphysics:

> He is the only great Geometer in the World, who ever was a man of Eloquence and fine Imagination. Not to mention his Talents of a profound Metaphysician.[21]

To judge from the way the "principe metaphysique"[22] is handled in the *Dialogues* it seems likely, however, that Hume found Maupertuis' theological extrapolations profound rather than convincing. Philo is reminded that the perception of order depends on explanation, and that explanation is the more authoritative for sticking to secondary causes. And where Maupertuis draws a sharp line between the perfection of nature's laws and a creation too flawed to support theodicy, Philo elides the separate realms of physics and biology, suggesting that there is as much good reason to deduce intelligent design from the intricacy of human anatomy as from the laws of motion—though we are left open to reflect that good reason may not be reason enough. Indeed, as Philo advances more deeply into his recantation, it becomes clear that he favours the low road of natural theology rather than the high road of a priori proof. But as his reliance on well-worn exempla of the design argument becomes more evident, the irony of his situation is marked by pointed allusion. A long rhapsody on the classical anatomy of Galen, one of the oldest chestnuts of debate, draws on two classic expositions of the argument from design, as Isabel Rivers has shown: John Wilkins's *Of the Principles and Duties of Natural Religion* (1678) and Samuel Clarke's *A Demonstration of the Being and Attributes of God* (1704).[23] Though the last has served as a stand-by for his opponent Demea (now departed in a huff),[24] Philo falls back unresistingly on Clark's argument that Galen would have deduced the hand of the Creator all the more confidently from "late Discoveries on Anatomy and Physick," such as the circulation of blood.[25] Hume sends out warning signals, however, when Philo, preserving Clarke's gist, but updating his biological reference, proceeds to declare, apparently oblivious of any reason to adjust his case:

> The farther we advance in these researches, we discover new scenes of art and wisdom: But descry still, at a distance, farther scenes beyond our reach; in the fine internal structure of the parts, in the œconomy of the brain, in the fabric of the seminal vessels. (DNR 12.3; 215)

At this moment the apostasy of the free-thinking Philo seems complete, but the climax proves short-lived, when Cleanthes, seizing on the concession, rejoices that his opponent has at last come round to his own view that the universe is like "a machine of human contrivance," the very crux of their disagreement, provoking Philo into fresh dispute (DNR 12.5; 216). But Philo's pious declaration is unsteadied, in any case, by the force of his earlier claim that the "new universe" revealed through the "discoveries of microscopes" suits his book better than his friend's, for the reason that it undercuts the tidy human analogy of maker and artefact that sustains the argument from design:

> The farther we push our researches of this kind, we are still led to infer the universal cause of All to be vastly different from mankind, or from any object of human experience and observation. (DNR 5.3; 166)

The position that Philo takes here is decidedly unusual in discourse of the period. Almost invariably the new underworld of microbiology received the traditional sanction of natural theology, regardless of what support it leant to Linnaeus's "horrible *War of all against all*."[26] But Maupertuis, answering the apologists "après Newton" who had comfortably accommodated the insect and subaqueous worlds in their theistic proofs,[27] dwelt pointedly on the outlandish in creation ("the majority of beings appear to us as monsters"), and insisted on the narrow limits of the known: "we live perhaps among an infinity of beings of which we are unable to discover either the nature, or even the existence."[28] Of course he wrote at a time when the micro-organic was at the cutting edge of research in natural history, when, owing in part to a forced admission of ignorance, the entire organic order seemed to constitute a *terra incognita.* But while there was no commanding principle like that of least action on the horizon, and no clear resolution to the competing claims of rival theories, there were findings enough to cause him to exclaim, "What are we to think? What a new universe!"[29] Hume's "farther scenes" are imbued with a similar response to recent discovery in the life sciences, and they stand at a distinct remove from the "new scene of thought" (Baconian or Newtonian in its scientific aspect) that inspired the first phase of his career.[30] Philo's discourse is part of a wide intellectual surge that followed in the wake of a new understanding of evolution and generation shaped by Maupertuis. Speaking of these new developments at the mid-century—a phase which a historian of biology was later to describe as "almost unexampled in the vigour and advancement of science," Diderot in *De l'interpretation de la nature* (1753) hailed "the moment of a great revolution."[31] Three figures were at the fore—Maupertuis and Buffon in France, John Turberville Needham in England. Placed in the context of their ideas, the *Dialogues* appears to be a conjectural as well as analytic work: one that offers in addition to its time-honoured rebuttal of the argument from design, a tentative argument *about* design as challenging as any of its period.

Though the relation of Hume's writing to the genre of natural history has been explored theoretically by Paul Wood among others,[32] the biological reference of the *Dialogues* has been left uncharted, despite periodic citation of the text by historians of the life sciences, or its evident links with work done in the Edinburgh of Hume's day. When Philo gives substance to his "farther scenes" by invoking research on the "fabric of the seminal vessels," Hume implicates the findings of the precocious Alexander Monro secundus, an illustrated sample of which appeared under the title "A Description of the Seminal Vessels" in *Essays and Observations* (1754), edited by Alexander Monro primus and by himself.[33] Contributions to this

journal were drawn from members of the Edinburgh Philosophy Society of which Hume had become secretary in 1751, the year of his move to the city, and the contents reflect the interests of the Society which were at that period predominantly medical, causing its historian, not untypically, to find Hume's role in it "difficult to understand" since moral topics were not on the agenda.[34] Placed first in the volume was an ambitious critique of Newton by Hume's long-standing friend Lord Kames, the aim of which was to circumvent the passivity ascribed to matter by classical mechanics through a theory—reminiscent of Leibnitz—that credited inanimate objects with immanent energy.[35] In the second essay the vitalist tenor of Kames's piece is well brought out by a scathing attack on it by John Stewart, Professor of Natural Philosophy at Edinburgh, who singles out as a particularly noxious source of such heresy "Mess. Buffon and Needham . . . who have carried the activity of matter to the highest pitch."[36] Hume (long-suffering editor!) is effectively listed as a member of the same school by Stewart when he is sneeringly credited with the "new and wonderful doctrine . . . that something may begin to exist, or start into being without a cause."[37] And the imputation is deepened when Stewart proceeds to cite a note from the *Philosophical Essays* (1748) in which he claims that Hume mistakenly attributes a belief in the "activity of matter" to Newton.[38] Again in defence of his belief that a system can only be activated by a force external to it, Stewart accuses Maupertuis, in the same passage, of reinstating the ether hypothesis in his *Essai de cosmologie* (1750).[39] Though wrong on both counts, Stewart was certainly correct in regarding Hume as resistant to the occasionalist reading of Newtonian physics that he was championing (matter operated by remote control), and it is perhaps fortunate that he was spared Philo's repeated claim in the *Dialogues* that the world "plainly resembles more an animal or a vegetable than it does a watch or a knitting-loom" (DNR 7.3; 176). Not all academics, however, were dismissive of the new ideas. At the first meeting of the Glasgow Literary Society on 10 January 1752, William Cullen, then Professor of Medicine at Glasgow, and already an ally of Hume's, read a paper on the "treatise entitled Cosmologie by Maupertuis."[40]

Stewart's casual reference to Buffon shows that Edinburgh's cultural societies had succeeded in their aim of keeping in touch with European developments in the sciences, and the same seems to have been true of other Caledonian centres. As Paul Wood points out in his study of Buffon's Scottish reception with special regard to Aberdeen, the *Histoire naturelle* was already in use in 1750 by Thomas Reid, who in common with other devout figures like James Beattie and Robert Eden Scott, demured over its materialism and reputed atheism.[41] The main sticking point for the professoriat was the concept of generation that Buffon expounded polemically in the second of the first three volumes of the *Histoire* that came out together in 1749. There he drew not only on Maupertuis' rejection of preformism, but on his understanding that both sexes contributed equally to the natural process that produced the embryo. Mindful too, it seems, of the principle of least action, he

remarked (with implicit irony) that reproduction put nature to no extra expense, making it clear that generation cost God nothing either.[42] Such rigid stone-walling of the numinous was difficult to overlook, and the elimination of divine agency from that mystery which a later commentator would claim to "have been felt in all ages to be the crux, the meeting point of heaven and earth, of God or no God" struck a blow against the prevailing belief in intelligent design.[43] Particularly at risk were the mechanistic explanations of the universe that depended upon an existence outside the machine to explain the making of the machine, its possible regulation, or at least the force that set it going. The premise that generation was merely a continuous and ordinary process of growth required no *deus ex machina*, and broke radically with the persistent and faith-inducing notion that the embryos of all creatures—past, present, and future—were stacked in either ovum or sperm, one within the other like Fabergé eggs, untouched since the day of creation.

While Edinburgh's societies would certainly have provided a conduit for Hume's familiarity with the new life science, his European contacts could well have given him a lead over many of his compatriots in this respect.[44] Adam Smith eulogised the *Histoire* in the mid 1750s, but Hume may have had wind of it as early as December 1748, for he happened to be in Paris in the week that Buffon informed the Academy (with an aplomb that gives some credence to the claim that the *Histoire* was the most widely disseminated of all eighteenth century texts)[45] that he, in company with Needham, had found the secret of both male and female seminal fluid which would be revealed in full to those who bought his forthcoming work. Later in life Hume grew well acquainted with Buffon,[46] who once begged him to list the volumes of the *Histoire* (ultimately 36) that he lacked—a clear indication that he had been building up a set. It seems that the first three volumes in this makeshift collection dated back to 1749, and Hume would in any case have had access to the 1750 edition held by the Advocates' Library, which in due course procured Maupertuis' *Lettres* (Berlin 1753), in addition to the *Essai de philosophie morale* (Berlin, 1749), and the *Essai* already mentioned. Hume himself acquired the first edition of Maupertuis' *Oeuvres* (Lyon, 1756), and his continuing interest in the life sciences is witnessed by his later ownership of works by Bonnet, and Robinet.[47] In the latter's *De la Nature* (1761–1763), a speculative treatise on evolution, he was delighted to find—surely a clue to his own love of conjecture in this field—"some of the boldest reasonings to be found in Print."[48]

In the course of the *Dialogues* Philo dismantles many kinds of argument for the existence of a supreme being, ranging from the a priori or cosmological proofs offered by Demea, to a variety of a posteriori inducements from the more subtle Cleanthes. Chief among the last is the argument that the order apparent in both the animate and inanimate universe is analogous to that of a machine, and that machines require makers. Though the analogy Cleanthes applies represents only one of many serviceable to his case, it had a special salience in the period that

Hume wrote, owing to the persistence of Cartesian dualism, which had deeply entrenched the view that organisms, including the human body, were to be understood as machines.[49] Without denying the order of the universe, or the need for an explanation of it, Philo brilliantly substitutes for the analogy of the machine the current, vitalist notion of generation, and the switch obviates the need to posit a supreme intelligence as creator. Many readers of the *Dialogues* would have recognized, had the text appeared when written, the context that underlies and enables Philo's flash of inspiration, his "new idea":

> If the universe bears a greater likeness to animal bodies and to vegetables, than to the works of human art, it is more probable, that its cause resembles the cause of the former than that of the latter, and its origin ought rather to be ascribed to generation or vegetation than to reason or design. (DNR 7.1; 176)

Signalling an awareness that the "new idea" had ancient sources,[50] Philo proceeds mischievously to provide a creation myth that marries the old and new. While the first part of this (corresponding to the vegetative cause) recalls Lucretius's idea that "we all spring from celestial seed" ("denique coelesti sumus omnes semine oriundi"), the second part (drawing on generation) glances at Buffon's summary of cometary cosmogonies from the *Histoire*,[51] and at the parsimony implied by recent accounts of self-sustaining systems:

> In like manner as a tree sheds its seed into the neighbouring fields, and produces other trees; so the great vegetable, the world, or this planetary system, produces within itself certain seeds, which being scattered into the surrounding chaos, vegetate into new worlds. A comet, for instance, is the seed of a world; and after it has been fully ripened, by passing from sun to sun, and star from star, it is at last tossed into the unformed elements, which every where surround this universe, and immediately sprouts up into a new system.
>
> Or if, for the sake of variety (for I see no other advantage) we should suppose this world to be an animal; a comet is the egg of this animal; and in like manner as an ostrich lays its egg in the sand, which, without any further care, hatches the egg, and produces a new animal; so . . . . (DNR 7.5–6; 177)

Rather than with the father, Philo's scenes of origin open with a mother (however uncaring), and like the new microcosmic scenes of which he later speaks, they recede back ever farther. Among the less contested of Philo's triumphs in the *Dialogues* is his demolition of the "short chronology" of Eusebius, Ussher, or indeed

Newton, which finds initial support from Cleanthes who clings to a belief in the "infancy of the world" (DNR 6.9–11; 172–73). To back up his view that prehistory has seen "endless" and sometimes catastrophic change, Philo claims that "strong and almost incontestable proofs may be traced over the whole earth, that every part of this globe has continued for many ages entirely covered with water" (DNR 6.12; 174), and he draws here on the *Histoire*. Opening his main text with an account of Neptunism, Buffon repeatedly cites his own "incontestable proofs" which appear under "Proofs" in the appendix,[52] and it was this topic—on which he had probably done more personal research than any other—that led the Sorbonne to condemn his work in 1751 on the incontestable ground that it contradicted Genesis. Philo does more, however, than recirculate the heresy that Buffon had muffled with a sly disclaimer.[53] He goes on to challenge the premise that the order of the universe proceeds from an intelligence, observing that it is founded on the analogy with human creation, whereas experience of nature suggests that matter normally precedes mind. "Generation has some privileges above reason," he urges, "for we see every day the latter arise from the former, never the former from the latter" (DNR 7.14; 179–80). The force of Philo's argument rests ultimately on his preference for one kind of analogy over another, and his choice is determined by his sense of what constitutes proper likeness, hence his many reminders that "the universe resembles more a human body than it does the works of human art and contrivance" (DNR 6.4; 171).

The argument is complicated, however, by the fact that analogy is in any case accorded a different status in that mechanist scheme of things that Cleanthes upholds. If, as Cleanthes asserts early in debate, the universe is "but one great machine, subdivided into an infinite number of lesser machines" (DNR 2.5; 143), the single intellect responsible for its design guarantees a uniformity of operating principles. Confidence of this kind received support from the successful application in the physical sciences of results and methods from one domain to another. Such was the working principle that led to the universal jurisdiction of gravity, and that had inspired Galileo to bridge the terrestrial and celestial when they were considered disjoint, causing him to formulate his far-reaching "doctrine of uniformity."[54] But mid-century developments in the life sciences revived a Baconian skepticism towards such tidy inference, and Maupertuis' querying of analogy—"it pleases our mind, but does it please nature?"[55]—was taken further by Buffon, who in the "Preliminary Discourse" to the *Histoire* took a kick at the foundations of the mechanical philosophy,[56] warning that the assumption of "uniformity" had fostered false comparisons between the animal, vegetable, and mineral worlds:

> The common mould found in things so unlike in themselves has less to do with nature than with the narrow spirit of those poorly informed men who so little know how to judge the force of truth as to recognize the just

> limits of analogy. May one suppose, then, that because blood circulates, sap does also? Or conclude from the vegetation known among plants a parallel vegetation in minerals, or from the motion of blood that of sap, or from that of sap the motion of petrifying gum?[57]

Buffon had in mind Linneaus's classification of the quadrupeds when he argued that it was invalid "to judge the whole by a single part,"[58] and Philo issues a similar caveat when, insisting on the arbitrariness of identifying the universe with a machine, he enjoins Cleanthes not "to allow one part to form a rule for another" (DNR 2.20; 148). In the *Treatise* Hume had warned that "the probability derived from analogy" depended on the degree of resemblance,[59] and Philo, developing this position, uses the same example as Buffon:

> After having experienced the circulation of the blood in human creatures, we make no doubt, that it takes place in Titius and Mævius: But from its circulation in frogs and fishes, it is only a presumption, though a strong one, from analogy, that it takes place in men and other animals. The analogical reasoning is much weaker, when we infer the circulation of the sap in vegetables from our experience that the blood circulates in animals; and those, who hastily followed that imperfect analogy, are found, by more accurate experiments, to have been mistaken. (DNR 2.7; 144)

Philo's "new idea," his likening of design to generation, comes equipped with an inbuilt critique of analogy, and once again he falls in with Buffon's stress on nature's variety and multitudinous means,[60] when he continues:

> By observation, we know somewhat of the œconomy, action, and nourishment of a finished animal; but we must transfer with great caution that observation to the growth of a foetus in the womb, and still more, to the formation of an animalcule in the loins of its male parent. Nature, we find, even from our limited experience, possesses an infinite number of springs and principles, which incessantly discover themselves on every change of her position and situation. (DNR 2.21; 148–49)

According to the *Histoire* mechanical principles fail to account for the functions of the human body, in which "growth and production are effects of laws of a quite different nature."[61] But Hume develops this recognition of inherent diversity more fully than Buffon who in his Cartesian discourse on man withholds the soul from creation, and brusquely settles on an anthropocentric arrangement for his quadrupeds in the *Histoire*, making the dog follow the horse as in the farmyard. Man in the *Dialogues* is decentred not only by the repeated use of "anthropomorphism"

(a word that may have been invented there for the purpose),[62] but by an array of argument and illustration that narrows human horizons to a "chink in a wall" (DNR 6.2; 170). Hume persistently reminds his readers of a microcosm that suggests origins "vastly different from mankind," and of a macrocosm that holds out the probability of plural and unrelated living forms (DNR, 5.3, 2.20, 7.11; 166, 148, 178).[63] He remarks on the reasonableness of polytheism, enshrining, above all, the pervasive mystery that mocks the bid to found "the model of the whole universe" on man, and intimates that morality has its source in human struggle rather than in the Godhead (DNR, 6.13, 2.19, 11.12–13; 175, 148, 211). But if the sense of intellectual humility, invoked by the survey of nature's diversity in the *Dialogues*, finds no parallel in Buffon, it has at least a point of departure in the *Essai de cosmologie*.

Towards the close of his summa Maupertuis attempts to account for the paradox that the narrow limits of knowledge are matched by the intensity of the desire to know. Contemplating the various forms of catastrophe, cometary and otherwise, to which the earth has been subject in its long prehistory, he reflects on the successive waves of extinction that must have wiped out whole populations, or have allowed "only the most robust of animals" to survive.[64] This drastic and repeated rupture of the chain of being is seen to have introduced gaping lacunae, and to have destroyed an intuitive communion which reason and imagination are challenged to repair. The idea of divergence, so vividly sketched here, takes off from the remarkable portrayal of evolution at the start of the *Essai*, where Maupertuis, dismissing the teleology of Aristotle and Newton on the one hand, and rejecting Lucretius's notion of chance assembly on the other, opens up a third route: descent through variation honed by survival. While Lucretius understood that animals learned to make use of the facial organs that they received by happenstance, Maupertuis suggests that it would indeed have been a marvel if they had existed without them:

> May we not say that in the chance combinations of the productions of nature, since only those who had developed certain adaptive connexions ("rapports de convenance") could survive, it is not surprising that such adaptation is actually found in all those species which do exist? Chance, let us say, has produced an innumerable multitude of individuals, a small number of which found themselves constructed in such a way that their organs were able to satisfy their needs. A much greater number had neither adaptation nor order: all these last have perished; animals without mouths were not able to live, others which lacked the organs of generation could not perpetuate themselves: the only ones to survive were those in which order and adaptation were hit upon; and the species we see today are only the smallest part of those whom a blind destiny has produced.[65]

When Philo argues, as he does repeatedly, that order is a condition of existence, and therefore needful of no further explanation than existence itself, he makes the same point, though with some difference of emphasis:

> It is in vain, therefore, to insist upon the uses of the parts in animals or vegetables and their curious adjustment to each other. I would vain know how an animal could subsist, unless its parts were so adjusted? Do we not find, that it immediately perishes whenever this adjustment ceases, and that its matter corrupting tries some new form? (DNR 8.9; 185)

Like Maupertuis Philo invokes the long perspective of an eventful prehistory in which the "revolutions of unguided matter" led to ever-changing forms. Indeed, he brings greater definition to Maupertuis' account of descent when he points out at the start of part 8 that the Lucretian (or "Epicurean") hypothesis has great force if developed in a specific way. If matter is supposed finite and subject to an "eternal duration," the emergence of "every possible order" is ensured. "No-one, who has a conception of the powers of infinite," he remarks, "will ever scruple this determination" (DNR 8.2; 182). Like Maupertuis, again, Philo dramatises the vigilance exacted by "the great work of self-preservation," remarking during his meditation on the pains of existence that "the least departure from the true path by mistake or necessity, must involve us in misery or ruin" (DNR 11.6, 11.9; 205, 208). But where Maupertuis' insistent focus on survival, framed by a theory of heredity that allowed for both variation and fruitful "error," led him to a virtually Darwinian sense of evolution, Philo tends to draw back from his near approaches to the idea.[66] Hume was perhaps deterred by the same obstacle that Buffon had run up against, causing him to revoke a notorious passage from the *Histoire.* There structural homologies had prompted him first to compare horse and ass, then man and horse, to include monkeys in the family of man, and to argue, finally, that adaptation and crossing could account for the rise of every creature from a single type. But the snag, Buffon concedes, was that species in the animal kingdom appeared to have been stable since historical records began.[67] Philo issues a similar caveat, though Hume—unwilling to let the argument rest there—goes on to list some cases of possible extinction in a note (DNR 11.9; 207).

Hume seems to have fewer reservations, however, when it comes to deploying the idea of survival by trial and error on a macrocosmic scale. Philo, at one point, concocts a cosmogony modelled on organic evolution, like some late twentieth-century ones:

> Many worlds might have been botched and bungled, throughout an eternity, ere this system was struck out: Much labour lost: Many fruitless

> trials made: And a slow, but continued improvement carried on during infinite ages in the art of world-making. (DNR 5.7; 167)[68]

In a similarly bold translation, he adapts an idea with a provenance in political theory to creation itself, so as to suggest that the construction of even the most complex creatures may be a modular, piece-meal affair. Where Bernard Mandeville had used the example of the building of a warship to illustrate the gradual evolvement of polity through the "uninterrupted Labour and joint Experience of many Ages,"[69] in Philo's version the ship is the product of a stupid designer who can get by with doing no more than combining items that have been refined by a long succession of "multiplied trials, mistakes, corrections, deliberations, and controversies." Brainbox Philo's allusion to a well-known passage in *The Fable of the Bees* provides, meanwhile, a pointed reminder of the way in which discourse is itself a co-operative enterprise. Indeed, we are left in no doubt that the *Dialogues* is deliberately attuned to the newfound sense of nature's design that emerges from its critique of natural theology. When Philo tells Cleanthes that it is his "turn now to tug the labouring oar" (DNR 10.36; 202), Hume underlines the corporate, dialogistic nature of his pursuit of truth, reviving a famous metaphor from the *Treatise* that enacts the way social covenants grow spontaneously rather than springing from some blueprint or master-plan: "Two men who pull the oars of a boat, do it by agreement or by convention, tho' they have never given promises to each other" (T 3.2.2.10; SBN 490).

Foremost among the forceful strokes that give fresh momentum to Philo's argument about natural design is Cleanthes's attack on his theory of non-existence by default. If the "powers and organs" of an animal are determined by what is "requisite for its existence," what account can be given, Cleanthes asks, for the doubling of organs such as eyes or ears, seeing this is surely "not absolutely necessary for the subsistence of the species" (DNR. 8.10; 185). Earlier, in an attempt to strengthen his favourite analogy of the living with the man-made, Cleanthes supplies the memorable comparison of nature to a library in which the books have the power to reproduce themselves as if they were vegetable or animal. In so far as living things differ from books, even from living ones, it is only in having a more complex organisation: all the better reason, then, he argues, for granting them an author. If a modern reader can refrain from recalling contemporary metaphors on the genome as text at this point, the temptation recurs when Philo, picking up again on his theme of a hidden "inherent principle" (174), launches a further bold conjecture. After demonstrating the curious way in which the digits of all multiples of the number 9 add up to 9 (or some product of it), he proceeds:

> To a superficial observer, so wonderful a regularity may be admired as the effect either of chance or design; but a skillful algebraist immediately

> concludes it to be the work of necessity, and demonstrates, that it must for ever result from the nature of these numbers. Is it not probable, I ask, that the whole œconomy of the universe is conducted by a like necessity, though no human algebra can furnish a key . . . may it not happen, that, could we penetrate into the intimate nature of bodies, we should clearly see why it was absolutely impossible, they could ever admit of any other disposition? (DNR 9.10; 191)

Already used by Philo in a similar context (DNR 6.12; 175), the last phrase re-echoes the crucial point made by Maupertuis, but it marks at the same time one important divergence between the philosopher and the naturalist. Whereas in the *Essai* the necessity responsible for organic design is primarily external, answering well to the later idea of natural selection, Philo adds to that conception another form of necessity that is exclusively internal, suggesting that development is controlled by constraints of structure as well as by those of livelihood. Though Philo has often been taken as a forbear of Darwin, he is perhaps more closely affined to the recent "process structuralists" who deal in the intrinsic limits to various modes of growth, on the understanding that organic innovation has its own generative grammar.[70]

By seizing on algebra to illustrate his concept of a deep regularity in nature, Philo puts some distance between himself and the "revolution" in the life sciences of his day. Buffon in his "Premier discours" virtually banished mathematics from the realm of natural history, pronouncing it to be tautologous. Diderot was soon to follow suit by proclaiming its decline.[71] And Maupertuis, despite pioneering the application of statistics to heredity, preferred the concrete certainties offered by physics which realised "laws such as mathematicians give,"[72] pre-eminently his own "principe metaphysique." But Philo's supposition of a rational, "inherent principle" that includes the organic puts him somewhat ahead of the mid-century revolution, for it enables an entire account that is logically free of reference to an initiating intelligence. He resolves, in effect, a paradox that repeatedly confronts readers of the *Histoire* and that appears at its most acute in the *Essai*, where Maupertuis simultaneously declares that the living world offers evidence for belief in nothing more than a blind destiny, and that the perfection of nature's laws are as good as a priori proof of the existence of a supreme and enlightened mind.[73] Philo in his discussion of misery deals at some length with the oddity of supposing that the proof of the pudding lies not in the eating but in the elegance of the recipe. But he also challenges the whole set of assumptions that underlie the argument for intelligent design. Why, he asks, should mind enjoy a temporal priority over matter; or a pre-existent mind require less explanation than pre-existent matter; and why, above all, should order be the exclusive property of mind. It is on the strength of this critique that Philo, reinterpreting the scope of theology, exclaims: "It were better, therefore, never to look beyond the present material world. By supposing it to contain the principle of its order within itself, we really

assert it to be God; and the sooner we arrive at that divine Being so much the better" (DNR 4.9; 162). It was surely this exceptional confidence in immanence (despite the gulf between *is* and *ought*)[74] that led Erasmus Darwin to find in the *Dialogues*, fifteen years after their eventual publication in 1779, a philosophical guarantor for his theory that an original "living filament" had evolved of its own accord into all living things,[75] and that even the mineral world was the product of generation:

> The late Mr David Hume, in his posthumous works, places the powers of generation much above those of our boasted reason; and adds, that reason can only make a machine, as a clock or a ship, but the power of generation makes the maker of the machine; and probably from having observed, that the greatest part of the earth has been formed out of organic recrements; as the immense beds of limestone, chalk, marble, from the shells of fish; and the extensive provinces of clay, sandstone, ironstone, coals, from decomposed vegetables; all of which have been first produced by generation, or by the secretions of organic life; he concludes that the world itself might have been generated rather than created.[76]

It is indicative of the way Erasmus Darwin approached the *Dialogues* that the observation he ascribes here to Hume originated, in fact, in the *Histoire* where Buffon had indeed claimed the idea of organic land formation as his own.[77] But nowhere outside the *Dialogues* could Darwin have come by a livelier sense of what he rightly ascribes to Hume: a view of a world gradually produced "by the activity of its inherent principles."[78]

Erasmus Darwin's association of Hume with the life sciences is instructive. It has too often been assumed that Hume's interest in science was confined to the physical sciences, more particularly to the experimental natural philosophy of Newton and Boyle that he imbibed in his youth. The immediate aim of this article is to show that Hume (in common with many of his circle) was conversant with the new ideas about generation and evolution that had taken root at the mid-century, chiefly in France, when he began to compose the *Dialogues*. But an appreciation of this context sheds further light on the significance of the work as a whole. Philo's dismantling of natural theology enables a remarkably prescient account of how natural design can subsist without a supernatural order.

NOTES

Thanks are due to the Research Office at UCT for the award of a grant, to the helpful staff of the National Library of Scotland, and to the journal's two anonymous readers

for their valuable comments. I am especially grateful to Jocelyn Harris for her encouragement throughout.

1 *Dialogues concerning Natural Religion*, ed. Norman Kemp-Smith, 2nd ed. (Indianopolis: Liberal Arts, 1947), 215. Future references are to this edition, and are included in the text.

2 *A Treatise of Human Nature*, ed. David Norton and Mary J. Norton (Oxford: Oxford University Press, 2000), abbreviated as "T" and cited by Book, part, section and paragraph, followed by the page number in the "SBN" edition, *A Treatise of Human Nature*, ed. L A Selby-Bigge, revised by P. H. Nidditch (Oxford: Clarendon Press, 1978), see T 3.1.3.7; SBN 282. Future references are given in the text.

3 "Natura enim simplex est & rerum causis superfluis non luxuriat," Liber III, Regulae Philosophandi I (see Isaac Newton's *Philosophiae Naturalis Principia Mathematica*, ed. Alexandre Koyré and I. Bernard Cohen, 2 vols. [Cambridge: Cambridge University Press, 1972], 2:550). "Nature," to quote Andrew Motte's translation, "is pleased with simplicity, and affects not the pomp of superfluous causes" (see *The Mathematical Principles of Natural Philosophy*, 2 vols. [London, 1729], 2:202). Like Newton, Hume on both occasions cites the precept, *nature does nothing in vain* (*Anima*, iii 12, 434^{a} 31–32), though Hume makes it clear in the *Treatise* (see above) that he knows Aristotle to be the source.

4 Maupertuis, "Accord de différentes loix de la Nature qui avoient jusqu'ici paru incompatible," *Histoire de l'Académie royale des sciences avec les mémoires, année MDCCXLIV* (Paris, 1748), 417–26. "*Nature dans la production de ses effets agit toujoûrs par les moyens les plus simples*," 421. This maxim was quoted at the end of a piece on Maupertuis in the *Monthly Review* III. Art. lxx (October 1750): 431–37, 437.

5 Maupertuis, "Accord de différentes loix de la Nature," 424. Mary Terrall shows that Maupertuis' principle emerged as a "response to historical attempts to formulate laws of motion," and traces it back to his treatise on astronomy, *Discours sur les différentes figures des astres avec une exposition des systèmes de MM. Descartes et Newton* (Paris, 1742). See *The Man who Flattened the Earth: Maupertuis and the Sciences of the Enlightenment* (Chicago: Chicago Univeristy Press, 2002), 357, 178. An English translation of this work was appended to John Keill's *An Examination of Dr. Burnet's Theory of the Earth* (Oxford, 1734).

6 Maupertuis, "Accord de différentes loix de la Nature," 424; "en recherchant ce qu'il y avoit de plus convenable à leur faire exécuter," 426.

7 Ibid., 423.

8 Maupertuis advertised this connection both in the preface to his second version of his essay in 1746, and in the foreword to the *Essai de cosmologie* in his *Oeuvres*, 4 vols. (1756), 1:xiv.

9 "Cette vérité géometrique dûe à M de Maupertuis, subsistera toûjours," see "Action," *Encyclopédie ou dictionnaire raisonné des sciences, des arts et des mêtiers* I (Paris, 1751), 1:119–20, 120. Charles Darwin twice invoked "Maupertuis' philosophical axiom 'of least action'" to support his thesis that living beings had descended from a single source, rather than from an array of initial creations. See *On the Origin of Species*, 4th ed. (London, 1861), chap. 14, 570, and *The Variation of Animals and Plants under Domestication* (London, 1868), 12–13.

10 Rich Foley argues persuasively for the reading of Philo as a dramatic creation in his article, "Unnatural Religion; Indoctrination and Philo's reversal in Hume's *Dialogues Concerning Natural Religion*," *Hume Studies* 32.1 (2006): 83–112.

11 To Adam Smith, 15 Aug. 1776, *The Letters of David Hume*, ed. J. Y. T. Greig, 2 vols. (Oxford: Clarendon Press, 1969), 2:334.

12 See the laudatory review of the *Essai de cosmologie* (Leide, 1750), which also comments on the essay "Accord de différentes loix de la Nature," reprinted with it, *Monthly Review* III. Art. lxx (October 1750): 431–37, particularly 434–35. B. C. Nangle identifies the writer as William Bewley (1726–1783). See his *The Monthly Review, First Series 1749–1789, indexes of contriburors and articles* (Oxford, 1934), 161, 4–5.

13 *Essai de cosmologie*, Avant-Propos, x–xi. Hume would certainly have been aware of this passage from the *Essai*: see the discussion of his fracas with John Stewart below.

14 For Bolingbroke's detailed comment on Maupertuis' "Les loix de mouvement et de repos" (1746, published 1748), see *Philosophical Works* (London, 1754), V, 250. This neglected essay of c.2000 words was appended as a footnote to Essay IV in the last volume of his *Works*. For an account of d'Alembert's critical response to Maupertuis' metaphysics in his *Traité de dynamique* (1758), see Terrall, *The Man who Flattened the Earth*, 291.

15 "Action," in *A Supplement to Mr Chambers's Cyclopædia*, 2 vols. (London, 1753).

16 See *Works* (1754), V, 249, 252–54. Bolingbroke had died in December 1751.

17 Maupertuis had himself called attention to the apparent hiatus ("un grand intervalle") between the two parts of his work, see *Essai* (1751), Avertissement, iv, for "objets moins élevés," Avant-Propos, vii.

18 For a definitive account of the composition of the *Dialogues*, see M. A. Stewart, "The Dating of Hume's Manuscripts" in *The Scottish Enlightenment: Essays in Reinterpretation*, ed. Paul Wood (New York:University of Rochester Press, 2000), 288–304.

19 Hume became Keeper of the Advocates' Library in 1752, but is known to have used its resources before his move from Ninewells.

20 Maupertuis, "Accord de différentes loix de la Nature qui avoient jusqu'ici paru incompatible," *Histoire de l'Académie royale des sciences avec les mémoires, année MDCCXLIV* (Paris, 1748), 421, 424. And see the MS "Library Accounts," National Library of Scotland, FR 339e(i).16: "1751 March 12, Histoire de l'Academie Sciences 1741–1744, 8 tom in 12, £1.16-." This was the Amsterdam edition (which included the *Mémoires*), but the accounts for this period are far from complete and it appears from Ruddiman's catalogue that the library was simultaneously acquiring the Paris edition.

21 To the Abbé Le Blanc, 5 Nov. 1755, *The Letters of David Hume*, ed. J. Y. T. Greig, 2 vols. (Edinburgh, 1969), 1:226–27. Maupertuis' skill as a geometer is evident in his *Discours sur les differentes figures des astres* (Paris, 1732), as also in his *La figure de la nature* (Paris, 1738), a copy of which was rebound in 1754 during Hume's time as Keeper. But Maupertuis clearly regarded the proof in "Accord de différentes loix de la Nature" as his greatest triumph in the field, listing there the "plus grand Géomètres" who had preceded him

on the problem, before ascribing his success in solving it to the superiority of modern geometry (418, 426).

22 Before achieving the status of a title in 1746, the term was used by Maupertuis in "Accord de différentes loix de la Nature," see 419, 424.

23 See Isabel Rivers, "Galen's Muscles, Wilkins, Hume, and the Educational Use of the Argument from Design," *Historical Journal* 36.3 (1993): 577–97; see also *Dialogues concerning Natural Religion and Other Writings*, ed. Dorothy Coleman (Cambridge: Cambridge University Press, 2007), 91n.

24 See Coleman, *Dialogues*, 63n.

25 Samuel Clarke, *A Demonstration of the Being and Attributes of God* (London, 1705), Proposition XI, 221.

26 For the translation of Linnaeus, see F. J. Brand, *Select Dissertations from the* Amoenitas Academicae, 2 vols. (London, 1781), 1:164, and see A. C. Crombie, *Styles of Scientific Thinking in the European Tradition*, 3 vols. (London: Duckworth, 1994), 2:1429–30.

27 Notably the influential William Derham of Boyle lectures fame, twice mentioned in the *Essai* (Avant-Propos, viii; 61). Maupertuis may well have had him in mind when he declares, "it is not in the thread of the spider that we need to search for proofs of the wisdom of its Author" ("ce n'est pas dans le fil de l'araignée qu'il faut chercher les preuves de la sagesse de son auteur"), 30; see also Avant-Propos, xxi. Derham had said of spiders (as of other "irrationals") that the "admirable Art they exert, is none of their own," and had cited the "strange uncouth Power" of their venom as further evidence of this. See *Physico-Theology: or, a demonstration of the being of God, from His work of creation*, 10th ed. (London, 1742), 235–36, 392.

28 *Essai de cosmologie*: "nous vivons peut-être parmi une infinité de ces Etres dont nous ne pouvons découvrir, ni la Nature, ni même l'existence," 56; "la plupart des Etres ne nous paroissent que comme des Monstres," 57.

29 "Ou en sommes nous? Quel nouvel univers!." So Maupertuis wrote to La Condamine, 24 Aug. 1750, on reading John Turberville Needham's *Nouvelles observations microscopique* (Paris, 1750), quoted by Terrall, *The Man who Flattened the Earth*, 318.

30 To [George Cheyne?], March or April 1734, *Letters*, 1:13.

31 Bentley Glass, "Maupertuis, Pioneer of Genetics and Evolution," in *Forerunners of Darwin*, ed. Bentley Glass et al. (Baltimore: John Hopkins Press, 1959), 51. Denis Diderot, *De l'interprétation de la nature* (1753), in *Oeuvres philosophiques de Diderot*, ed. Paul Vernière (Paris: Garnier, 1961): "Nous touchons au moment d'une grande révolution dans les sciences," 180.

32 P. B. Wood, "Hume, Reid and the Science of the Mind" in *Hume and Hume's Connexions*, ed. M. A. Stewart and John P. Wright (Pennsylvania: Pennsylvania State University Press, 1994), 119–39; and "The Science of Man" in *Cultures of Natural History*, ed. N. Jardine and J. A. Secord (Cambridge: Cambridge University Press, 1996), 169–90.

33 Alexander Monro (1733–1817), who began his medical studies in 1750, presented *De Testibus et Semine in variis animalibus* as his thesis for the M.D. in 1755, though employed as a lecturer since 1753. See R. E. Wright-St. Clair *Doctors Monro* (London:

Wellcome Historical Medical Library, 1964), 70–72. Alexander Monro and David Hume, eds. *Essays and Observations, Physical and Literary* (1754), facs., ed. Paul Wood, 3 vols. (Bristol: Thoemmes Press, 2002), 1:396–402. On the joint editorship of the *Essays* by Hume and Alexander Monro *primus* (not *secundus* as favoured by Mossner and J. Y. T. Greig), see Paul Wood's introduction to this edition, xii.

34 Roger L. Emerson, "The Philosophy Society of Edinburgh 1748–68," *The British Journal for the History of Science* 14.47 (1981): 146.

35 See Henry Home, "Of the Laws of Motion," in Monro and Hume, *Essays and Observations* (1754), 1:69.

36 See John Stewart, "Remarks on the Laws of Motion," in Monro and Hume, *Essays and Observations* (1754), 1:72.

37 Monro and Hume, *Essays and Observations*, 1:116–17; and see E. C. Mossner, *The Life of David Hume* (Oxford: Clarendon Press, 1970), 258.

38 Stewart, "Remarks on the Laws of Motion," 1:130. The reference is to a long footnote in the *Philosophical Essays* (London, 1748), where Hume remarks that Newton "had recourse to an etherial active Matter to explain his universal Attraction; tho' he was so cautious and modest as to allow, that it was a mere Hypothesis" (119). Newton had indeed described the ether as "active matter" in "An Hypothesis explaining the Properties of Light" (1675), and proved reluctant to give up this problematic idea. See A. Rupert Hall, *Isaac Newton: Adventurer in Thought* (Cambridge: Cambridge University Press, 1992), 136, 355–57. Hume's footnote survives, albeit it in slightly altered form, in *An Enquiry concerning Human Understanding* (see 7.1).

39 Stewart, "Remarks on the Laws of Motion," 1:129. Maupertuis had in fact categorically rejected the ether hypothesis in his *Discours sur les différentes figures des astres* (Paris, 1732, chap. 3), and resurrects it in the *Essai* (Avant-Props, x–xi) only as a thought experiment when he argues that the present lack of a good physical explanation for the uniformity of planetary motion is not a reason to adduce intelligent design. For an accurate reading of the passage concerned (repeated from "Les Loix"), see Terrall, *The Man who Flattened the Earth*, 273.

40 See *Notices and Documents illustrative of the Literary History of Glasgow, during the greater part of the last century*, ed. W. J. Duncan (Glasgow, 1831), 132. Hume was in the neighbourhood of Glasgow in the autumn of 1751, and probably in touch with William Cullen who was campaigning on his behalf for the Glasgow Chair of Logic; see Mossner, *Life of David Hume*, 248–49.

41 Paul B. Wood, "Buffon's reception in Scotland: the Aberdeen connection," *Annals of Science* 44 (1987): 169–90; see especially, 169–70, 174–75.

42 Buffon, *Histoire naturelle*, 3 vols. (Paris, 1749), 2:17: "la production des êtres organisés ne lui coûte rien." Maupertuis remarked of Buffon's agreement with his theory of generation: "the only difference between us lies in a point I don't understand at all, the internal moulds." See Terrall, *The Man who Flattened the Earth*, 317; and for the language of thrift, Maupertuis, "Accord de différentes loix de la Nature," 423.

43 To Rev F. D. Maurice, *Charles Kingsley, His Letters and Memoirs of his Life, ed. by his wife*, 2 vols. (London, 1877), 2:171.

44 For instance, Hume's acquaintance Pierre Desmaizeaux (probably the author of the first favourable review of the *Treatise*) was a friend of Maupertuis.

45 Jacques Roger, *Buffon: A Life in Natural History*, trans. Sarah Bonnefoi (Ithaca: Cornell University Press, 1997), 184. For the work's extraordinary reception see also Paul-Marie Grinevald, "Les editions de l'*Histoire naturelle*" in *Buffon 88*, ed. Jean Gayon (Paris: VRIN, 1992), 631–37; and Jeff Loveland, *Rhetoric and Natural History: Buffon in Polemical and Literary Context* (Oxford: Voltaire Foundation, 2001), 12–14.

46 In addition to the published correspondence, there are two letters inviting Hume to dine at the Jardin du Roy; see NLS, Hume MS. 23154.341 and 345.

47 See David Fate Norton and Mary J. Norton, *The David Hume Library* (Edinburgh: Edinburgh Bibliograhical Society, 1996), 24, 24n, 113, 77, 125.

48 To the Rev. Hugh Blair, 26 April 1764, *Letters*, 1:436–37.

49 M. A. Stewart in his essay "Religion and Rational Theology" shows that Hume drew on George Cheyne's *Philosophical Principles of Religion* (1715, 5th ed. 1736, 2) for Cleanthes's fullest statement of this analogy (143), and points to the prevalence of a Cartesian dualism in the natural theology of the period, long after other aspects of Descartes' thought had become outmoded. See *Cambridge Companion to the Scottish Enlightenment*, ed. Alexander Broadie (Cambridge: Cambridge University Press, 2003), 39, 46. A good instance is supplied by Buffon's "De la Nature de l'Homme" which is founded, as Jacques Roger observes, on "Cartesian dualism, which was then the orthodox doctrine of the church," Buffon, *Histoire* (1749), 2: particularly, 430; and Roger, *Buffon*, 153.

50 In the pre-Socratics and in Strato, particularly. Compare Hume's remark in the *Natural History of Religion*: "The ancient mythologists, indeed, seem throughout to have rather embraced the idea of generation than that of creation, or formation; and to have thence accounted for the origin of this universe." See *The Natural History of Religion*, ed. A Wayne Colver, in *David Hume on Religion* , ed. A.Wayne Colver and John Valdimir Price (Oxford: Clarendon Press, 1976), section 4, paragraph 15, page 41.

51 Lucretius, *De Rerum Natura*, Bk II, l.990. See Lucretius, *Of the Nature of Things*, text with translation and plates, 2 vols. (London, 1743), 1:180. Buffon included his own theory that a collision with the sun led to the ejection of matter from both bodies, *Histoire*, 1:136.

52 Buffon, *Histoire*, 1:81, 89; and Articles VII, VIII, 229–307.

53 See Roger, *Buffon*, 187–88; and Loveland, *Rhetoric and Natural History*, 13.

54 Galileo Galilei, *Dialogo sopra i due Massimi Sistemi* (Florence, 1632).

55 *Venus Physique*, "Elle plait à notre esprit: mais plait-elle à la Nature?," *Oeuvres*, 2:51.

56 Buffon develops his critique of the mechanical philosophy further in his discussion of nutrition and growth. *Histoire*, 2:50ff.

57 Buffon, *Histoire*, 1:10: "Le moule commun de toutes ces choses si dissemblables entr'elles, est moins dans la Nature que dans l'esprit étroit de ceux qui l'ont mal connue, & qui sçavent aussi peu juger de la force d'une vérité, que des justes limites d'une analogie

comparée. En effet, doit-on, parce que le sang circule, assurer que la sève circule aussi? doit-on conclurre de la végétation connue des plantes à une pareille végétation dans le minéraux, du mouvement du sang à celui de la sève, de celui de la sève au mouvement du suc pétrifiant?" The opinions mockingly outlined here are those of the botanist Stephen Hales whom Buffon had translated. As a faithful Newtonian, Hales wrote in the hope that his researches on sap would answer to his hunch that there was "a great analogy between plants and animals," but though disappointed in this respect he continued to uphold the analogy, identifying, for example, leaves with lungs. See Stephen Hales, *Statical Essays*, vol. 1 (London, 1731), 3, 326. Translations are mine throughout.

58 Buffon, *Histoire*, Premier Discours, 1:9: "de vouloir juger du tout par une seul partie."

59 T 1.3.12.25; SBN 142. Hume developed this argument further in the first paragraph of his essay "The Sceptic," as Peter Hans Reill has recently pointed out. See *Vitalizing Nature in the Enlightenment* (Berkeley: California University Press, 2005), 37–38.

60 Buffon, *Histoire*, 1:11ff: "la variété du dessein," "la multitude des moyens d'execution," "une infinite de combinations . . . & de renouvellemens."

61 Buffon, *Histoire*, 2:61: "il est tout aussi évident que les nutrition, le développement & la reproduction se sont par d'autres loix."

62 In the *Dialogues* "anthropomorphism" is used six times, the first usage recorded in the OED is from *A Supplement to Mr Chamber's Cyclopædia* (1753). A search in *Eighteenth-Century Collections Online* revealed only two previous eighteenth-century uses, from 1721 and 1738, both probably nonce-words. Hume gives a broader sense to the old specific term "anthropomorphite," used six times.

63 Compare Maupertuis on this point, *Essai*, 55–56.

64 *Essai*, 55. See also his *Systeme de la nature*, section, XLV, *Oeuvres* (1756), 2:148–49.

65 *Essai*, Avant-Propos, xiii–xiv: "Mais ne pourroit-on pas dire que dans la combination fortuite des productions de la Nature, comme il n'y avoit que celles où se trouvoient certains rapports de convenance, qui pussent subsister, il n'est pas merveilleux que cette convenance se trouve dans toutes les especes qui actuellement existent? Le hasard, diroit-on, avoit produit une multitude innombrable d'individus; un petit nombre se trouvoit construit de maniere que les parties de l'animal pouvoient satisfaire à ses besoins; dans un autre infiniment plus grand, il n'y avoit ni convenance, ni ordre: tous ces derniers ont péri; des animals sans bouche ne pouvoient pas vivre, d'autres qui manquoient d'organes pour la génération ne pouvoient pas se perpétuer: les seuls qui soient restés sont ceux où se trouvoient l'ordre & la convenance; & ces especes, que nous voyons aujourd'hui, ne sont que la plus petite partie de ce qu'un destin aveugle avoit produit." This passage has been coupled with the *Dialogues* by Bentley Glass (see note 17), and by A. C. Crombie, *Styles of Scientific Thinking in the European Tradition*, 3 vols. (London, 1994), 2:1441.

66 Maupertuis' very real claim to having foreshadowed Charles Darwin's main ideas is well brought out by A. C. Crombie who describes his conjectures on evolution as "a formally systematic explanation of the origin of all species of organisms by differentiation from common ancestors." Since change was governed by "the blind statistics of varied birth and selective survival," history represented "a succession of states of dynamic

equilibrium which through time had generated the adaptive diversity we now saw." See Crombie, *Styles of Scientific Thinking*, 2:1434. Maupertuis also understood divergence in terms of Darwin's celebrated tree metaphor, as did Buffon who supplies in the *Histoire* a spatio-temporal diagram for the descent of dog breeds from a common ancestor through cross-breeding and climatic adaptation, with the explanation, "je joins ici une table, ou, si l'on veut, une espèce d'arbre généalogique . . . [le] Chien de Berger est la souche de l'arbre," etc. See Buffon, *Histoire*, vol. 5 (1755): 225, foldout opposite 229.

67 "L'Asne," in Buffon, *Histoire*, vol. 4, 1st ed. (Paris, 1753), 377–403, especially 381–84. Hume's note and paragraph are among his later additions to the MS.

68 The word "botched" echoes William Derham's contrary declaration: "we see nothing wanting, nothing redundant, or frivolous, nothing botching, or ill-made." See *Physico-Theology* (London, 1742), 36. For the likelihood of Hume's early knowledge of this text, first published in 1713, see Isabel Rivers, "Galen's Muscles, Wilkins, Hume, and the Educational Use of the Argument from Design," *Historical Journal* 36.3 (1993): 590.

69 See "The Third Dialogue," *The Fable of the Bees*, ed. F. B. Kaye, 2 vols. (Oxford: Clarendon Press, 1924), 2:143, 141.

70 For a concise popular account, see Kim Sterelny and Paul E. Griffiths, *Sex and Death: An Introduction to the Philosophy of Biology* (Chicago: Chicago University Press, 1999), 26, 231–33; and Marjorie Grene and David Depew, *The Philosophy of Biology* (Cambridge: Cambridge University Press, 2004), 280–86.

71 See "First Discourse" (1749), and for a full discussion of this aspect of the *Histoire*, Loveland, *Rhetoric and Natural History*, 131–52; and for Diderot, *De l'interprétation de la nature*, 178–79.

72 *Essai* (1751), Avant-Propos, xxxii–xxxiii: "ces loix, telles que les Mathématiciens les donnent."

73 *Essai*, xxix, xxxiii.

74 This distinction belongs to the *Treatise* (3.1.1.27), but is effectively developed in the discussion of justice and of political society in the second *Enquiry* (sections 3, and 4). It is difficult to resist the impression that the ethical ideas that Darwin expressed in chapter 5 of *The Descent of Man* (1871) were influenced by this last work. Darwin's respectful citation of the first *Enquiry*, and his endorsement of "Philo's instinct" in the crucial Notebooks of 1838 are no more than an index to his reliance on Hume, see "Notebooks M and N" in Howard E Gruber, *Darwin on Man, together with the Early and Unpublished Notebooks* (Chicago:Chicago University Press, 1974), 291, 295, 348.

75 *Zoonomia*, 2 vols. (London, 1794), 1:505.

76 *Zoonomia*, 1:509.

77 Buffon, *Histoire*, 1:272–73. Erasmus Darwin was seeking to complete his set of Buffon's *Histoire* in March 1775, see *The Letters of Erasmus Darwin*, ed. Desmond King-Hele (Cambridge: Cambridge University Press, 1981), 72.

78 *Zoonomia*, 1:509.