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Charles Darwin's use of theology in the *Origin of Species*

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Abstract. This essay examines Darwin's *positiva* (or positive) use of theology in the first edition of the *Origin of Species* in three steps. First, the essay analyses the *Origin*'s theological language about God's accessibility, honesty, methods of creating, relationship to natural laws and lack of responsibility for natural suffering; the essay contends that Darwin utilized *positiva* theology in order to help justify (and inform) descent with modification and to attack special creation. Second, the essay offers critical analysis of this theology, drawing in part on Darwin's mature ruminations to suggest that, from an epistemic point of view, the *Origin*'s *positiva* theology manifests several internal tensions. Finally, the essay reflects on the relative epistemic importance of *positiva* theology in the *Origin*'s overall case for evolution. The essay concludes that this theology served as a handmaiden and accomplice to Darwin's science.

The central claim of the *Origin of Species* is that all biological life on Earth is the descendant of one (or a few) ancient ancestors, having evolved to the present state primarily by natural selection acting upon random variation, among other natural processes. It is well known that Darwin marshalled an array of empirical evidence to establish his theory. What is less well known is that Darwin also drew upon theology. As the late historian Dov Ospovat observed, 'To ignore or attempt to explain away Darwin's theism is to cut oneself off from understanding much of Darwin's science'.[1] If Ospovat is correct, then a full understanding of Darwin's science requires exploration of his theology, a task that this essay undertakes in three steps. First, I examine the *Origin*'s theological language about God's accessibility, honesty, methods of creating, relationship to natural laws and lack of responsibility for natural suffering; I argue that Darwin utilized theology in order to help justify and inform descent with modification and to attack special creation. Second, I offer a critical analysis of this theology, drawing in part on Darwin's mature ruminations to suggest that, from an epistemic point of view, the *Origin*'s theology manifests several internal tensions. Finally, I assess the relative epistemic importance of theology to the case for evolution as a whole in the *Origin*. I conclude that theology was a handmaiden and accomplice to Darwin's science.

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1 Dov Ospovat, 'Darwin's theology', review of Neal Gillespie's *Charles Darwin and the Problem of Creation*, *Science* (1980) 207, p. 520. An excellent analysis of Darwin's understanding and use of theology, which I draw upon in this essay, can be found in Neal Gillespie, *Charles Darwin and the Problem of Creation*, Chicago: University of Chicago Press, 1979.

Before examining Darwin's particular claims, some preliminary comments are in order. First, when I refer to the *Origin* in this essay, I have the first edition in mind, which historians widely consider the most significant. Second, historians have long debated the sincerity of Darwin's theological statements in the *Origin*.[2] My own view is that the balance of contemporary scholarship shows that, at the time of the *Origin*, Darwin likely believed most of the core theological claims that will be explored in this essay. However, the heart of my argument does not depend upon this contention. Whether Darwin personally accepted these claims is irrelevant to the fact that, as we will see, some of them shaped the content of his theory and, more importantly, they all served (or purported to serve) as epistemic support for evolutionary theory.[3] My focus is not on Darwin's motives or personal sincerity but on the premises, background claims and presuppositions that actually appeared in the *Origin* to defend and shape descent with modification.[4]

Third, this essay focuses on the *Origin* as a historical text, with a view to examining how the text itself treats theological claims in its 'one long argument' for descent with modification. Accordingly, this essay is not a study of the argument for evolution considered in its purest epistemic form, in which the argument is removed from its historical moorings and stripped of any (epistemically) unnecessary claims. While I will critically analyse the text from an epistemic view, I do so in service of understanding the theology (and science) of the *Origin*, rather than in service of understanding the epistemic properties of evolutionary theory *simpliciter*, decoupled from the idiosyncrasies, emphases and peculiarities of the *Origin* itself.

Finally, this essay focuses on one particular type of theology in the *Origin*. We may call this *positiva* theology, to coin a term, in which Darwin deploys an Enlightenment-style theology in order to enhance the credibility of his argument or theory. *Positiva* theology differs from *reductio* theology, as we may call it. Darwin repeatedly used the *reductio* form to articulate special creationists' own theology in order to empirically test it and find it wanting.[5] (He often tried to 'reduce their theology to an absurdity', to use the phrase loosely, by showing that it was at odds with the facts of nature.) While

2 See David Kohn, 'Darwin's ambiguity: the secularization of biological meaning', *BJHS* (1989) 22, pp. 215–239.

3 A statement that provides 'epistemic support' to another statement is one that 'raises the probability, however minute, of the truth of the latter statement' or that 'increases the justification or warrant a person has for believing the latter statement'. For the purposes of this essay, I am agnostic about whether or not the theological claims Darwin made in the *Origin* properly provide epistemic support to his theory. They appear to be intended to make descent with modification more plausible, and will be treated as such.

4 As such, even though this essay occasionally refers to 'Darwin's theology', nothing in the present argument hinges upon whether Darwin actually accepted, rather than simply used as justification, the theological claims discussed below.

5 For example: Charles Darwin, *Origin of Species*, London: John Murray, 1859, pp. 55–56, 185–186, 242–243, 275–276, 354–355, 372, 393–398, 453–454. In these passages, Darwin examined the empirically testable predictions of special creation in the context of comparing the theory's explanatory power against the explanatory power of his own theory (or against the transmutation thesis). That is, Darwin typically used *reductio* theology in comparative arguments. See also David Depew, 'The rhetoric of the *Origin of Species*', in Robert Richards and Michael Ruse (eds.), *Cambridge Companion to the 'Origin of Species'*, Cambridge: Cambridge University Press, 2008, pp. 237–255.

reductio theology forms a crucial part of Darwin's argument for evolution, it is essentially a negative enterprise, cutting away at special creation's own foundation; *positiva* theology, on the other hand, positively asserts a different Enlightenment-style theology as independent support for descent with modification and against special creation.[6] As we will see, however, the line between *reductio* and *positiva* theology can be thin, and some of the subarguments discussed below contain elements of both.

Of course, these two types of theology do not begin to exhaust the ways in which Darwin incorporated God-talk into the *Origin*. As John Brooke and others have perceptively argued, Darwin borrowed from natural theology similar research problems, presuppositions, patterns of argumentation, metaphors, concepts and content.[7] Space limitations prevent any comprehensive treatment, however; for now *positiva* theology will occupy centre stage. I will argue that it not only helps (or purports to help) provide epistemic justification for Darwin's theory but arguably informs some of its content as well.

The Divine Architect

In the *Origin*, Darwin used a specific theological view of God's relationship to natural laws in order to argue for evolution and against special creation. An intimation of this view appeared in a passage Darwin chose from William Whewell's *Bridgewater Treatise* as an epigraph for the *Origin*:

> But with regard to the material world, we can at least go so far as this – we can perceive that events are brought about not by insulated interpositions of Divine power, exerted in each particular case, but by the establishment of general laws.

More directly, Darwin wrote near the finale of the *Origin*,

> Authors of the highest eminence seem to be fully satisfied with the view that each species has been independently created. To my mind it accords better with what we know of the laws impressed on matter by the Creator, that the production and extinction of the past and present inhabitants of the world should have been due to secondary causes, like those determining the birth and death of the individual.[8]

In this passage, Darwin compared two theories in light of a claim about natural laws.[9] More exactly, he compared special creation and evolutionary theory to a background

6 *Positiva* theology is 'independent' in the sense that its epistemic legitimacy did not depend upon the truth (or justification) of special creation. Whereas Darwin could assume the truth of the tenets of special creation in order to perform a *reductio ad absurdum* on these claims, he could not do the same with his *positiva* theology; it required separate grounds for its truth. I should add that not every *positiva* claim explored in this essay properly falls under the general heading of 'Enlightenment-style theology', although many do.

7 John Brooke, 'The relations between Darwin's science and his religion', in John Durant (ed.), *Darwinism and Divinity*, New York: Oxford University Press, 1985, pp. 40–75, esp. 48–49. See especially the references below for Gillespie, Richards, Cornell, von Sydow, Lustig, Brooke, Nelson, Cosans, England, Ospovat, Depew and Moore.

8 Darwin, op. cit. (5), p. 488.

9 In the very next sentence of the passage, Darwin made explicit the comparison between special creation and his own theory, contrasting special creation with the view that 'all beings' are 'lineal descendants of some

claim – what 'we' already 'know' about the laws of nature – in order to assess which theory best accorded with this background knowledge. Darwin reasoned that knowledge about the laws of nature favoured the 'production and extinction' of flora and fauna by 'secondary causes' rather than by independent acts of creation. This claim implied that the laws were *unbroken* – otherwise they could not favour purely secondary causes (and, hence, descent with modification) rather than miraculous causes (used in special creation).

But what justified the (implied) claim about unbroken law? While a full answer must take into account the *Origin* as a whole, including the role of natural selection, in this passage theology implicitly served as the immediate justification. Consider that, from an epistemic perspective, a naked appeal to the laws of nature alone was insufficient justification to favour secondary causes exclusively. At the time, many thinkers held that 'a law presupposes an agent', as Paley had famously said.[10] In traditional theism, this 'agent' both sustained the world in an orderly fashion and acted miraculously within the world; in this view, the two actions were not contradictory but rather complementary means of accomplishing the divine will. Thus Darwin had to give some justification for his claim that the laws of nature were unbroken – contrary to miracles – and thus favoured a biological theory that invoked only secondary causes.

Theology provided the edge. Laws were 'impressed laws on matter by the Creator'. The language of 'impressed' laws, I would argue, suggests a picture of a Creator who, having once implemented these laws, allowed nature to act only by secondary causes. Consider, first, Darwin's endorsement of this view elsewhere. In his autobiography (which he originally intended only for his family), Darwin affirmed the dichotomy between laws and miracles: 'the more we know of the fixed laws of nature', he wrote, 'the more incredible do miracles become'.[11] He also claimed that nature operates by laws alone: '*Everything* in nature is the result of *fixed* laws'.[12] Darwin's early notebooks reflected the same sentiments, privately endorsing divine creation by law as 'far grander' than specific instances of creation by miracle, which were 'beneath the dignity of him, who is supposed to have said let there be light & there was light'.[13] And, in his 1844 manuscript, he added that 'laws capable of creating individual organisms ... should exalt our notion of the power of the omniscient Creator'.[14] Thus, in writings before and after the *Origin*, Darwin consistently rejected miracles and instead favoured unbroken natural law.

few beings which lived long before the first bed of the Silurian system was deposited'. Darwin, op. cit. (5), pp. 488–489.

10 William Paley, *Natural Theology*, 12th edn, London: J. Faulder, 1809 (first published 1802), pp. 7, 416–418.

11 Charles Darwin, *The Autobiography of Charles Darwin 1809–1882* (ed. Nora Barlow), New York: W.W. Norton & Co., 1958, p. 86.

12 Darwin, op. cit. (11), p. 87, emphasis added.

13 Gavin de Beer (ed.), 'Darwin's notebooks on transmutation of species. Part III. Third notebook [D] (July 15 to October 2nd 1838)', *Bulletin of the British Museum (Natural History)*, historical series 2, No. 4 (July 1960), pp. 119–150, esp. 132.

14 Francis Darwin (ed.), *The Foundations of the Origin of Species*, Cambridge: Cambridge University Press, 1909, p. 52.

These emphases dovetail with the views of a number of Darwin's intellectual mentors, including William Whewell, John Herschel, Charles Babbage and Francis Bacon, who conceived of natural laws as God's primary mode of governing the physical world. For them, scientific explanations ought to refer to these laws rather than to miracles. These men were not deists – they believed God actively sustained the world by His laws – yet they considered appeals to secondary causes to be scientifically superior to reliance on miracles.[15]

More directly, Babbage, Herschel and Whewell used the identical word – 'impressed' – in order to express the same idea of God inscribing matter with enduring, lawful qualities.[16] For example, in the *Preliminary Discourse*, Herschel wrote of the raw materials of the universe: 'by creating them ... endued with certain fixed qualities and powers, he has impressed them in their origin with the spirit ... of his law, and made all their subsequent combinations and relations inevitable consequences of this first impression'.[17] And Whewell declared in his *Bridgewater Treatise*,

> God is the author and governor of the universe through the laws which he has given to its parts, the properties which he has impressed upon its constituent elements: these laws and properties are, as we have already said, the instruments with which he works ... through these attributes thus exercised, the Creator of all, shapes, moves, sustains and guides the visible creation.[18]

This statement occurs in the same paragraph as the claim Darwin borrowed from Whewell as an epigraph to the *Origin*, which stated that God does not work by discrete miracles but rather 'by the establishment of general laws'. Whewell went on in the next two paragraphs to quote Francis Bacon and Herschel to the same effect, citing the Herschel quote above.[19]

As such, 'the Creator' who 'impressed laws on matter' was not the God of special creation, but of unbroken law. From an epistemic point of view, Darwin's argument only made sense with this understanding of the deity. An allusion to a Master Architect rather than a Miracle Worker provided the justification for unbroken laws, and these laws allowed only secondary causes, which favoured evolution over special creation. Theology thus played a subtle – yet pivotal – role in this argument for evolution and against special creation.

Of course, Darwin's appeal here is indirect rather than straightforward, requiring a fair amount of interpretation. The *Origin*'s language is understated and artfully ambiguous, one might say. Little surprise that Darwin's contemporaries differed on whether descent with modification was reconcilable with traditional theism's

15 This is not to imply that Darwin was a theist per se, but that he preferred laws to miracles, whatever his beliefs about the ultimate ontology of the laws themselves.

16 Charles Babbage, *The Ninth Bridgewater Treatise*, 2nd edn, London: John Murray, 1838, p. 24, less directly: pp. 40, 95, 169. The Herschel and Whewell references are below.

17 John Herschel, *A Preliminary Discourse on the Study of Natural Philosophy*, London: Longman *et al.*, 1840, p. 37, emphasis removed. See p. 39 as well.

18 William Whewell, *Astronomy and General Physics Considered with Reference to Natural Theology*, London: W. Pickering, 1836, p. 357. See also pp. 136, 230.

19 See Francis Bacon, 'A confession of faith', in *The Works of Francis Bacon* (ed. James Spedding *et al.*), vol. 7, London: Longmans and Co. etc., 1892, p. 221.

understanding of the laws of nature and, especially, God's providence over organic history.[20] But despite this disagreement, Darwin's appeal to law had *epistemic* import only if these laws were conceptualized in a Herschelian and Whewellian manner rather than in a special-creationist one.

To be sure, there is some ambiguity in the *Origin* about unbroken law in the history of the cosmos; three times in the closing pages, Darwin nodded toward the miraculous creation of the first life.[21] In the second edition, Darwin even added that life was first breathed 'by the Creator'.[22] While there is good evidence that Darwin was a deist in 1859,[23] the *Origin* itself inconsistently seemed to accept and reject miracles. This apparent tension will be taken up later; for now, I will refer to the theology of the *Origin* as semi-deistic.[24]

A number of scholars have recognized the link between natural laws and theology in the *Origin*.[25] John Cornell argues, for example, that the volume portrayed the physical world as the product of a 'divine arrangement of universal laws', a view that arose from Darwin's early convictions about God's limited role in the natural world.[26] Robert Richards writes of Darwin in the *Origin*, 'Yet in this work of twenty-years maturation, he continued to suggest that the laws of evolution, those secondary laws, ought best be conceived as God's commands'.[27] And David Kohn observes not just a connection

20 John Brooke, 'Laws impressed on matter by the Creator?', in Richards and Ruse, op. cit. (5), pp. 256–274, esp. 266–272.

21 Darwin, op. cit. (5), pp. 484, 488, 490. See also Chris Cosans, 'Was Darwin a creationist?' *Perspectives in Biology and Medicine* (2005) 48, pp. 362–371.

22 Charles Darwin, *Origin of Species*, 2nd edn, London: John Murray, 1860, pp. 488, 490. In the fifth edition of the *Origin* (London: John Murray, 1869, p. 577), Darwin attenuated some of this theistic language and in private correspondence in 1863 he recanted it altogether. Francis Darwin, *The Life and Letters of Charles Darwin*, 3 vols., London: John Murray, 1887, vol. 3, p. 18. See Brooke, op. cit. (20), pp. 256–274.

23 Michael Ruse, *Darwinian Revolution*, 2nd edn, Chicago: University of Chicago Press, 1999, p. 181; Robert J. Richards, 'Theological foundations of Darwin's theory of evolution', in P.H. Theerman and K.H. Parshall (eds.), *Experiencing Nature*, Dordrecht: Kluwer Academic Publishers, 1997, pp. 61–79, esp. p. 64; Brooke, op. cit. (20); Gillespie, op. cit. (1), pp. 132–133; Janet Browne, *Charles Darwin: Voyaging*, New York: Knopf, 1995, pp. 411, 438–439, 513; John Cornell, 'God's magnificent law: the bad influence of theistic metaphysics on Darwin's estimation of natural selection', *Journal of the History of Biology* (1987) 20, pp. 381–412, esp. 384–91.

24 Even though the *Origin* alluded to a miraculous creation of the first life, I refer to its theology as semi-deistic rather than theistic because it did not clearly endorse the notion that God ontologically sustains the world, a staple tenet of traditional theism.

25 For example, Richard England, 'Natural selection, teleology, and the Logos', *Osiris* (2001) 16, pp. 270–287, esp. 274–75; Dov Ospovat, 'God and natural selection', *Journal of the History of Biology* (1980) 13, pp. 169–194; Momme von Sydow, 'Charles Darwin: a Christian undermining Christianity?', in David M. Knight and Matthew D. Eddy (eds.), *Science and Beliefs: From Natural Philosophy to Natural Science, 1700–1900*, Burlington: Ashgate, 2005, pp. 141–156.

26 John Cornell, 'Newton of the grassblade? Darwin and the problem of organic teleology', *Isis* (1986) 77, pp. 405–421, esp. 421. Cornell believes that Darwin's conviction about designed laws was so deep that it fundamentally shaped his understanding of the 'vital organization' and behaviour of biological organisms (esp. p. 414).

27 Richards, op. cit. (23), p. 65. See also *idem*, 'Darwin's theory of natural selection and its moral purpose', in Richards and Ruse, op. cit. (5), pp. 47–66.

between Darwin's view of natural laws and his theology, but that Darwin regarded his theology as more venerable than creationist theology:

> Time and again, while damning the narrowness of special creation, and by direct implication providential theology, he appeals to a higher, nobler, more enlarged and enlightened theological perspective. For Darwin in the *Origin*, the laws of nature implied that there was order in the universe . . . But his open position was not that of an atheist. He can say the laws of nature are impressed on matter by a Creator . . . God was an implication of nature's order. And evolution by natural selection was an explanation of natural order that the highest, honest, religious mind ought not despise.[28]

As a brief addition, it is arguable that Darwin's deism shaped the *Origin* at a more fundamental level as well. I have maintained above that his view of God's limited action played a role in his *argument* for evolution (and against special creation), but it may also have influenced the *content* of his theory itself. The process of natural selection acting upon random variations lies at the centre of Darwin's theory. A deistic theology – rather than an interventionist theology – readily sanctions this process which does not rely on God's direct hand but on environmental pressures, competition, random variation and inheritance.[29] In the 1830s, 'Darwin started on the path to evolution', Michael Ruse concurs, 'perhaps because he was now thinking of God as someone Whose greatness is evidenced by unbroken law rather than by miracle'.[30] A distant Creator commended a process of purely secondary causes, the very heart of his nascent theory.[31]

In sum, theology provided epistemic aid to evolution by its use of unbroken law and perhaps also shaped the content of evolution by endorsing a naturalized means of biological change. Apparently, the *Origin* did not dispense with God-talk so much as harmonize science with the 'right' understanding of the deity.

The problem of natural pain and suffering

Darwin found evidence for his theory in, of all places, pain and suffering. Three years prior to the *Origin*, Darwin wrote to a colleague, 'What a book a devil's chaplain might write on the clumsy, wasteful, blundering, low, and horribly cruel works of nature!'[32]

28 Kohn, op. cit. (2), p. 238.

29 Because a semi-deistic theology also sanctioned a naturalized method, it allowed Darwin the epistemic (or rhetorical) advantage of conforming to methodological naturalism, an increasingly pervasive view of science among biologists during Darwin's era. Ronald Numbers has argued that it was Darwin's adherence to this method – even more than his extensive empirical evidence – that helped his theory win converts. If this is correct, then semi-deistic theology played an even greater (indirect) role in the effectiveness of Darwin's argument. Ronald Numbers, 'Science without God: natural laws and Christian beliefs', in David Lindberg and Ronald Numbers (eds.), *When Science and Christianity Meet*, Chicago: University of Chicago Press, 2003, pp. 265–286; *idem, Darwinism Comes to America*, Cambridge, MA: Harvard University Press, 1998, pp. 24–48, esp. 48.

30 Michael Ruse, 'The origin of the *Origin*', in Richards and Ruse, op. cit. (5), pp. 1–13, esp. 2.

31 The claim that Darwin's (nascent) theory relied upon 'secondary causes' is in principle compatible with the idea that these secondary causes were progressive, so long as this progress was not due to the action of an interventionist God.

32 Francis Darwin and A. Seward, *More Letters of Charles Darwin*, vol. 1, London: John Murray, 1903, p. 94.

To Darwin, the problem of pain was no mere academic difficulty. In a personal letter, he wrote that he suffered a 'bitter and cruel loss' when his daughter Annie – whom he described as his 'favourite child' – died at age ten in 1851.[33] Even twenty-five years after Annie's death, Darwin confided, 'Tears still sometimes come into my eyes, when I think of her sweet ways'.[34] As a number of scholars have argued, the problem of suffering informed Darwin's science.[35] In the *Origin*, Darwin argued that suffering itself was evidence for his theory: since natural suffering is more compatible with evolutionary theory than with special creation, it counted as evidence in favour of evolution. In the final sentence of his chapter on the evolution of instincts, for example, Darwin closed with the following meditation:

> Finally, it may not be a logical deduction, but to my imagination it is far more satisfactory to look at such instincts as the young cuckoo ejecting its foster-brothers, – ants making slaves, – the larvae of ichneumonidae feeding within the live bodies of caterpillars, – not as specially endowed or created instincts, but as small consequences of one general law, leading to the advancement of all organic beings, namely, multiply, vary, let the strongest live and the weakest die.[36]

In the final chapter of the *Origin*, in which Darwin recapitulated his chief arguments, he noted that, given his theory, we should not be surprised

> if all the contrivances in nature be not, as far as we can judge, absolutely perfect; and if some of them be abhorrent to our ideas of fitness. We need not marvel at the sting of the bee causing the bee's own death; at drones being produced in such vast numbers for one single act, and being then slaughtered by their sterile sisters; at the astonishing waste of pollen by our fir-trees; at the instinctive hatred of the queen bee for her own fertile daughters; at ichneumonidae feeding within the live bodies of caterpillars; and at other such cases. The wonder indeed is, on the theory of natural selection, that more cases of the want of absolute perfection have not been observed.[37]

Years later, in his autobiography, he echoed a similar view, remarking that 'the existence of suffering' counts 'against the existence of an intelligent first cause' but 'agrees well with the view that all organic beings have been developed through variation and natural selection'.[38] As John Brooke observes, 'The presence of so *much* pain and suffering in the world Darwin considered to be one of the strongest arguments against

33 F. Darwin, op. cit. (22), vol. 1, pp. 380–381.

34 Darwin, op. cit. (11), p. 98. While the matter is debatable, Janet Browne contends that Annie 'was the apple of her proud father's eye' and that this loss may have marked 'the formal beginning of Darwin's conscious dissociation from believing in the traditional figure of God'. Browne, op. cit. (23), pp. 499, 503.

35 John Brooke, 'Religious belief and the content of the sciences', *Osiris* (2001) 16, pp. 3–28, esp. 20; James C. Livingston, review of Frank Burch Brown, *The Evolution of Darwin's Religious Views*, *Journal of the American Academy of Religion* (1987) 55, p. 819; Brooke, op. cit. (7), pp. 66–67; Paul Nelson, 'The role of theology in current evolutionary reasoning', *Biology and Philosophy* (1996) 11, pp. 493–517; David Livingstone, 'Re-placing Darwinism and Christianity', in Lindberg and Numbers, op. cit. (29), pp. 183–202, esp. 185–189.

36 Darwin, op. cit. (5), pp. 243–244.

37 Darwin, op. cit. (5), p. 472.

38 Darwin, op. cit. (11), p. 90.

belief in a beneficent God. But, he added, it accorded well with his theory of natural selection'.[39]

Darwin's key claim in these passages is that some instances (or amounts) of natural suffering are more expected given his theory than given special creation.[40] In his view, only through an intense struggle for survival do species adapt and flourish, so it is no surprise that less-fit organisms perish along the way. This pattern of death and cruelty is less expected given special creation, which (as Darwin saw it) posits a benevolent, all-powerful, all-knowing God who designs creatures to adapt and flourish in their local environments. Darwin implicitly invoked what has been called the 'prime principle of confirmation', in which evidence counts more in favour of theory A than of theory B if the evidence is more probable (or more expected) given theory A than given theory B.[41] Thus the presence of natural suffering counted more as evidence in favour of evolution than of special creation, since suffering was more probable given evolution than given special creation.

The argument relies on the theological assumption that it is improbable that an omnibenevolent, omnipotent and omniscient God would have intentionally designed creatures to cause or experience great suffering.[42] Despite a host of traditional theodicies which sought to reconcile God and natural suffering, Darwin implied that the special creationists' conception of God was simply implausible given such misery. Thus the *Origin* tacitly endorsed a particular view of God's nature and moral obligations, and used this view as direct epistemic support for evolution and against its primary rival.

Arguably, at a deeper level, Darwin's theological struggles with suffering did not simply provide evidence for his theory but also shaped its content as well. Recall the quote from the *Origin* (above), in which Darwin stated that instances of natural suffering are 'small consequences of one general law, leading to the advancement of all organic beings, namely, multiply, vary, let the strongest live and the weakest die'.[43] In this passage, he characterized the work of variation and selection as leading to 'the *advancement* of all organic beings'.[44] Natural suffering, apparently, was acceptable

39 John Brooke, *Science and Religion*, New York: Cambridge University Press, 1991, p. 316, original emphasis.

40 Unlike the first extract on natural suffering (cited above), the second extract does not explicitly compare evolution to special creation (relative to natural suffering). However, analysis of the broader context of the second extract shows that Darwin's argument is clearly comparative. Darwin, op. cit. (5), p. 472.

41 More formally, Darwin's argument could be developed or expressed using the odds form of Bayes' theorem: $P(ET/PS)/P(SC/PS) = [P(ET)/P(SC)] \times [P(PS/ET)/P(PS/SC)]$, where PS = pain and suffering, ET = evolutionary theory and SC = special creationism.

42 Strictly speaking, the theological assumption in Darwin's argument is not that natural pain and suffering is improbable given the special-creationist conception of God, but rather that natural pain and suffering is less probable given this conception of the deity than given evolutionary theory. I have used the former claim in the main text because I think it accurately reflects the spirit of Darwin's argument. Readers who prefer the more strict interpretation of the argument should note that this strict interpretation also depends upon an assessment about what God would or would not do.

43 Darwin, op. cit. (5), p. 244.

44 Darwin, op. cit. (5), p. 244, emphasis added. In the final paragraphs of the *Origin*, Darwin wrote, 'And as natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection' (p. 489). And, 'Thus, from the war of nature, from famine and death, the

collateral damage in a process that ultimately produced a higher, better outcome. God designed the laws of nature in keeping with his moral nature: these laws led to progress so that the final end justified any suffering along the way. Natural selection thus insulated God from the suffering so troubling to special creation; it exonerated God from direct responsibility for natural suffering while also ensuring that the struggle for existence led to a morally acceptable end.[45] Thus Darwin's theology sanctioned his theory. The belief in a distant, yet moral, God required a means of creation that could account for the presence of natural suffering in a manner consistent with God's character. Variation and selection, with their progressive element, provided just that.

The only wise (and inventive and parsimonious) God

Darwin's famous argument from homology also hinged upon theology.[46] In the *Origin*, Darwin considered the similar pattern of bone structures in the hand of a man, paw of a mole, leg of a horse and paddle of a porpoise. Special creationists claimed that each of these structures served a highly functional purpose (or even an optimal one) and thus reflected the species-specific design plan of a wise Creator. Darwin wanted to convince his readers that evolution by natural selection provided a superior explanation. To this end, he aimed an attack squarely at his rival:

> Nothing can be more hopeless than to attempt to explain this similarity of pattern in members of the same class, by utility or by the doctrine of final causes. The hopelessness of the attempt has been expressly admitted by Owen in his most interesting work on the 'Nature of Limbs.'[47]

Both here and elsewhere in his homology argument, Darwin drew primarily from *On Limbs* (1849), a work by Richard Owen, perhaps the leading comparative anatomist of the time.[48] Because Darwin not only invoked the authority of *On Limbs*, but also cited it directly in his central attack on special creation,[49] a close analysis of the work is

most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows' (p. 490). Michael Ruse claims that Darwin actually increased his emphasis on progress over the six editions of the *Origin*. Ruse, op. cit. (23), epilogue. Dov Ospovat agrees and notes that theological concerns were among the moorings of Darwin's belief in progress. Ospovat, *The Development of Darwin's Theory*, Cambridge: Cambridge University Press, 1981, pp. 223–224; see also Richards, op. cit. (23), pp. 47–66; von Sydow, op. cit. (25), pp. 147–150.

45 Gillespie, op. cit. (1), p. 127; Ospovat points out that Darwin may have appealed to 'progress' to try to vindicate himself, too, as the author of a theory that depicted nature as 'painful and bloody'. Ospovat, op. cit. (44), p. 224.

46 Especially insightful are Nelson, op. cit. (35); and Abigail Lustig, 'Natural atheology', in Abigail Lustig, Robert J. Richards and Michael Ruse (eds.), *Darwinian Heresies*, Cambridge: Cambridge University Press, 2004, pp. 69–83.

47 Darwin, op. cit. (5), p. 435.

48 Richard Owen, *On the Nature of Limbs: A Discourse*, Chicago: University of Chicago Press, 2007 (first published 1849).

49 See the discussion below.

in order. Careful inspection reveals that, in addition to empirical evidence, Owen used theological claims to reject final causes (or direct divine purposive adaptations) as explanations for homologous structures. To appreciate this, consider one of Owen's central axioms, stated early in *On Limbs*:

> But by whatever means or instruments Man aids, or supersedes, his natural locomotive organs, such instruments are adapted expressly and immediately to the end proposed. He does not fetter himself by the trammels of any common type of locomotive instrument, and increase his pains by having to adjust the parts and compensate their proportions, so as best to perform the end required without deviating from the pattern previously laid down for all. There is no community of plan or structure between the boat and the balloon, between Stephenson's locomotive engine and Brunel's tunneling machinery: a very remote analogy, if any, can be traced between the instruments devised by man to travel in the air and on the sea, through the earth or along its surface.[50]

In short, human inventors fashion their various locomotion machines 'expressly and immediately' for the particular purpose of each machine. Inventors do not employ a common design for all machines, attempting to innovate new functions while also rigidly accommodating a universal plan.

Owen contended that the special creationist (or 'teleologist') held that God created in the same manner: 'The teleologist', he asserted, 'would . . . expect to find the same direct and purposive adaptation of the limb to its office as in the machine [invented by humans]'.[51] Thus, just as humans do not invent locomotive machines from a common type, but rather directly for specific purposes, so God created limbs at the species level *de novo* for specific environments, rather than modifying a more general type. As philosopher Paul Nelson observes, the underlying assumption is, 'If the creator is free to do as he pleases, the appearance of [a] plan can become the appearance of limitation or constraint, suggesting an unimaginative or even slavish repetition of structures along some predetermined pattern'.[52] Owen assumed that the 'apparent uniformity of certain biological patterns is inconsistent with the freedom of a creator to act as he wishes'.[53] An unconstrained God, Owen presumed, would always start from scratch.[54]

It is precisely this assumption that Owen used to drive home his attack on special creation. He argued extensively in *On Limbs* that different species sometimes do have limbs that share a common type or 'unity of plan'.[55] As he saw it, these limbs manifested

50 Owen, op. cit. (48), pp. 9–10.

51 Owen, op. cit. (48), p. 10.

52 The language is Nelson's; see Nelson, op. cit. (35), p. 511, emphasis altered.

53 Nelson, op. cit. (35), p. 511.

54 More precisely, the God of special creation would always start from scratch, never drawing on a common pattern; or, if He did use a common pattern, He would erase any trace of having done so. For ease of exposition, I will focus upon the former assumption.

55 For example, Owen, op. cit. (48), pp. 4–40, esp. 39–40. Owen also suggested that the God of special creation would not use a common plan to create limbs designed for different purposes on the same animal. See his discussion of the forelimbs and hindlimbs of bats, for example (pp. 7, 18–19, 39). Unfortunately, space constraints restrict exploration of this variant of the *de novo* theological assumption.

characteristics precisely opposite to those predicted by special creationism. Thus Owen's criticism can be represented as a *modus tollens*:

1 If special creationism is true, then limbs of organisms will not manifest a common type beyond the species level.
2 But some limbs of organisms manifest a common type beyond the species level.
3 Thus special creationism is not true.

At a minimum, Owen's argument can succeed only if an assumption essential to premise 1 is true – namely that the God of miracles always creates afresh rather than by drafting off a general plan. It is true that special creation held that God expressly and directly created organisms, organs and limbs at the species level to match particular environments. But the theory did not logically prohibit God from starting with or incorporating a common design plan, modified for the functional requirements of a new species in a new environment. This latter idea was Owen's addition, allowing him to use his empirical evidence to counter special creation.

Elsewhere in *On Limbs*, Owen continued his subtle deployment of theology. At the end of his first detailed analysis of appendages, about forty pages into the work, Owen self-consciously stepped back to make his argument against special creationism clear:

> I think it will be obvious that the principle of final adaptation fails to satisfy all the conditions of the problem. That every segment and almost every bone which is present in the human hand and arm should exist in the fin of the whale, solely because it is assumed that they were required in such number and collocation for the support and movements of that undivided and inflexible paddle, squares as little with our idea of the simplest mode of effecting the purpose, as the reason which might be assigned for the great number of bones in the cranium of the chick, viz. to allow the safe compression of the brain-case during the act of exclusion, squares with the requirements of that act.[56]

In this dense passage, Owen made two central claims. First, the similarity of bone structure between a human hand (and arm) and 'the fin of the whale' does not harmonize with 'our idea of the simplest mode' of producing a functional fin. Second, the 'great number of bones in the cranium of the chick' exceeds the physical 'requirements' necessary for hatching from an egg ('the act of exclusion').

Taking these claims in order, recall that special creationism held that God directly and expressly created organisms' limbs for specific adaptive purposes at the species level. This meant that God directly and expressly created the whale's fin for the purpose of locomotion in water. But Owen rejected this view because the whale's fin had the same basic bone structure as a human hand and arm – which was too elaborate, in Owen's mind, for what was 'required' for the function of a simple 'undivided and inflexible paddle'. An over-engineered fin 'squares little with our idea of the simplest mode' of outfitting the fin for its purpose. That is, the special-creationist explanation failed because it did not harmonize with a human conception of (superlative) simplicity – the 'simplest mode' of creating. In short, any plausible view of divine creativity must accord

56 Owen, op. cit. (48), pp. 39–40.

with human notions of parsimony.[57] While Owen was not clear on exactly what constituted the 'simplest mode' of creation, his view seemed to imply that God would be restrained, producing only the minimum internal structure necessary for the paddle's outward function. (This is why Owen disparaged the idea that a complex bone structure was 'required' for the paddle's simple purpose.)

Owen's second claim in the passage reinforced the appeal to parsimony. The great number of bones in the cranium of the chick does not square with the 'requirements' for hatching from an egg. By Owen's lights, a respectable God would not produce a skeletal structure – whether in the whale's fin or the chick's head – more intricate than needed to accomplish the structure's function. In short, God fashioned organic parts as simply as possible for their purpose. Surprisingly, Owen gave neither evidence nor argument for the theological assumptions in this passage,[58] perhaps because he regarded them as uncontroversial. Good Victorians knew, apparently, that the Almighty was no prodigal.

It may be that Owen personally accepted the theological assumptions he used to attack special creation. But Owen's personal views are irrelevant for present purposes. What matters is that he utilized the claims above as part of his case against special creation (and for non-material archetypalism). These claims included: first, that a God who is free to create as He wishes would create new biological limbs *de novo* rather than from a pre-existing pattern. Second, that God must create biological structures (like limbs) in accord with a human conception of the 'simplest mode' to accomplish the respective functions of these structures. And third, that God would only create the minimum structure required for a given part's purpose. One might wonder whether Owen had subconsciously gilded God to resemble the archetypal Victorian gentleman – who is at once ingenious and industrious, yet sensibly temperate. In any case, these *positiva* additions enabled Owen to test the alleged predictions of special creation and so use his detailed empirical observations to their fullest advantage.

When Darwin invoked Owen to attack special creation, he implicitly relied upon this same line of reasoning in order to make his homology argument succeed. In fact, Darwin drew on the exact passage explored above, explicitly citing Owen's example of bird craniums.[59] Moreover, Darwin incorporated Owen's ideas into a passage in the *Origin* that is arguably Darwin's primary direct assault on special creation's account of homology. In this passage, Darwin asked four key rhetorical questions designed to undermine special creation, each of which presupposed one or more of the *positiva* assumptions imported from Owen.[60]

57 Compare with Lustig, op. cit. (46), pp. 74–76.

58 On a related point, see Nelson, op. cit. (35), pp. 509–510.

59 'Why should the brain be enclosed in a box composed of such numerous and such extraordinarily shaped pieces of bone? As Owen has remarked, the benefit derived from the yielding of the separate pieces in the act of parturition of mammals, will by no means explain the same construction in the skulls of birds'. Darwin, op. cit. (5), p. 437. These statements draw from Owen's 'simplest mode' quote and the two sentences immediately after it. See Owen, op. cit. (48), p. 40.

60 Darwin, op. cit. (5), pp. 436–437; see Owen, op. cit. (48), pp. 7, 18–19, 36, 39–42. Not only does the content of two of the four questions come directly from *On Limbs*, but attentive readers will find that each question assumes one or more of the theological assumptions explored above. For example, Darwin asks, 'Why should similar bones have been created in the formation of the wing and leg of a bat, used as they are for such

Whether Darwin was consciously aware of the theological commitments contained in Owen's work is quite beside the point. Epistemologically, Darwin needed these theological claims in order to use Owen's argument effectively in crippling special creation. Remove the theology and little substance remains. For example, if one allows that God could design organisms 'by adjustment', modifying previous designs in order to accommodate the functional requirements of new organisms, then one need not accept the *de novo* premise. And, if one allowed that God's creative ways did not always conform to human notions of the 'simplest' method, then one could discard another of Owen's central assumptions. A similar criticism could be raised for the remaining theological claim. But the truth of these claims (or their criticisms) is irrelevant. The key point is that Owen's *positiva* theology critically supported his attack on special creation. By extension, Darwin's own assault also relied on theology.

Positiva theology not only helped Darwin assail special creation, it also helped him establish descent with modification. Since Darwin framed the *Origin* primarily as a contest between special creation and descent with modification, a successful attack on the former implied that the latter emerged as the *de facto* victor. Thus theological claims indirectly gave positive epistemic support to Darwin's homology argument for evolution. None of this is to say that theological premises are the only important premises in the argument; in their assessments of the doctrine of final causes, both Owen and Darwin drew on carefully established empirical data about homologies. Yet, as we have seen, theological assumptions were essential to Owen's case and, by extension, to Darwin's case as well.

The homology argument played no small role in the *Origin*'s overall polemic for descent with modification. In the *Origin*, Darwin introduced homology by declaring that it fell under morphology, 'the most interesting department of natural history, . . . [which] may be said to be its very soul'.[61] The correct account of homologous structures would thus give insight into the heart of organic history. And in personal correspondence in 1860, Darwin noted that, along with embryology, homology provided nearly enough ground alone to 'disbelieve in the innumerable acts of creation'.[62] In fact, the significance of the homology argument is reflected in its longevity; in the present day, this argument – along with its theological substance – is routinely cited as important evidence for evolution.[63]

In sum, Darwin not only used theology as part of his direct apologetic for evolution, but did so in an argument which he regarded as significant to his overall case for descent with modification.

totally different purposes?' Among other things, this question presupposes a variant of the *de novo* assumption, that God would create new limbs directly and expressly for their respective purposes rather than modifying each of them from a common design plan.

61 Darwin, op. cit. (5), p. 434.

62 Darwin and Seward, op. cit. (32), p. 173.

63 See the arguments and references in Nelson, op. cit. (35), pp. 506–12; and Lustig, op. cit. (46), pp. 74–83.

Divine honesty

The God of the *Origin* did not leave deceptive marks upon the natural world. More exactly, Darwin suggested that the Almighty did not create organisms that, when studied, indicate false information about their origins; instead, the information gleaned from these organisms could be taken as providing reliable clues to their beginnings. This particular idea appeared in all six editions of the *Origin* and in personal correspondence.[64] Darwin also made similar remarks in an early notebook, in the 1842 sketch, in the 1844 manuscript and in *Descent of Man*, although in these works he did not tie the 'truthfulness' of nature explicitly to the deity.[65]

In Chapter 5 of the *Origin*, Darwin noted that, in some cases, horses will produce offspring that resemble the markings of a foreign species of horse more than the markings of their own species. Likewise, hybrids sometimes resemble foreign species of the horse genus more than their own parental species.[66] Darwin stated that these tendencies could be readily explained by an ancient ancestor who shared traits common to all species in the horse genera. On the other hand, he saw these facts as a problem for special creation because, in that view, God created each species independently such that 'like follows like' – offspring should resemble their parental species rather than a foreign species. Special creation seemed to have an empirical problem: the observable data conflicted with a straightforward prediction of their view. However, Darwin noted that creationists could account for this anomaly by asserting 'that each species has been *created* with a tendency to vary, both under nature and under domestication, in this particular manner, so as often to become striped like other species of the genus'.[67] That is, creationists could adjust their theory by saying that God designed some purebred and hybrid offspring with a predisposition to resemble other species of the horse genus. Thus while the tendencies of horse variation seem to be clearly explained by common ancestry, the (modified) creationist explanation could account for the data by holding that God had designed horse variation in a manner that appeared to be exactly what one would expect if common ancestry were true. God had hidden His direct hand.

To contemporary ears, this may seem as if special creationists had simply invoked an all-powerful God to accommodate, rather than explain, data that should be regarded as a problem for their theory. But contemporary sensibilities aside, Darwin's own response is telling. In the very next sentences, he wrote,

> To admit this view is, as it seems to me, to reject a real for an unreal, or at least for an unknown, cause. It makes the works of God a mere mockery and deception; I would almost as soon

64 Darwin, op. cit. (5), p. 167. Darwin's language is identical in parallel passages in other editions. F. Darwin, op. cit. (22), vol. 2, p. 361.

65 Gillespie makes a similar point, but less precisely. Gillespie, op. cit. (1), pp. 128–29; Gavin de Beer (ed.), 'Darwin's notebooks on transmutation of species. Part 1. First notebook [B] (July 1837–February 1838)', *Bulletin of the British Museum (Natural History)* (January 1960), historical series 2(2), pp. 23–73, esp. 67; F. Darwin, op. cit. (14), pp. 49, 250–251; Charles Darwin, *Descent of Man*, vol. 1, London: John Murray, p. 186. For another example, see Charles Darwin, *Origin of Species*, 3rd edn, London: John Murray, 1861, pp. 517–518. Identical language appears in the fourth, fifth, and sixth editions.

66 Darwin, op. cit. (5), pp. 165–167.

67 Darwin, op. cit. (5), p. 167, emphasis added.

> believe with the old and ignorant cosmogonists, that fossil shells had never lived, but had been created in stone so as to mock the shells now living on the sea-shore.[68]

Darwin's reference to the 'ignorant cosmogonists' is likely an allusion to the work of select palaeontologists from a previous era who had argued that God created some natural artefacts, like fossils, to appear older than they actually were.[69] Darwin regarded such an explanation as unacceptable. Apparently following his *vera causa* scruples, he protested that this creationist explanation relied on an 'unreal' or 'unknown' cause because there was no independent evidence (or present experience) to think that God created in a manner which disguised His involvement.[70] The special-creation account held that the unusual features of certain horses were actually the result of a divine miracle when they appeared to be the result of evolution from a common ancestor. Accordingly, a careful empirical study of these horses could not provide accurate information about their origins. More generally, this implied that empirical data about an organism could not be trusted to give accurate information about its natural history. The creationist explanation rendered the empirical data itself unreliable. This meant that scientists could no longer trust empirical data, which cast the scientific enterprise itself into doubt.

But why did Darwin not simply end the matter by using his *vera causa* principles to claim that the creationist explanation 'makes the empirical evidence a mere mockery and deception'? Instead, he wrote that the creationist explanation 'makes *the works of God* a mere mockery and deception.'[71] The reason, I would argue, is that Darwin wanted to drive home the reliability of the empirical evidence by linking it to God's moral character. The creationist explanation was mistaken not just because it violated the *vera causa* requirement but, more fundamentally, because it disparaged God's honesty – the very thing which sanctioned the trustworthiness of scientific data. God's probity meant that the data could be trusted to yield straightforward information; thus, if horses *appear* to have arisen from a common ancestor, then they *had* arisen from a common ancestor. For Darwin, divine integrity was a crucial factor that favoured the evolutionary account over the special-creation account.

Moreover, God's probity showed why the *vera causa* requirement could not be fulfilled by special creation: there could be no independent evidence (or present

68 Darwin, op. cit. (5), p. 167.

69 Darwin may have also been raising a subtle criticism of Philip Gosse, a contemporary who had argued in *Omphalos* (1857) that God had created fossils with the appearance of great age. Gosse was roundly criticized for portraying God as a deceiver.

70 A critic might protest that Darwin's allusion to his *vera causa* requirements in this passage is epistemically independent of his invocation of divine honesty in the next sentence. This view is not implausible. However, because the immediate context is Darwin's discussion of special creation, the *vera causa* requirement for 'real' (as opposed to 'unreal' or 'unknown') causes applies directly to the (modified) special-creation account in which God created organisms to give false empirical evidence about their origins. To Darwin's mind, such a 'cause' does not pass the *vera causa* test because there is no independent evidence (or present experience) to corroborate this view of the divine; indeed, in the next sentence, Darwin implies that quite the opposite is true: God is not a deceiver. The truth about God's moral character is why the (modified) special-creation account fails the *vera causa* test.

71 Darwin, op. cit. (5), p. 167, emphasis added.

experience) of spurious empirical 'facts' because a moral God would allow no such thing. More generally, the reliability of empirical data was now beyond reproach – in effect, science itself was possible because God was no deceiver.

The textual evidence spanning from Darwin's early notebooks to *Descent of Man* makes it difficult to discern whether or not Darwin personally held this belief. As mentioned, he repeatedly claimed that nature is non-deceptive, but only tied this claim to the deity in the *Origin* and in private correspondence. Even so, the present point is not to analyse Darwin's personal theological beliefs but rather to examine the epistemic role that theology played in the first edition of the *Origin*. On this latter point, Darwin clearly used theology in the *Origin* in order to strengthen his position.

It is important to emphasize that, in this instance, the evolutionary and creationist explanations were at an empirical standstill: strictly speaking, both could account for the unusual data about horses. Scientific evidence was plainly impotent to settle the dispute. Instead, Darwin turned to the heavens, citing God's moral probity as the adjudicating factor. Rightly or wrongly, Darwin used God's (alleged) non-deceptive character as more than just a mooring for a general philosophy of nature; it functioned as direct epistemic support for descent with modification.[72]

In sum, Darwin deployed God-talk to favour evolution over special creation in an instance in which, to his mind, neither empirical data nor *vera causa* requirements (alone) were adequate. In this case, an extra-empirical criterion provided vital support to his argument – and this criterion, surprisingly, centred on God's integrity. By extension, divine integrity also ensured the reliability of empirical data and, hence, science itself.

The inscrutable God

In Darwin's time, the argument for biological design had received its most rigorous formulation from William Paley, who had argued in *Natural Theology* (1802) that the intricate adaptation of organs and organisms to their environment implied divine design rather than chance material processes. Arguably, one of the high points of Paley's work was his design argument about the vertebrate eye. 'I know no better method of introducing so large a subject', he explained,

> than that of comparing a single thing with a single thing; an eye, for example, with a telescope. As far as the examination of the instrument goes, there is precisely the same proof that the eye was made for vision, as there is that the telescope was made for assisting it. They are made upon the same principles; both being adjusted to the laws by which the transmission and refraction of rays of light are regulated.[73]

From here Paley went on to detail the various structural and functional adaptations of the eye to its environment, why the eye and telescope were appropriately analogous, and why this implied that the eye, like the telescope, was designed. No stranger to Paley's views, Darwin had studied Paley's *Natural Theology* and *Evidences of Christianity* as a

72 Some contemporary scholars may think Darwin made a category mistake, invoking theology at a level at which it did not belong. But the present point is to understand the text of the *Origin* rather than to attack it.

73 Paley, op. cit. (10), p. 18.

student at Cambridge, recalling later that both 'gave me as much delight as did Euclid', a favourite author. And, just two weeks prior to the publication of the *Origin*, Darwin wrote to a colleague that 'I do not think I hardly ever admired a book more than Paley's *Natural Theology*. I could almost formerly have said it by heart'.[74]

Moreover, since his notebooks of 1838, Darwin openly struggled with how to account for the eye by purely secondary causes.[75] As Abigail Lustig observes, the development of the vertebrate eye was one of the chief difficulties for Darwin's theory as well as one of the 'classical examples' of natural theology, giving him clear impetus to focus on it in his case for evolution in the *Origin*.[76]

Unsurprisingly, Darwin's response to Paley's eye argument became a 'centrepiece' of a chapter dedicated to addressing the strongest objections to evolutionary theory.[77] Darwin noted that it seemed prima facie 'absurd in the highest possible degree' that an organ as intricate as the eye 'could have been formed by natural selection'.[78] Instead, he wrote,

> It is scarcely possible to avoid comparing the eye to a telescope. We know that this instrument has been perfected by the long-continued efforts of the highest human intellects; and we naturally infer that the eye has been formed by a somewhat analogous process.[79]

Darwin offered two questions as an immediate reply, writing in the very next sentences, 'But may not this inference be presumptuous? Have we any right to assume that the Creator works by intellectual powers like those of man?'[80] Although Darwin's brevity makes interpretation difficult, his questions implied that the analogy between humans and God broke down. Human beings, he proposed, cannot know that their own causal powers are relevantly similar to the Creator's causal powers. Apparently, such knowledge was beyond human ken.[81] Darwin asked rhetorically what 'right' humans have for this analogy – that is, what sound basis was there to think that human beings can know such a thing about God's 'intellectual powers'? His questions suggested that justification for the vertebrate-eye argument failed because certain features of God's nature, such as His creative power, were inaccessible to human beings.[82] Thus Darwin's negative rebuttal of the vertebrate-eye argument consisted of unmistakable theological ideas about human epistemology.

74 Darwin, op. cit. (11), p. 59; F. Darwin, op. cit. (22), vol. 2, p. 219.

75 Gavin de Beer (ed.), 'Darwin's notebooks on transmutation of species. Part II. Second notebook [C] (February to July 1838)', *Bulletin of the British Museum (Natural History)* (May 1960) historical series 2(3), pp. 75–118, esp. 103; also de Beer, op. cit. (13), p. 130.

76 A.J. Lustig, 'Darwin's difficulties', in Richards and Ruse, op. cit. (5), pp. 109–128, esp. 109–110; *idem*, op. cit. (46), pp. 72–74.

77 Lustig, op. cit. (46), p. 72; Darwin, op. cit. (5), pp. 186–194.

78 Darwin, op. cit. (5), p. 186.

79 Darwin, op. cit. (5), p. 188.

80 Darwin, op. cit. (5), p. 188.

81 Brooke, op. cit. (7), pp. 53–54.

82 Darwin echoes David Hume, who said, 'it must evidently appear contrary to all rules of analogy to reason, from the projects and intentions of men, to those of a Being so different, and so much superior'. David Hume, *An Inquiry Concerning Human Understanding*, Indianapolis: Hackett, 1977 (first published 1748), p. 100.

By way of a positive alternative to Paley's eye argument, Darwin stated that extant vertebrates offered meagre evidence for this theory and that the fossil record yielded none.[83] Instead, he used the variations in extant *in*vertebrates to construct an account of how the eye might have developed historically in vertebrates, suggesting that this scenario provided sufficient grounds to believe that an organ as 'perfect as the eye of an eagle might be formed by natural selection' even if one 'does *not know* any of the transitional grades'.[84] Darwin also wrote that rudimentary light-sensitive nerves could have slowly evolved into complex organs over vast years of slight, inheritable, advantageous variations preserved by natural selection. More generally, Darwin cited the claim that the lungs of vertebrates were originally a 'floating apparatus or swimbladder' for an ancient organism 'of which we *know nothing*' as key evidence for the incremental development of complex organs.[85] These arguments, Darwin thought, would persuade a fair-minded reader who remembered that 'his reason ought to conquer his imagination'.[86]

Curiously, Darwin's scenarios included very little reasoning about concrete empirical evidence. Historian Peter Dear observes that, despite Darwin's rhetoric to the contrary, his account actually conscripts reason in service of imagination. 'Darwin's attempts to persuade . . . use reason to explore ideas that have first been conjured up by the imagination', Dear explains. 'The role of reason is really to enable a leap from ordinary imagination to the literally unimaginable'.[87] In a similar vein, rhetorician David Depew regards Darwin's argument as a 'thin thought experiment' designed to sway a Victorian audience about the efficacy of natural selection.[88]

Despite the idiosyncrasies of this passage, however, it is important to recall that Darwin's full reply to Paley's theistic creationism is contained in the *Origin* as a whole rather than in this particular section of text. Natural selection functions as Darwin's central substitute for Paley's watchmaker, and the *Origin* details an extensive case for Darwin's blind watchmaker, drawing on an array of empirical evidence. So, one must weigh Darwin's particular response to Paley's vertebrate-eye argument against the backdrop of the *Origin* as a whole.

Even so, natural selection was meant to explain even complex organs. The case for natural selection may have been *more* than its account of the vertebrate eye but it was certainly not *less*. The path to victory had to pass through Paley's full gauntlet. And arguably a strong point of Paley's position was the vertebrate-eye argument, to which Darwin provided almost no concrete empirical rebuttal. Thus, at the sharp edge of Paley's sword – where the design argument was most cutting – Darwin parried with

83 Darwin, op. cit. (5), p. 187.

84 Darwin, op. cit. (5), p. 188, emphasis added.

85 Darwin, op. cit. (5), p. 191, emphasis added.

86 Darwin, op. cit. (5), p. 188.

87 Peter Dear, *The Intelligibility of Nature*, Chicago: University of Chicago Press, 2006, p. 100. See also John Angus Campbell, 'Why was Darwin believed?' *Configurations* (2003) 11, pp. 227–30.

88 Darwin, op. cit. (5), pp. 188–189. Depew argues that Darwin also cleverly cast natural selection in the language of an agent who had God-like powers to 'pick out with unerring skill each improvement' in organisms. Depew, op. cit. (5), pp. 245–51; for a more sympathetic reconstruction of Darwin's argument see Lustig, op. cit. (76), pp. 109–128.

imaginative speculation and theology-laden epistemology rather than strong empirical evidence. In particular, Darwin's direct rebuttal of Paley, which emphasized the inaccessibility of God's creative powers, owed more to theology than to science.

A number of historians have recognized that Darwin's response to Paley's argument had deep personal and theological roots. Historian James Moore perceptively notes that there is a touch of piety in the humble manner in which Darwin approached metaphysical and theological questions.[89] John Brooke observes, 'When Darwin did vent his spleen against the apologetic thrust of natural theology, it was usually because he was taking exception to the arrogance, as he saw it, of those who considered themselves privy to God's purposes'.[90] And John Cornell argues that a 'theological thread runs through' Darwin's counter to Paley, a thread that was to Darwin's mind 'compatible with a more sublime theology'.[91] In the *Origin*, Darwin apparently drew upon this 'more sublime theology' to hold meekly that God's creative powers were opaque to humans. Once again, he commissioned theological claims to strengthen his naturalized account of organic history.

Tensions within the theology of the *Origin*

We may now step back from analyses of particular theological threads in the *Origin* to look at the tapestry as a whole. Perhaps surprisingly, Darwin's 'muddle' about theology, which he acknowledged later in life,[92] was subtly present in the first edition of the *Origin*, manifest as a pattern of vagueness, logical incoherence and epistemic illegitimacy. In order to establish this claim, this section will be more evaluative than previous sections, but it will do so 'from the inside'; not by importing 'external' views opposed to Enlightenment-style theology, but by taking the *Origin*'s theology on its own terms, analysing it for internal logical consistency as well as harmony with Darwin's mature reflections.

The first tension, mild in nature, concerns the *Origin*'s apparent acceptance and rejection of miracles. If the interpretation earlier in the essay is correct, then, in a discussion of what 'we know about laws impressed on matter by the Creator', the *Origin* tacitly endorsed unbroken natural law as the sole means of the 'production and extinction of the past and present inhabitants of the world'.[93] However, elsewhere Darwin explicitly wrote that 'life was first breathed' into 'one primordial form', suggesting a miraculous origin of life.[94] Advocacy of both broken and unbroken natural

89 James Moore, *The Post-Darwinian Controversies*, New York: Cambridge University Press, 1979, p. 318. Moore also observes that the *Origin* 'largely . . . dealt with theological questions' which 'profoundly' concerned Darwin 'throughout his scientific career'. James Moore, review of *Charles Darwin and the Problem of Creation, BJHS* (1981) 14, p. 189. Moore here summarizes Neal Gillespie's 'outstanding achievement' with approval.

90 Brooke, op. cit. (7), p. 65; de Beer, op. cit. (75), p. 79.

91 Cornell, op. cit. (23), pp. 399–400; see also Gillespie, op. cit. (1), pp. 132–133.

92 Letter to J.D. Hooker on 12 July 1870; Darwin and Seward, op. cit. (32), p. 321.

93 Darwin, op. cit. (5), p. 488.

94 Darwin, op. cit. (5), p. 484, also pp. 488, 490; see Cosans, op. cit. (21), pp. 362–371; and Gillespie, op. cit. (1), pp. 127–133.

law may suggest an underlying conflict. However, a charitable interpretation proposes that the *Origin* articulated a semi-deism in which God originally impressed the laws of nature onto matter and later directly created the first life, but then let unbroken natural law govern the unfolding of organic evolution. This is a coherent position, but one which raises uncomfortable questions about whether a God who intervened once to create life might not so do again.[95]

These were murky waters. Darwin's strategy, consciously or otherwise, was to avoid clarifying the matter. Vague God-talk had the disadvantage of blurring the true theological moorings and implications the *Origin*'s new science; it had the considerable advantage, however, of allowing deists and theists to interpret the *Origin* in the image of their own gods, making evolution by natural selection appear more persuasive. In this case, perhaps Darwin ignored theological clarity for the larger purpose of scientific success.

A second tension arises regarding the epistemic value of natural pain and suffering in the case for evolution. As we have seen, Darwin argued that, while no logical deduction could be made, pain and suffering counted as evidence for descent with modification rather than for special creation. Darwin also spoke of a 'Creator' who impressed laws onto matter, but did not perform miracles in organic history subsequent to the first life. Apparently, a remote God who allowed nature to operate by 'one general law' for the 'advancement of all organic beings' was not culpable for natural pain and suffering, unlike a God who deliberately designed organisms within organic history.

But one might wonder, 'what if the *Origin*'s Creator was omniscient?' This God would know that the 'general law' in which 'strongest live and the weakest die' would include innumerable cases of agony and extermination, and thus might plausibly be said to be no less culpable than the God of special creation.[96] These are deep matters, of course, and the task here is not to impose an 'external' criticism on Darwin's argument but, in this case, to consult his mature ruminations. Surprisingly, he effectively conceded the point in a letter to M.E. Boole in 1866:

> I may however remark that it has always appeared to me more satisfactory to look at the immense amount of pain & suffering in this world, as the inevitable result of the natural sequence of events, i.e. general laws, rather than from the direct intervention of God though I am aware this is not logical with reference to an omniscient Deity.[97]

By 1866, Darwin apparently believed that pain and suffering were not more compatible with the existence of an omniscient God (who let evolution unfold by general laws) than with the God of special creation.

95 For example: letter from W.H. Harvey to Darwin on 24 August 1860. Darwin Correspondence Project Database, http://www.darwinproject.ac.uk/entry–2898/, letter no. 2898, accessed 27 August 2010.

96 Arguably, Darwin needed to retain the *Origin*'s tacit endorsement of the moral goodness of the Creator. For example, this concept apparently undergirded claims about divine honesty as well as the 'advancement of all organic beings' in the face of natural suffering.

97 Darwin Correspondence Project Database, http://www.darwinproject.ac.uk/entry–5307/, letter no. 5307, accessed 16 July 2010.

But the *Origin* itself was unclear on this matter. Strictly speaking, Darwin did not refer to the deity in the 1859 edition as omniscient.[98] But to many readers, his reference to a 'Creator' would plausibly be understood this way, absent any qualifications. (Indeed, in his 1844 manuscript he explicitly referred to an 'omniscient Creator'.[99]) In any case, if Darwin's mature reflections are correct, then the *Origin*'s vagueness about the omniscience of God obscured exactly how natural suffering favoured descent with modification over special creation. The offence here is not the mortal sin of logical inconsistency but rather the venial sin of imprecision. At a personal level, in 1859, Darwin was troubled in many ways by natural suffering, but at a rhetorical level, it also offered too powerful a weapon to leave aside. The primary purpose of the *Origin* was to establish descent with modification and undermine special creation. In the case of natural suffering, theology played a role in this greater objective, with little attention given to whether, in the end, it could legitimately accomplish the task.

A third and more serious difficulty concerns the logical incompatibility of some of the *Origin*'s theological statements. For example, in his reply to Paley's vertebrate-eye argument, Darwin asked rhetorically, 'Have we any right to assume that the Creator works by intellectual powers like those of man?'[100] The claim asserts that human beings are not justified in believing that God operates in ways analogous to the intellectual powers of the human mind. However, in his homology argument, Darwin implied, following Owen's lead, that God creates in ways that accord with human notions of simplicity. God would not fashion certain biological structures from a common type, posited Owen, because this 'squares . . . little with our idea of the simplest mode' of creating these structures to fulfill their function.[101] Collectively, then, Darwin claimed, first, that human beings cannot know that God creates in ways analogous to the intellectual powers of the human mind, and, second, that God creates in ways that harmonize with the human conception of the simplest method of creating.

Add to these claims the plausible assumption that, at least in some contexts, notions of (superlative) simplicity very likely shape how human beings think and, in particular, how they create new inventions or theories. These three statements are jointly incoherent. They imply that humans can both *know* and *not know* that God's creative methods correspond with human conceptions of superlative simplicity. The *Origin* effectively dispatched Paley and deployed Owen only at the cost of fragmenting internally.

98 A bit speculatively, Darwin's preface to his initial argument about natural suffering in the *Origin* included a qualification very similar to the one he gave to M.E. Boole, suggesting that Darwin may have been aware in 1859 that an omniscient 'Creator' posed a problem for his argument. '[I]t may not be a logical deduction', he wrote carefully, 'but to my imagination it is far more satisfactory' to accept that natural pain accords with evolution rather than with special creation. The qualification – 'it may not be a logical deduction' – closely resembles his concession to Boole: 'I am aware this is not logical with reference to an omniscient Deity'. Darwin, op. cit. (5), pp. 243–244; Darwin Correspondence Project Database, http://www.darwinproject.ac.uk/entry–5307/, letter no. 5307, accessed 16 July 2010, emphasis added.

99 F. Darwin, op. cit. (14), p. 52.

100 Darwin, op. cit. (5), p. 188.

101 Owen, op. cit. (48), p. 40.

The most severe tension, however, can be found in the fundamental justification for all the *positiva* theological claims in the *Origin*.[102] Judged from an epistemic point of view, these claims offer genuine support for descent with modification only if they are justified in the first place. In this vein, one may ask, 'if Darwin's own theory is true, what justification is there for the *positiva* theology he used to support his theory?' To appreciate his query, consider Darwin's own reflections in his autobiography that he felt

> compelled to look to a First Cause having an intelligent mind in some degree analogous to that of man . . . This conclusion was strong in my mind about the time, as far as I can remember, when I wrote the *Origin of Species*. But then arises a doubt – can the mind of man, which has, as I fully believe, been developed from a mind as low as that possessed by the lowest animal, be trusted when it draws such grand conclusions?[103]

This question, in one form or another, haunted Darwin from at least around 1859 to the end of this life.[104] Just six months after the debut of the *Origin*, Darwin wrestled with the relationship between God and evolution in a letter to Asa Gray, writing that he believed in divinely designed laws with the details left to chance. 'Not that this notion *at all* satisfies me', Darwin immediately added. 'I feel most deeply that the whole subject is too profound for the human intellect. A dog might as well speculate on the mind of Newton'.[105]

In Darwin's view, the human mind was not designed by God in order to know God; it was instead equipped by nature to cope with the survival and reproductive needs of ancient hunter-gatherers on the African landscape.[106] Indeed, in *Descent of Man*, in which Darwin applied evolutionary theory to the human species, God did not fashion the human mind, but rather the reverse: Darwin argued that religious beliefs, including the monotheistic concept of God, arose due to a combination of abstraction, anthropocentric projection and social utility.[107]

But what of the *positiva* theological claims in the *Origin* itself? It seems that if Darwin had applied evolutionary theory to himself while writing the *Origin*, then he would not have been justified in his claims about God. Here, the looming problem comes to a head: by his own lights, if evolution is true, then some of the reasons for this theory – the homology argument, the natural-suffering argument, claims about divine honesty and

102 As indicated below, perhaps the one exception is the claim that humans cannot know whether God's intellectual powers are analogous to their own.

103 Darwin, op. cit. (11), pp. 92–93.

104 In a letter written in 1881, Darwin struggled with whether, given the truth of evolution, he could know that the universe was the result of purpose or of chance (to say nothing of the existence or attributes of God). F. Darwin, op. cit. (22), vol. 1, p. 316. See also England, op. cit. (25), pp. 274–275.

105 F. Darwin, op. cit. (22), vol. 2, p. 312, original emphasis. Darwin does not say in this letter that his theological muddle arose because of his theory of evolution. That connection became explicit later.

106 Some contemporary Darwinists echo the same refrain. Michael Ruse, 'Belief in God in a Darwinian age', in Jonathan Hodge and Gregory Radick (eds.), *The Cambridge Companion to Darwin*, New York: Cambridge University Press, 2003, pp. 368–392, esp. 350–351; Patricia Churchland, 'Epistemology in the age of neuroscience', *Journal of Philosophy* (1987) 84, pp. 544–553, esp. 548–549.

107 Darwin, op. cit. (65), pp. 65–69.

about God's relationship to the laws of nature, and so on – are no longer justified.[108] In effect, the theology of the *Origin* undermined itself.

Darwin was still entitled to use *reductio* theology, in which he simply took special creation's theology seriously in order to test its empirical predictions. (One can test a claim – say, that the Earth is flat – without having justification for that claim.) But if his mature reflections are correct, then *positiva* theology, which purported to be independent support for his theory, was an epistemic failure.

In summary, by taking seriously the laws of logic as well as Darwin's mature thoughts, an analysis of the *Origin*'s theology reveals vagueness, logical incoherence and epistemic illegitimacy. Darwin's later theological 'muddle' was quietly present in 1859. In this view, the theology of the *Origin* resembles an assortment of claims that – even if some were existentially important to Darwin – do not appear, from an epistemic point of view, to have been carefully scrutinized for plausibility, clarity or consistency, but rather were recruited to satisfy the primary purpose of establishing evolution and undermining its chief rival.

Summary and conclusion

We may now step back and take stock of the claims advanced in this essay. I have argued that, in the first edition of the *Origin*, Darwin drew upon at least the following *positiva* theological claims in his case for descent with modification (and against special creation):

1 Human begins are not justified in believing that God creates in ways analogous to the intellectual powers of the human mind.
2 A God who is free to create as He wishes would create new biological limbs *de novo* rather than from a common pattern.
3 A respectable deity would create biological structures in accord with a human conception of the 'simplest mode' to accomplish the functions of these structures.
4 God would only create the minimum structure required for a given part's function.
5 God does not provide false empirical information about the origins of organisms.
6 God impressed the laws of nature on matter.
7 God directly created the first 'primordial' life.
8 God did not perform miracles within organic history subsequent to the creation of the first life.
9 A 'distant' God is not morally culpable for natural pain and suffering.
10 The God of special creation, who allegedly performed miracles in organic history, is not plausible given the presence of natural pain and suffering.

108 Compare with von Sydow, op. cit. (25), pp. 150–156, who gives a temporal account of Darwin's loss of religious beliefs; von Sydow thinks this loss was due in large measure to the development of evolutionary theory.

I have further argued that Darwin utilized theological claims in the *Origin* to provide epistemic support for descent with modification (and against special creation) in at least the following ways:

1 as a crucial background claim that helped adjudicate between his theory and a rival theory;[109]
2 as the primary factor that eliminated a rival theory in a case in which Darwin's theory and a rival were at an empirical stalemate;[110]
3 as a justification for applying the *vera causa* criterion to a competing theory in order to reject that theory;[111]
4 as grounds to counter Paley's formidable design argument about the vertebrate eye;
5 as a partial substitute for an empirically based counter to Paley's design argument about the vertebrate eye;[112]
6 as a tacit premise in his argument about natural suffering and pain;
7 as tacit assumptions in his famous homology argument, an area of study Darwin declared part of the 'very soul' of natural history.

I have also argued that Darwin drew upon theology not simply to argue for his theory, but to inform or undergird the theory (or key aspects of the theory), including:

1 to support recourse to explanations involving only natural (or secondary) processes, causes and events;[113]
2 to help justify the trustworthiness of empirical data.[114]

Finally, I have argued that a meta-level analysis of Darwin's theological statements reveals several tensions:

1 imprecision in his argument from natural suffering,[115]

109 For example, Darwin's talk of 'laws impressed on matter' and his response to the (modified) special-creation account of horse variability.

110 For example, Darwin's response to the (modified) special-creation account of horse variability.

111 Arguably, Darwin rejected the (modified) special-creation account of horse variability as relying on an 'unreal' or 'unknown' cause – and hence violating the *vera causa* requirement – because there was insufficient independent evidence (or present experience) to claim that God was a deceiver, as the creationist account implied. Instead, Darwin implied that God was not a deceiver. The (modified) special-creationist position invoked an unreal cause (rather than a true cause) because it held a mistaken notion of God's moral character. For further argument, see the section on 'divine honesty' as well as note 71.

112 Recall that Darwin's rebuttal did not consist of clear empirical evidence but rather of a 'thin thought experiment', to borrow David Depew's phrase, and two theology-laden claims about God's opacity.

113 See the sections on 'the problem of natural suffering' and 'the Divine Architect'.

114 In his critique of the (modified) special-creationist view of horse variability, Darwin's appeal to God's probity helped establish the non-deceptive nature of empirical data.

115 Recall Darwin's lack of clarity about whether natural suffering was more compatible with evolution than with special creation in light of the *Origin*'s (allegedly) omniscient Creator who would have foreseen (and allowed) natural suffering.

2 logical incoherence in his reply to Paley and use of Owen and[116]
3 the epistemic illegitimacy of the *positiva* theological claims in the *Origin*.[117]

A number of scholars agree that Darwin used theology significantly in the *Origin*. As mentioned, John Brooke argues that Darwin borrowed from natural theology similar research problems, presuppositions, concepts, metaphors, patterns of argumentation and content for his theory.[118] In his careful study of Darwin's belief in evolutionary progress, Dov Ospovat argues that one of Darwin's justifications for progress in the face of natural suffering was 'essentially the same' as that of Malthus and Paley, namely 'that the laws of nature were designed by a benevolent God'.[119] Abigail Lustig maintains that the *Origin* 'was itself created in response to . . . the theological argument from design' and can only be understood in light of its Paleyan theological heritage.[120] Momme von Sydow holds that 'three of the main influences on Darwin's biological theory' are 'Paley's belief in the divine design of nature; the conviction that God rules by laws which are eternal, universal and unchangeable; . . . [and] Malthus' principle of population, partly presented as a theodicy'.[121] Strikingly, John Cornell and Robert Richards independently argue that the heart of Darwin's theory – natural selection – arises from Darwin's distinct theology.[122] Richards, for example, gives evidence that 'Darwin created natural selection in the image of God' so that 'natural selection was more than a blind force of nature. It functioned as the surrogate creator operating according to divine command'.[123] More generally, a number of historians argue that Darwin should not be understood as a man bent upon undermining theology so much as a radical reformer of natural theology.[124]

There is, in addition, Darwin's *reductio* use of theology. Recall that he frequently articulated special creationists' own theology in order to empirically test it and find it wanting. Darwin repeatedly made these tests in a context of comparison to evolution, contending for the broad explanatory power of natural selection and common descent juxtaposed to the anaemic explanatory power of special creation. *Reductio* theology was, in short, essential to his comparative argument in the *Origin*.

As a brief aside, quite a few contemporary neo-Darwinists explicitly or implicitly employ some of the *Origin*'s same theological claims and argument

116 Specifically, Darwin's conflicting claims about human ignorance (*à la* Paley) and human knowledge (*à la* Owen) of God's creative ways.

117 If Darwin's mature thoughts are correct, then theological claims 2–10 are unjustified. Claim 1 may still be justified, however, given Darwin's (mature) evolutionary antirealism about theology.

118 Brooke, op. cit. (7), esp. pp. 48–49.

119 Ospovat, op. cit. (44), p. 223.

120 Lustig, op. cit. (46), p. 70. She also comments that 'evolutionary theory' was 'born in theology'.

121 Von Sydow, op. cit. (25), pp. 141–156.

122 Cornell, op. cit. (23), pp. 381–412; Richards, op. cit. (23), pp. 61–79; see also Lustig, op. cit. (46), p. 75.

123 Richards, op. cit. (23), pp. 63 and 69 respectively.

124 Especially Gillespie, Ospovat, Brooke and Moore. A dated but helpful survey of scholars for and against this view can be found in Kohn, op. cit. (2), pp. 215–239, esp. 215–218.

strategies.[125] Although the present essay focuses only on the *Origin*, readers who doubt the presence of theology in contemporary discussions are encouraged to examine the cited references; they will find plenty of God-talk to go around.

One final question remains: even if theology in its various guises played an epistemic role in the *Origin*'s case for evolution (and against special creation), *how much* of a role did it play, in particular, with respect to the roles of empirical evidence and naturalized (or secular) concepts, presuppositions, arguments, metaphors and the like? In short, how much did the *Origin* actually need God? While a full answer cannot be ventured here, two comments are in order. First, by way of clarification, this essay does not dispute that Darwin's theory in the *Origin* was naturalized in the crucial sense that it posited natural laws, entities and causes to explain biological change.[126] Nor does it reject the centrality of Darwin's use of empirical evidence or non-theological concepts and claims to articulate, defend and apply his theory.

Second, and more importantly, teasing apart the fabric of Darwin's one long argument into 'theological', 'naturalized' and 'empirical' (and other) threads – and then assessing the individual epistemic importance of each – is an extremely complicated task, made more so by Thomas Kuhn's perceptive analysis of the interwoven nature of metaphysics, epistemology, methodology and empirical evidence in paradigms.[127] If the scholars mentioned above are correct, then theology plays a large role in the concepts, assumptions, structure and defence of Darwin's argument and theory. But this essay defends a much more modest position, focusing on the epistemic role of *positiva* theology. In the *Origin*, this theology interfaces with empirical data and naturalized concepts and assumptions in complex ways, functioning on many different epistemic levels, from adjudicating background claims, to premises in arguments, to fundamental presuppositions. Despite this complexity, it seems reasonable to conclude that *positiva* theology was one of the many resources that Darwin drew upon, but neither the most frequent nor the most prominent resource. *Positiva* theology served as a handmaiden,

125 Here are a dozen or so references: Jerry Coyne, *Why Evolution Is True*, New York: Viking, 2009, pp. 81–85; Francis Collins, *The Language of God*, New York: The Free Press, 2006, esp. Chapters 3–9; Stephen Jay Gould, *The Panda's Thumb*, New York: W.W. Norton & Co., 1992, pp. 20–21; Elliott Sober, *Philosophy of Biology*, 2nd edn, Boulder: Westview Press, 2000, pp. 27–57; Francisco J. Ayala, *Darwin and Intelligent Design*, Minneapolis: Fortress Press, 2006, pp. 85–89; Kenneth Miller, *Finding Darwin's God*, New York: HarperCollins, 1999, pp. 80, 100–103, 267–269; Philip Kitcher, *Abusing Science*, Cambridge, MA: MIT Press, 1982, pp. 124–164; Michael Shermer, *Why Darwin Matters*, New York: Times Books, 2006, pp. 16–18; Douglas Futuyma, *Science on Trial: The Case for Evolution*, Sunderland: Sinauer Associates, 1995, pp. 128–131; Arthur Peacocke, 'Welcoming the "disguised friend" – Darwinism and divinity', in Robert Pennock (ed.), *Intelligent Design Creationism and Its Critics*, Cambridge, MA: MIT Press, 2002, pp. 471–486; Jean Pond, 'Independence', in Richard Carlson (ed.), *Science and Christianity: Four Views*, Downers Grove: InterVarsity Press, 2000, pp. 67–104; Howard Van Till, 'Partnership', in Carlson, op. cit., pp. 195–234; Ian Barbour, *When Science Meets Religion*, New York: HarperCollins, 2000, pp. 111–113; John Haught, *Deeper than Darwin*, Boulder: Westview Press, 2004, pp. 55–68. See also the multiple references cited in Nelson, op. cit. (35); and Lustig, op. cit. (46).

126 Although, of course, some of the scholars I have cited above would not fully accept this claim.

127 This is not to say that Kuhn's analysis is entirely correct, especially in its bolder constructivist and incommensurability themes. Thomas Kuhn, *The Structure of Scientific Revolutions*, Chicago: University of Chicago Press, 1962. Also relevant here are contemporary discussions of the Quine–Duhem thesis about holism in testing.

faithfully assisting Darwin's central character (natural selection), and as an accomplice, working with a host of empirical data, logical inferences and naturalized concepts and claims to explain and defend evolution and to undermine special creation.

Handmaidens and accomplices are, of course, less alluring to historians than matriarchs and masterminds. But they are not unimportant. *Positiva* theology legitimized everything, from the trustworthiness of empirical data, to the famed homology argument, to Darwin's naturalized method. Despite its internal tensions, it informed both his 'one long argument' and his theory.

Contrary to conventional wisdom, the *Origin* did not so much separate science from theology as it articulated science from the vantage of semi-deism. Moreover, it proposed evolution by natural selection as an alternative to another theology-laden explanation, special creation. In the final analysis, the contrast in the *Origin* is not between theistic creationism and naturalistic evolution, but between theistic special creation and semi-deistic evolution – the latter with specific (and perhaps conflicted) notions of the existence, character, actions and obligations of God.