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NATURAL SELECTION SHADOWED FORTH: ARISTOTLE'S *DE PARTIBUS ANIMALIUM* AFTER DARWIN

Abstract

Until the last years of his life, Charles Darwin had actually never read Aristotle. The sole reference he makes to his naturalist forebear in *On the Origin of Species* came in an addition to the fourth edition, published in 1866, in which he mistakenly refers to Aristotle's summation of Empedocles' position at *Physica* II 8, as Aristotle's own, and notes that 'we see here the principle of natural selection shadowed forth' (while disputing the specific scientific point Aristotle – though actually Empedocles – was supposedly making). So when his friend William Ogle, a minor scientist and physician, and an evangelist Christian, published a translation of Aristotle's *De partibus animalium* in 1882 and sent a copy to Darwin, he was able to declare that he felt "some self-importance in thus being a kind of formal introducer of the father of Naturalists [Aristotle] to his great modern successor [Darwin]." Ogle, who despite his religious inclinations was nevertheless a strong proponent of Darwin's theories, did not agree with Aristotle's scientific theories – not least because Aristotle's teleological model of animal development, which had been adopted as a model by many post-classical Christian scientists and theologians for centuries, was dealt a serious blow by Darwin's theory of natural selection. So it is perhaps surprising to see Ogle produce a translation of one of Aristotle's major biological treatises. By looking at key passages of Aristotle and Ogle's translation, this paper will examine the reasons for Ogle's curious choice to publish his work, setting it into the wider scientific, and Darwinian, context of late-nineteenth century Britain, and explaining how Aristotle the teleologist was used by Ogle to re-enforce Darwin's position as a modern natural historian.

Keywords

Darwin, Aristotle, Natural History, History of Science, Biology

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The sole reference Darwin makes to Aristotle in *On the Origin of Species* is in a note added to the fourth edition, published in 1866 (seven years after the book's initial release), in which he mistakenly refers to Aristotle's summation of Empedocles' position at *Physica* II 8.198b, as Aristotle's own:

> Aristotle, in his 'Physics Auscultationes' (lib. 2, cap. 8, s. 2), after remarking that rain does not fall in order to make the com grow, any more than it falls to spoil the farmer's corn when threshed out of doors, applies the same argument to organisation; and adds (as translated by Mr. Clair Grace, who first pointed out the passage to me), "So what hinders the different parts [of the body] from having this merely accidental relation in nature? as the teeth, for example, grow by necessity, the front ones sharp, adapted for dividing, and the grinders flat, and serviceable for masticating the food; since they were not made for the sake of this, but it was the result of accident. And in like manner as to the other parts in which there appears to exist an adaptation to an end. Wheresoever, therefore, all things together (that is all the parts of one whole) happened like as if they were made for the sake of something, these were preserved, having been appropriately constituted by an internal spontaneity; and whatsoever things were not thus constituted, perished, and still perish." We here see the principle of natural selection shadowed forth, but how little Aristotle fully comprehended the principle is shown by his remarks on the formation of the teeth.[1]

But the very next sentence in the Greek demonstrates that Aristotle is *refuting* this position, not adopting it – he says that "it is impossible that this should really be the way of it. For all these phenomena and all natural things are either constant or normal, and this is contrary to the very meaning of luck or chance." The argument he cites here comes from Empedocles, who, like Darwin, rejected a teleological model of species development underpinned by intelligent design, though his model was driven by random chance rather than natural and sexual selection, as Darwin would have it.

Darwin's attention was drawn to this passage, as he notes, by a letter from Clair James Grece, not himself a scientist but a philologist whose interest must have been piqued by Darwin's *Origin of Species*. According to Darwin, "he was so kind as to send me translations of several passages in Greek authors bearing on Natural Selection",[2] which, Grece said, showed "that 'Natural Selection' was known to the ancients".[3] Sadly, we have lost this

[1] Darwin (1866) p. xiii.
[2] Darwin to John Murray, 31 December 1867. Darwin Correspondence Project (DCP) letter no. 5743.
[3] Grece to Darwin, 12 November 1866. DCP letter no. 5267.

original letter and the other passages Grece included in it. While it is clear that Darwin had not read the original text, in Greek or in English translation, Grece had – and felt compelled to share it with Darwin. Whether Grece also misread the passage in question, or Darwin just misunderstood his summation, we cannot say.

Regardless of the misidentification, Darwin would be right to see both Aristotle and Empedocles as his predecessors – for both were interested in the development of species, and Empedocles even attempted to put forward a theory of evolution. Even so, the footnote's mistake, whether Darwin's or not, was driven by Darwin's complete ignorance of ancient Greek natural history.[4] In a letter to schoolteacher and amateur naturalist J.A. Crawley in 1879, he declared: "I have forgotten the very little Greek which I once knew. Nor have I ever read, to my shame be it spoken, the works of Aristotle."[5] In the 'Historical Sketch' as it was first added to his *Origin of Species* at its third printing in 1861, his only reference to classical authors is to declare that he will be "passing over" them.[6] In 1838, when he was just back from his famous voyage on the *Beagle* and had already begun to formulate what would become his theory of natural selection, Darwin had written in a notebook "Read Aristotle to see whether any my views very ancient?"[7] – using the imperative and ending on a question-mark. But even so, it took him 44 years to get round to it, by which time Darwin was in the last months of his life.

The catalyst for finally reading Aristotle was his friend William Ogle, a minor scientist and physician, as well as committed evangelist, who nevertheless was a strong proponent of Darwin's theories. Ogle had been educated at Rugby under Thomas Arnold, and was a lifelong proponent of hospital and nursing reform, about which he corresponded with Florence Nightingale.[8] He wrote to Darwin in 1871 to thank him for sending him a copy of *Descent of Man*:

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[4] In *Descent of Man*, his work on sexual selection, Darwin wrote two of his footnotes in Latin to shield his readers from indelicacy. Not trusting in his unpractised Latin, however, he had to ask his son to check the translation (Dawson 2007, pp. 36-8).
[5] Darwin to J.A. Crawley, 12 February 1879. DCP letter no. 11875.
[6] Darwin (1861) p. xiii.
[7] Barrett et al. (1987) p. 325 c267.
[8] Wildman (2023).

which you have been so kind as to send to me, and many congratulations to you on having so successfully reached the end of another stage in your work. I need hardly say that I am greedily reading the book, not only with pleasure and admiration, like all the rest of the world, but with compelled assent, which I fear cannot be said equally of all your readers.[9]

The *Descent of Man*, which explicitly argued that humans had a common ancestor with apes, was by far the most controversial of Darwin's works,[10] so for Ogle to offer it "compelled assent" was no empty gesture.[11]

In 1882, Ogle published a translation of Aristotle's *De partibus animalium*, and it is in this edition that Charles Darwin first came to read Aristotle. Ogle sent Darwin a copy of the book upon publication, alongside a note which declared:

I feel some self-importance in thus being a kind of formal introducer of the father of Naturalists to his great modern successor. Could the meeting occur in the actual flesh, what a curious one it would be! I can fancy the old teleologist looking sideways and with no little suspicion at his successor, and much astounded to find that, while there was actually no copy of his own works in the house and while his views were looked on as mere matters of antiquarian curiosity, Democritus whom he thought to have effectually and everlastingly squashed, had come to life again in the man he saw before him! I have, however, such faith in Aristotle as a real honest hunter after truth, that I verily believe, that, when he had heard all you have to say on your side, he would have given in like a true man, and have burnt all his writings…[12]

This final sentiment is quite striking – Ogle, who had just gone to the effort of translating one of Aristotle's biological treatises, declaring that Aristotle himself would want to burn it upon meeting Darwin! But it can be explained through the distinction Ogle here makes between Democritus and Aristotle.

Ogle's dichotomy is intended to map onto contemporary battle-lines between materialists, with Darwin at their head, and on the other hand teleologists insisting on the active intervention of a creator. The very first line of Ogle's introduction states, "how came these adaptations about, is a question coeval, we may be sure, with the first recognition of the adaptations

[9] Ogle to Darwin, 25 February 1871. DCP letter no. 7514.
[10] Dawson (2007) pp. 26-81.
[11] On the difference between humans and non-human animals in Aristotle, see Labarrière (1984).
[12] Ogle to Darwin, 17 January 1882. DCP letter no. 13621.

themselves."[13] The demonstrative pronoun 'these' here, coming as it does without clear antecedent because this is the first line in the book, can only refer to the 'adaptations' currently being discussed at length in both academic and popular discourse – that is, debates about evolution, and whether Darwin's materialist explanation of it was accurate. Ogle follows by saying:

> The answers to it fell of old, as ever since, into two main divisions. One group of philosophers there was, who fancied that they found an adequate cause for the phenomena in the necessary operations of the inherent properties of matter; while another sought a solution in the intelligent action of a benevolent and foreseeing agent, whom they called God, or Nature, as the case might be.[14]

Aristotle, according to Ogle, falls into this latter camp, as his explanation of adaptation has nature as the operating force in a teleological model of change. Later Christian thinkers certainly did appropriate his views on gradualism into a theological model of evolution, by replacing 'Nature' with 'God'.[15] Meanwhile Democritus and Empedocles are Ogle's prime examples of the former division, though it is Darwin, says Ogle, who has perfected their ancient model. As we have seen, there is some truth in this, though Darwin was certainly not across all the details. In a footnote, Ogle sums up Empedocles' position then observes that "the relation in which the hypothesis stands to that of Darwin may thus be expressed; the old philosopher insists on the survival of the fit, Darwin on the survival of the fittest. What a vast difference underlies the apparent similarity in the introduction of a single short syllable scarcely needs to be pointed out."[16]

It is not a stretch of the imagination to think that Ogle, who was an expert on Aristotelian natural history and had pointed out relevant passages to Darwin himself in the past,[17] had spotted Darwin's mistake in falsely attributing Empedocles' explanation of the development of teeth to Aristotle, and meant, with this footnote, to provide a polite and oblique correction of his friend.

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[13] Ogle (1882) p. i.
[14] *Ibid*.
[15] For the definitive account of the history of this idea, see Lovejoy (1936).
[16] Ogle (1882) p. ii, 2n.
[17] Darwin to Ogle, 25 September 1875. DCP letter no. 10171.

So Ogle is interested in Aristotle's biology at least in part because of the way in which it can contextualise contemporary debates about evolution and Darwinism, and provide it with a classical lineage – if not necessarily back to Aristotle himself then to Empedocles. But why, if Ogle is a supporter of Darwin, translate a treatise he believes argues the opposing side? Ogle makes clear that Aristotle was wrong[18] – yet values Aristotle not so much for his argument, but for the scientific method which he developed:

> By the skilful use of scientific method to discover new truths is a noble achievement; but far nobler is it to discover the method itself, by which alone such achievements are made possible; and to have done this is Aristotle's glory. That the method as left by him was not perfect, that there were flaws which the fuller experience of after-ages detected, and gradually remedied, may be allowed… To detect and strengthen these is to confer a benefit on mankind; but is a service which can never be put on a par with that rendered by the original conception.[19]

This empiricism – improved on by Darwin, but founded by Aristotle – was what had made Darwin's theory of evolution so convincing, supported as it was by years of carefully collected observations of the natural world.[20] And it is something Ogle strives to emphasise in Aristotle's scientific method too, which is why he endlessly reasserts that Aristotle carried out dissections, including probably of human foetuses.[21] We are reminded of Ogle's claim in his letter to

[18] Ogle's presentation of a dichotomy between Aristotelian teleology and Darwinian materialism was shaped by contemporary debates about Darwinism; more recent scientific thought has highlighted how evolution is at least partially an Aristotelian teleological process, driven by natural biological systems. "The major importance of natural genetic engineering is that this capability removes the process of genome restructuring from the stochastic realm of physical-chemical insults to DNA and replication accidents. Instead, cellular systems for DNA change place the genetic basis for long-term evolutionary adaptation in the context of cell biology where it is subject to cellular control regimes and their computational capabilities" (Shapiro 2002, p. 747). Teleology isn't necessarily at odds with materialism. See also, Jablonka and Ginsburg (2013); Ginsburg and Jablonka (2015); for the historical view, McDonough (2020).

[19] Ogle (1882) p. xix.

[20] On Aristotle's scientific method and how it is represented in *De partibus animalium* 1, see Leunissen (2010) pp. 76-81; Lang (2019) pp. 57-64.

[21] E.g. Ogle (1882) pp. 149, 165, 210, 212f. Aristotle describes observing miscarried embryos at *Hist. anim.* 583b. Bubb notes with some scepticism that "the small size of human fetuses and neonates – and all the more so those aborted or miscarried early in gestation […] – suggests that any fetal dissection that Aristotle might have engaged in would have remained mostly at the level of gross anatomy, allowing him simply to confirm or modify in a

Darwin – that upon presentation of Darwinian evidence, Aristotle, the great empiricist, would have no choice but to acquiesce and burn all his writings.

Moreover, Ogle sees in Aristotle a fellow natural historian, and one whose passion for the subject bridges the more than two thousand years separating them. Aristotle's defence of his interest in natural history – offering an answer to Plato's emphasis on the human soul above all else – is given early on in the treatise:

> Every realm of nature is marvellous: and as Heraclitus, when the strangers who came to visit him found him warming himself at the furnace in the kitchen, is reported to have bidden them not to be afraid to enter, as even in that kitchen divinities were present, so we should venture on the study of every kind of animal without distaste; for each and all will reveal to us something natural and something beautiful. Absence of hap-hazard and conduciveness of everything to an end are to be found in Nature's works in the highest degree, and the resultant end of her generations and combinations is a form of the beautiful.[22]

Reading that, it is clear why a nineteenth-century natural historian would feel a connection to Aristotle, despite differing views on the primacy of form or function.

That Ogle chose to put forward his argument for the longevity of the scientific method, and Darwin's exemplary position at its head, through the translation of an ancient Greek treatise may be a little idiosyncratic. But "Victorians located science in many places, not just in the laboratory [...] large and small public lectures and scientific demonstrations, textbooks, atlases, dozens of popular magazines and pamphlets, and even the literature of science fiction provided hosts of learners with insights into the discoveries of science."[23] Why not in classical literature too? Late Victorian society still held up "antiquity as an exemplary standard, something of permanent and general value able to resist the corrosions of change and relativity"[24] – so that

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general way the parallels that he had drawn from animal subjects" (Bubb 2022, p. 30). Le Blond, meanwhile, argues that Aristotle's "study of the development of the [human] embryo is truly extraordinary and could only have been completed with the help of a microscope" (Le Blond 1945, p. 25)! See also Lennox (2018); Crivellato and Ribatti (2007).

[22] *De part. anim.* 645a = Ogle (1882) p. 17.

[23] Gates (1997) p. 179.

[24] Stray (1996) p. 77.

Aristotle could still be expected to carry intellectual and rhetorical weight in support of Ogle's model of science.

Indeed, for all its antiquity, *De partibus animalium* must have struck Ogle as strikingly contemporary. Aristotle's interest in categorising animals (fig. 1), although taking up only the first part of the book and by no means "systemic",[25] really was the intellectual forefather of Linnaeus' programme of taxonomy, "one of the quintessential achievements of modern science."[26] "One of the striking features of Ogle's Introduction", remarks Gotthelf, "especially to a 19th century reader, is the fresh sense it gives of the breadth – the immensity – of Aristotle's undertaking, and of the way he has brought an incredible mass of data under theoretical control."[27] And that Aristotle does not appear to really reach a conclusion to his own satisfaction in the work, also may have appealed to Ogle's sense of the progressiveness of science, as much as it also frustrated him. Aristotle's enquiry sets himself out as the direct ancestor of the nineteenth-century natural philosopher, while his inability to answer the many questions he raises simultaneously legitimises his descendants.

i. Sanguineous Animals [*Vertebrata*].		
A. Vivipara [*Mammalia*].		1. Man.
		2. Quadrupeds.
		3. Cetacea.
B. Ovipara.		
α. With perfect ovum.		4. Birds.
		5. Quadrupeds and Apoda [*Reptiles and Amphibia.*]
β. With imperfect ovum.		6. Fishes.
ii. Bloodless Animals [*Invertebrata*].		
α. With imperfect ovum.		7. Malacia [*Cephalopods*].
		8. Malacostraca [*Crustacea*].
β. With scolex.		9. Insecta [*Remaining Arthropoda and some Vermes.*]
γ. With generative slime; buds; or spontaneous generation.		10. Ostracoderma or Testacea [*Mollusca excepting Cephalopods*].
δ. With spontaneous generation only.		11. [*Zoophytes.*]

Fig. 1: Aristotle's "main groups of animals", as set out by Ogle (1882) p. xxxiii.

[25] Ogle (1882) p. xxi.
[26] Ritvo (1997) p. 335. On the influence of Aristotle on debates over the categorisation of plants before Linnaeus, see Larson (1971) pp. 1-49; Aristotle's taxonomy is discussed in an extensive footnote, 22-4. See also Pellegrin (1986) p. 58f.
[27] Gotthelf (1999) p. 21.

At the same time, Ogle's temptation to read too much into Aristotle skates over the many places where, as far as modern biology is concerned, Aristotle is wholly ignorant. At times, one sees how hard Ogle must fight to make Aristotle's natural history seem intellectually contiguous with nineteenth-century science. So the ground-breaking work of Linnaeus to categorise animals is given more precedence in Aristotle's own categorisation than warranted, through careful translation. In an early footnote, Ogle notes that while Aristotle's term εἶδος is "practically defined" and "scarcely differs from that of Cuvier", justifying its translation as species,[28] the definition of γένος in Aristotle is harder to map onto Linnaean taxonomy; Ogle says "it may mean any natural group of animals larger than a species and not larger than a class".[29] (An example of a 'class' would be – mammal). In fact, Aristotle "is very far from adhering strictly to this definition of genus. He uses the term in the most lax manner to express any group however large and however small."[30] One can detect the note of frustration in Ogle – though we should not be surprised that Aristotle's language fits improperly onto Linnaean taxonomy, given it predates it by 2,000 years. His understanding of and interest in natural history was fundamentally different, and *De partibus animalium* is only circumstantially a book about taxonomy. Ogle, nevertheless chaffed by Aristotle's lack of Linnaean foresight, endeavours to correct Aristotle's shortcomings – and translates γένος "variously – genus – order – tribe – class – natural group – kind, etc., as seemed most convenient in each separate case."[31] The significant effect of this can be seen at 644b. I have given the Greek, A.L. Peck's Loeb translation and Ogle's own:

σχεδὸν δὲ τοῖς σχήμασι τῶν μορίων καὶ τοῦ σώματος ὅλου, ἐὰν ὁμοιότητα ἔχωσιν, ὥρισται τὰ γένη, οἷον τὸ τῶν ὀρνίθων γένος πρὸς αὐτὸ πέπονθε καὶ τὸ τῶν ἰχθύων καὶ τὰ μαλάκιά τε καὶ τὰ ὄστρεια.

[28] *Ibid*. p. 141.
[29] *Ibid*.
[30] *Ibid*. p. 142.
[31] *Ibid*.

Peck
Now it is practically by resemblance of the shapes of their parts, or of their whole body, that the groups are marked off from each other: as e.g. the groups Birds, Fishes, Cephalopods, Testacea.

Ogle
It is generally similarity in the shape of particular organs, or of the whole body, that has determined the formation of the larger groups. It is in virtue of such a similarity that Birds, Fishes, Cephalopoda, and Testacea have been made to form each a separate class.[32]

(Testacea was the Linnaean name for what Aristotle simply labels "bivalves", as they are indeed now classed.) Where Peck translates γένος as "group", capturing Aristotle's ambiguity, Ogle has translated it first as "larger groups" and then as "class", the correct Linnaean term – presumably as a back-formation, because the examples Aristotle proceeds to give are all identifiable with Linnaean classes. He is trying to neaten up Aristotle and bring him in line with nineteenth-century taxonomic terminology.[33]

Throughout his translation and the copious notes that accompany them, Ogle works hard to tie Aristotle to Darwinism too, sometimes through the continuity of ideas and sometimes through the continuity of the scientific method. He is not always subtle about it. When Aristotle is explaining why he has chosen to focus on the physiology of animals rather than their development, Ogle makes a telling translation choice:

δεῖ δὲ μὴ λεληθέναι καὶ πότερον προσήκει λέγειν, ὥσπερ οἱ πρότερον ἐποιοῦντο τὴν θεωρίαν, πῶς ἕκαστον γίνεσθαι πέφυκε μᾶλλον ἢ πῶς ἔστιν. οὐ γάρ τι μικρὸν διαφέρει τοῦτο ἐκείνου. ἔοικε δ' ἐντεῦθεν ἀρκτέον εἶναι (καθάπερ καὶ πρότερον εἴπομεν, ὅτι πρῶτον τὰ φαινόμενα ληπτέον περὶ ἕκαστον γένος, εἶθ' οὕτω τὰς αἰτίας τούτων λεκτέον) καὶ περὶ γενέσεως [...] ἡ γὰρ γένεσις ἕνεκα τῆς οὐσίας ἐστίν, ἀλλ' οὐχ ἡ οὐσία ἕνεκα τῆς γενέσεως.

[32] *De part. anim*. 644b = Ogle (1882) pp. 15-6.
[33] Ogle is completely correct when he highlights the difficulty in pinning down a single meaning for γένος in Aristotle, certainly one which aligns to a specific theory of taxonomy. This is because in Aristotle's biological treatises "there is no classification scheme in the background, and all attempts to construct one for Aristotle have failed" (Balme 1962, p. 85). This includes, of course, the taxonomic system Ogle draws up from *De part. anim*. (fig. 1). See also Pellegrin (1986) pp. 58-61. My interest here is not so much in what Aristotle may actually mean by γένος and εἶδος, however, but what Ogle is trying to *make* him mean.

Peck
We must also decide whether we are to discuss the processes by which each animal comes to be formed – which is what the earlier philosophers studied – or rather the animal as it actually is. Obviously there is a considerable difference between the two methods. I said earlier that we ought first to take the phenomena that are observed in each group, and then go on to state their causes. This applies just as much to the subject of the process of formation [...] the process is for the sake of the actual thing, the thing is not for the sake of the process.

Ogle
Another matter which must not be passed over without consideration is, whether the proper subject of our exposition is that which the ancient writers concerned themselves, namely, what is the process of formation of each animal; or whether it is not rather, what are the characters of a given creature when formed. For there is no small difference between these two views. The best course appears to be that we should follow the method already mentioned, and begin with the phenomena presented by each group of animals, and, when this is done, proceed afterwards to state the causes of the phenomena, *and to deal with their evolution* [...] *For the process of evolution is for the sake of the thing finally evolved*, and not this for the sake of the process.[34]

Aristotle says that when we have finished looking at what an animal's form is, we can ask how it came to be in that form – its γένεσις. For the process of its development (again, γένεσις) exists to furnish its form, rather than its form being predicated upon the process of development. Ogle chooses to translate γένεσις as "evolution" or "process of evolution", and notably in the last sentence even renders ἡ οὐσία as "the thing finally evolved" – but that is clearly not what Aristotle meant. He was not talking about the development of a species over time, but at a fixed point of development – the development of a foetus into a person rather than the development of *Homo sapiens* over millennia. For Aristotle, "the question of the origins of life, animals and humans did arise, but as a problem involving a single-generation beginning rather than a continuing process [...] The question of whether species have changed was not posed."[35] Ogle must have known he was stretching the definition of γένεσις to the point of mistranslation here. As it was, Darwin "was famously reluctant to use the term [evolution] (it does not appear at all in the *Origin*)",[36] but it was nevertheless attached to him and fairly swiftly

[34] *De part. anim*. 640a = Ogle (1882) p. 3f. Emphasis mine.
[35] Lang (2019) p. 36.
[36] Gribbin and Gribbin (2020) p. 34.

became almost synonymous with Darwinism.[37] I am not suggesting that Ogle was conflating Aristotelian teleology with anti-teleological Darwinism – but he *was* putting the ideas together and presenting them as competing theories of evolution, which Aristotle's certainly is not. This ability to connect Aristotle to Darwin was aided substantially by the fluidity of what Darwinism actually meant in the popular consciousness of late-nineteenth century Britain.[38] Although Ogle never substantially mischaracterises Darwin's theories or endorses Aristotle's teleological model, other biologists and public voices *were* actively mischaracterising Darwin and arguing in favour of teleological evolution, so that Darwin could indeed be made, somehow, to support Aristotle. In this context, Ogle's project does not look as unexpected.

Ogle's attempts to put Darwin in conversation with Aristotle are best exemplified in his copious notes. In a discussion about teeth, Aristotle notes that:

> Nature allots each weapon, offensive or defensive, to those animals alone that can use it; or, if not to them alone, to them in a more marked degree; and she allots it in its most perfect state to those that can use it best; and this whether it be a sting, or a spur, or horns, or tusks, or what it may of a like kind. Thus as males are stronger and more choleric than females, it is in males alone that such parts as those just mentioned are found, or at any rate it is in males that they are found in the highest degree of perfection.[39]

The footnote of this section approves of Aristotle's observation, but replaces Aristotle's teleological explanation – Nature has formed the teeth as offensive or defensive weapons according to the function required by each animal, and differently according to sex – with Darwin's theory of sexual selection:

> ... it is more probable that both weapons and temperament are attributable to one common cause; and what that cause is Darwin has shown in his work on sexual selection. The males contend with each other for the females, and such males as chance variation has endowed

[37] Thomas Huxley, 'Darwin's bulldog' and populariser of Darwinism, was slow to accept all of the mechanisms behind Darwin's theory. In his 1880 work *The Crayfish: An Introduction to the Study of Biology*, "he pushed his readers to accept evolution but never discussed the role of natural selection" (Lightman 2010, p. 10). Although later in life he did draw more of a distinction between evolution and Darwinism (Moore 1991, pp. 353-5), by then the popular conception of Darwinism as, if not the only, certainly the foremost model of evolution had well-and-truly been established.

[38] Moore (1991).

[39] *De part. anim*. 661b = Ogle (1882) p. 58.

with a slightly stronger weapon or slightly stouter heart will as a rule prevail in the struggle; and, obtaining preferential possession of the females, will leave offspring in greater numbers than their less favoured competition. Of this offspring some will inherit the physical and moral advantages of their sires. Of these again the best-armed and the most valiant will be most successful in propagating their kind; and so on, generation after generation, the comparatively weakly and cowardly being eliminated at each stage of improvement.[40]

This is a neat summation of Darwin's theory, evidenced by an observation taken from Aristotle but used to correct Aristotle's incorrect conclusion. (And by the way, Darwin's theory of sexual selection, as set out in *Descent of Man*, is somewhat distinct from his theory of natural selection, though the two are interconnected and often conflated.) Again, by the very fact that Ogle chose to make this point in a footnote about teeth, we might see this as another polite and oblique correction to Darwin's incorrect footnote from the *Origin of Species*.

When Aristotle states that "the large size and great branching of [deer's] horns makes these a source of detriment rather than of profit to their possessors",[41] Ogle comments that "it is somewhat astounding to find so determined a teleologist suddenly declaring that antlers are not merely useless but injurious to stags" before reflecting that "their great size and branching serve however as ornaments, and so give an advantage in the sexual struggle" – citing Darwin in the process.[42] To support Aristotle's assertion that animals are never provided with more than one means of defence, Ogle quotes Darwin's similar, albeit more equivocal, statement that "very few male quadrupeds have weapons of two distinct kinds specially adapted for fighting with rival males".[43]

But Ogle is not only interested in connecting Aristotle's works to Darwin. His footnotes are full of references to dozens of eighteenth- and nineteenth-century biologists from Britain and across Europe, tying Aristotle's observations into contemporary debates about natural history. When Aristotle makes a brief observation about the mouth of cephalopods,[44] Ogle takes the opportunity to comment that Aristotle's "account of the anatomy and

[40] Ogle (1882) p. 187
[41] *De part. anim.* 663a = Ogle (1882) p. 61.
[42] Ogle (1882) p. 189.
[43] Darwin (1871) p. 257.
[44] *De part. anim.* 679a = Ogle (1882) p. 98.

habits of the Cephalopods has received a tribute of praise from many writers. 'Respecting the living habits of the Cephalopods,' says Owen, 'Aristotle is more rich in detail than any other zoological author, and Cuvier has justly observed that his knowledge of this class, both zoological and anatomical, is truly astonishing'".[45] Ogle is therefore not only eager to praise Aristotle himself, but also acknowledge the praise of two of the greats of modern biology, the French naturalist Georges Cuvier (1769-1832), who first proved that animals can go extinct, and Sir Richard Owen (1804-1892), most famous now for his bitter opposition to Darwin's theories but a celebrated palaeontologist and naturalist in his own right. (He also coined the word 'dinosaur'.) Quoting Owen quoting Cuvier has the nice effect of making the praise of Aristotle seem all the more universal – for if two of the most significant and celebrated biologists saw Aristotle as their equal, so surely must the entire academy.

When faced with one of Aristotle's errors, Ogle variously adopts three different strategies. If he resolves to simply dispute Aristotle, he does so briefly and matter-of-factly; thus, when Aristotle asserts that "vision is so placed [in the head] in all animals",[46] Ogle merely comments, "not so" before citing starfish and scallops, which both have eyes elsewhere.[47] When Aristotle states that rennet is found in ruminants' third stomach,[48] Ogle simply states: "This is erroneous. It is the fourth stomach that gives rennet".[49]

More frequently, Ogle will go to pains to explain that, while Aristotle was wrong, he had good cause for thinking as he did, and is not therefore to be overly criticised. So when discussing Aristotle's brief mention of how the body causes motion, which Aristotle ascribed to the contraction of various sinews by the heart, thereby ignoring both muscles and nerves, Ogle remarks:

> Of the contractility of muscular tissue he knew nothing; though it is impossible to suppose that he did not know that what we call a muscle swelled up, becoming shorter, and broader, during action [...] That he himself felt how unsatisfactory [his explanation] was, we may infer from his saying so very little on the subject, notwithstanding its importance. We must remember, moreover, that, while nerves were still undiscovered, no explanation of voluntary

[45] Ogle (1882) p. 220f.
[46] *De part. anim.* 656b = Ogle (1882) p. 44.
[47] Ogle (1882) p. 174.
[48] *De part. anim.* 676a = Ogle (1882) p. 91.
[49] Ogle (1882) p. 217.

motion was possible. A. had to find some anatomical machinery connecting the tendons, which were clearly the immediate agents that acted on the bones, with the volitional centre, which he took as we know to be the heart and not the brain. He could find no other continuous substance between these two, than some or other kind of fibrous tissue, in the form either of tendinous fibre or of arterial wall. This therefore he assumed to be the intermediate agent, no other being apparently forthcoming.[50]

From the evidence at his disposal, Ogle argues, Aristotle made a perfectly logical, albeit wrong, inference.

Occasionally, Ogle works hard to explain how, in actual fact, Aristotle was not wide of the mark at all. So for example, Aristotle argues that "nutriment in all cases consists of fluid and solid substances, and [...] it is by the force of heat that these are concocted and changed".[51] Ogle defends this by noting that, "although we have now learnt that digestion is due to the action of gastric and other juices, yet it is no less certain that heat is not without considerable influence on the process."[52] This is very generous to Aristotle, for whom heat was not only influential but the active agent in digestion.

How did Darwin respond to all this? Well, he sent an initial reply to Ogle's letter containing the translation the very same day, thanking him for the gift but sounding decidedly sceptical about Aristotle: "I suspect that your Introduction will interest me more than the text, notwithstanding that he was such a wonderful old fellow",[53] he wrote. Nevertheless, a month later, Darwin had actually read the introduction as well as a good chunk of the translation besides. He now replied, unsolicited, with another note, praising Ogle in the highest:

You must let me thank you for the pleasure which the Introduction to the Aristotle book has given me. I have rarely read anything which has interested me more; though I have not read as yet more than a quarter of the book proper. From quotations which I had seen I had a high notion of Aristotle's merits, but I had not the most remote notion what a wonderful man he was. Linnæus & Cuvier have been my two Gods, though in very different ways, but they were mere school-boys to old Aristotle. – How very curious, also, his ignorance on some points as on muscles as to means of movement. – I am glad that you have explained in so probable a manner some of the grossest mistakes attributed to

[50] *Ibid*. p. 197.
[51] *De part. anim*. 650a = Ogle (1882) p. 28.
[52] Ogle (1882) p. 159.
[53] Darwin to Ogle, 17 January 1882. DCP letter no. 13622.

him. I never realised before reading your book to what an enormous summation of labour we owe even our common knowledge.[54]

So Ogle's message on the importance of empiricism in biology, and its foundation with Aristotle, was quite accepted by at least one contemporary reader – by Charles Darwin, himself. Although Darwin was aware of Aristotle's mistakes, he praised Ogle's approach to "explaining" them. Ogle's mission in translating *De partibus animalium* was to establish a place for Aristotle in the pantheon of natural historians, while also creating a noble ancestry for Darwin's own scientific endeavours – with Darwin's firm approval of Ogle's translation, it would seem he was successful on both counts.

Lightman has suggested that "Darwin must have been constantly disappointed by the way in which prominent populizers – even his friends – presented his theory. Evolution was rarely popularized in ways that reflected Darwin's major contribution to biology, his theory of natural selection."[55] If that be so, he may have recognised his legacy was on safer grounds with Ogle – who never quite made Aristotle or Empedocles into Darwinians, but rather presented them as interlocutors within a distinctly modern discipline defined by Darwinism. They could both be safely wrong, because they were, of course, writing right at the birth of biology as a discipline – but they provided the subject with a continuity and illustriously ancient interlocutors which reinforced both biology as a whole, and Darwin in particular. Darwin, in turn, could take pride that he was standing on the shoulder of such giants. In Ogle's work, it could be made clear – what Empedocles and Aristotle had started, Darwin perfected.

[54] Darwin to Ogle, 22 February 1882. DCP letter no. 13697. For a comprehensive account of these two letters to Ogle, see Gotthelf (1999) pp. 3-30.
[55] Lightman (2010) p. 6.

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