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# **The Mathematics of Evolutionary Biology - Implications for Ethics, Teleology and 'Natural Theology' Transcript**

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**The Mathematics of Evolutionary Biology -  
Implications for Ethics, Teleology and 'Natural Theology'**

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**Introduction**

It is a very great honour to be invited to give tonight's Boyle lecture, and I want to start by thanking those who have invited me, and especially Michael Byrne who has so graciously steered me through all the practicalities in advance of this event, under the aegis of the Advisory Board chaired by Lord Cork and Orrery. I am of course also delighted to thank the Rector of St Mary-Le-Bow, George R. Bush, for allowing me to stand thus tonight in his sanctuary and declaim to you. And finally I am particularly indebted to Professor Christopher Insole for agreeing to come all the way from Durham to respond to me: I can think of no one in this country whose criticism I would more gratefully crave, and I am certain that I (and we all of us) are going to learn from his response.

As Professor John Hedley Brooke brought to your attention in his own fine Boyle Lecture of 2010, Robert Boyle's particular concern in his own day was with the dangers of a form of emerging modern science that might seek to disjoin profoundly significant philosophical and theological questions from its own undertakings. *Plus ça change, plus c'est la même chose*, we might say: Boyle's insights were, and remain, remarkably prescient of intensifying contemporary problems in the interface between science, philosophy and theology. Thus in what follows tonight I want to focus on one particular realm of contemporary science (evolutionary biology) in which a sustained attempt has indeed been made in recent decades to present 'secular science' as if it came unproblematically front-loaded with particular ethical and cultural meanings.

Yet many critical philosophers and theologians would strongly contest these presumptions. I speak here of the contested arena of evolutionary 'cooperation', so-called, and how to explain it - that is, what it *means*, scientifically, ethically, philosophically, even theologically. This will be the central focus of tonight's presentation. As we shall see, the reason this topic has become a lightning rod of theoretical contention in recent decades is that, on one rendition, the phenomenon of cooperation precisely supports the 'selfish gene' ideology that has so dominated secular philosophy of biology of late; whereas on another rendition, it threatens that ideology at its core. Much is therefore at stake.

Let me state in anticipation how my lecture will unfold tonight. I shall proceed in three major moves, corresponding to the three sections of the paper.

First, I shall provide as clear but as accessible an account as I am able of what evolutionary 'cooperation' *is*, and why its explanation by a new generation of mathematical biologists (those who chart the regularities of evolutionary 'strategies' on a mathematical calculus of probability) have come into contestation over whether all such cooperation is explicable in terms simply of individual genetic advantage. The theoretical conundrum here has not only split mathematical and empirical biologists of late, but also divided factions within each of these communities; at base, then, there is a meaning-making impasse, arising from a set of significant questions which - I shall argue - demand *philosophical* interrogation, a probing to what the philosopher R. G. Collingwood once called the 'absolute presuppositions' of the theoreticians involved. And this is tricky, because often such 'absolute presuppositions' are not completely out in the open, and may even be unconsciously presumed - though with passion! Hence arise what I have called the current 'paroxysms' in this arena of scientific debate.

Secondly, I shall then move to some of the major philosophical issues we have uncovered. These involve debates about *ethics* on the one hand (what 'cooperation' bespeaks as a potential 'hard-wiring' for human ethical behaviours and principles), and *metaphysics* on the other (what 'cooperation' may tell us about the fundamental patternings and processes of evolution: what constitutes their fundamental state of 'being' and 'becoming'). Needless to say these are no less contested arenas of debate than those at the first level of explanatory theory; but once again, I shall dare to suggest to you that some of the richest recent developments in the understanding of 'cooperation' actually march philosophically *against* what has in recent decades become a sort of 'orthodoxy' in evolutionary theory: viz., that 'ethics' as a subject is fundamentally reducible to genetic determinism and the propulsions of genetic 'selfishness'; and that the 'metaphysics' of evolution is a matter of pure randomness, an arena vacated of any intrinsic meaning or purpose.

Thirdly, and if I have convinced you thus far, I shall end with a sketch of how I perceive 'natural theology' as a crucially important and continuing cultural project in the face of contemporary scientific debates such as this. In order to make this case I shall of course have to define (indeed re-define) 'natural theology' rather carefully in order to stave off certain false expectations. Most of you will know from earlier Boyle lectures (especially last year's insightful presentation by Russell Re Manning) that the term 'natural theology' has accrued a bewildering range of possible meanings in the classic and modern periods; and even the most famous book of that name, *Natural Theology*, by William Paley, which so entranced Darwin in his younger years, is often misunderstood as

to its original intention and force. What I most certainly do not want to argue under this rubric of 'natural theology' is that one could move from 'evidences' about cooperation in evolution (as purveyed within a secular scientific discourse often already propelled underlyingly by atheistic presumptions), to an unproblematic public demonstration of God's existence. That would be a foolhardy ambition indeed. And actually, that particular hard-nosed construal of 'natural theology' is itself a sort of modern chimera, as many before me have commented. But even in the brilliantly-adjusted version of that modern ambition which focuses on *induction* and *probabilities* rather than strict deductive force (I am thinking of course here of the magisterial work of Richard Swinburne), there are problems about how to 'tot up' the probabilities at the end of the game; and that takes us straight back into the realm of what existing beliefs and presumptions are being brought to the table by the contestants in the first place (I shall come back to that issue briefly at the end of this lecture).

However, I do not want to fall back, either, on the much weaker theological alternative to such inductive arguments which is often assumed to be the only credible default contemporary position left for 'natural theology' now: that is, a preferential (and thus entirely optional) Christian *interpretation* of evolution from an already-presumed basis in systematic theology and revelation. My proposed alternative, as we shall see, attempts to escape between the horns of these dilemmas, by essaying a subtler and third alternative which focuses on what crucial shifts may happen *in the knowing subject* precisely in ruminating on the idea of evolution-as-whole, and especially through the lens of debate about the mysterious phenomenon of cooperation.

This involves not just a survey of the scientific evidences for cooperation, and then a deeper and necessary probing of the possible philosophical implications of its meaning. For it finally calls forth, I shall argue, a *special* kind of perusal of the 'whole', one in which spiritual as well as ethical decisions and commitments are entertained and educed. It is in this sense that I shall argue we may most fruitfully speak of 'natural theology' today: it has a particular role in this contemplative cultivation of what I call 'spiritual sensation'.

Now in order to effect these three major moves within the space of a short lecture, I am going to have to move not only deftly but with a certain daring boldness for which I ask forgiveness in advance. I shall then leave it to my kindly interlocutor to expose the inevitable weaknesses and lacunae that may remain in what I have attempted.

## **I: Why Evolutionary Cooperation Matters**

We must be extremely careful, first, to be clear what we *mean* by 'cooperation' in the evolutionary context. The scientific and philosophical literature, even now, is littered with confusion about its precise definition and its relation to 'altruism' (with which it is often identified); and this semantic confusion greatly exacerbates the already-contentious theoretic debates about its explanation and significance. There is also more general confusion caused when 'cooperation' is used too loosely and colloquially, to mean merely 'collaboration' between different individuals with mutual benefit. For in evolutionary populations such 'mutualism' clearly furthers the fitness of both parties, and thus its perdurance is not difficult to explain; whereas the same is not true of cooperation. So what precisely *is* 'cooperation', then, and why is it so puzzling to the theoreticians?

A decent (accessible) rendition, which is made the more precise when provided with mathematical formulation, runs thus: *'cooperation' is the phenomenon* (encountered right across the evolutionary spectrum, from micro-organisms to humans), *in which one entity within an evolutionary population suffers loss of 'fitness', and another correlatively gains 'fitness'*. In other words, this phenomenon represents a calculus of *gain through loss* - what we might in more theologically-laden terms call *productive 'sacrifice'*. Notice, however, and by way of immediate caution, that there is nothing in this initial definition that says anything about *intentionality*: cooperation is simply an evolutionary phenomenon that *happens* in various forms; and that is what is so interesting and puzzling, since the 'selfish gene' world-view would suggest that such manifestations of 'unselfishness' would naturally be screened out in the processes of evolutionary selection. The fact that cooperation is *not* screened out, but in fact stabilizes naturally in various circumstances in a continuous dance with its opposite, 'defection' (that is, direct individual 'selfishness', which seems so much more expectable), is what requires theoretical explanation.

But let us not abandon the issue of 'intentionality', either; since in humans and some of the higher mammals this becomes an especially interesting empirical *additum* to the more generic phenomenon of 'cooperation', as just defined. That is why I prefer to distinguish 'cooperation' in general from 'altruism' as a subset of it, in which there is an *intentional surrendering of fitness by one individual or set of individuals in an evolutionary population for the sake of, or out of love or regard for, another or others*. To engage in 'altruism', so defined, will therefore require a level of consciousness, will, and at least rudimentary beliefs, to qualify; and thus the question of what species other than the human are also capable of 'altruism', so defined, as opposed to unmotivated 'cooperation' more generally, is another issue currently under debate.

Why then has giving an account of cooperation become so 'paroxysmic' of late for empirical and mathematical biologists? The answer lies in the debate about what 'causes' it, and how to 'explain' it (and much hangs here on the technical parsing of these key philosophical notions). But it is the mathematical modelling of evolutionary processes which has proved so fruitful in the last decades in giving a precise account of the surprising prevalence and significance of 'cooperation' alongside 'defection' in evolutionary populations. The big question here is how the basic movements of mutation and selection in evolution are conjoined with cooperation and defection to 'structure' evolutionary processes. To put it simply and briefly (drawing on an important survey article by the Harvard mathematical biologist, Martin A. Nowak, with whom I have myself collaborated for some

years), there are at least four or five explanatory circumstances which have now been identified by mathematical biologists as yielding sustained forms of cooperation when we would not, *prima facie*, expect it.

The first 'rule' for cooperation (as Nowak puts it) is the basic one, but also the one where most of the current drama and disagreement is being played out, since much depends on how it is accounted for mathematically. The last, the fifth, is an explanatory model for cooperation which many evolutionary biologists of this generation still suspect is bogus, because it moves beyond an individual fitness calculus to a group one. To anticipate: one's view on the mathematical frame of the first explanation will tend to be rather closely connected to whether one sees force in the fifth one at all.

So let me now run quickly through these 'five rules'. The first rule, commonly known as 'kin selection', or 'inclusive fitness', explains 'cooperation' in terms of the benefits accrued not to the co-operator itself (who takes the fitness 'loss', of course) but to its genetic relatives, thus ensuring that individual genetic 'advantage' (aka 'selfishness') still does in a sense endure, though via genetic relatives. Following the original insights on this phenomenon by J. B. Haldane, it was William Hamilton who later attempted to formalize this first cooperative mechanism mathematically (whereby the co-efficient of 'relatedness' must exceed the 'cost' of cooperation over the 'benefit' of cooperation). And this came to be called 'Hamilton's rule', a formula which Nowak and E.O. Wilson and a younger mathematician colleague, Corina Tarnita, have more recently and contentiously challenged as to its mathematical efficacy. (E.O. Wilson thereby effected a dramatic theoretical *volte face* in the process, having been for years one of the prime defenders of 'inclusive fitness' theory.)

*But note that Nowak and colleagues do not now challenge thereby the importance of kin, as such, as a key factor in the evolving of cooperation. As any empirical biologist will testify of work in the field, the vast majority of cases of cooperation are witnessed in genetic relations, whether close or remote: that is not a contentious issue as such. The problem is that in our generation whole academic careers have been built on the particular mathematical force of Hamilton's rule, along with a set of more hidden philosophical presumptions that have tended to come with it. I shall comment on those shortly. (To put it a little contentiously we might say that for many such biologists, Hamilton's rule has been the key unifying 'story' of their research, a fulcrum of meaning which has in effect replaced the holistic interpretation of nature supplied in much earlier generations by classic 'natural theology'.)*

The second, third and fourth 'rules' for cooperation are in a way intriguing variants on the first, but do not intrinsically *require* genetic relatedness in the same way as the first. The second rule, 'direct reciprocity', originally investigated by Robert Trivers, urges that if one individual cooperates, another might in due course be drawn to cooperate too; and such might extend a chain of 'imitative' cooperation to some mutual benefit, at least for a while until defection breaks in once more. Even then, a so-called 'forgiving' strategy may help to re-establish chains of cooperation.

The third rule, 'indirect reciprocity' (originally explored with particular insight by Nowak and his teacher Karl Sigmund), applies principally in the human realm, although conceivably a rudimentary form of it can also be efficacious in higher mammals in the absence of specifically human language. Here, one cooperates with another whom s/he may never meet again, but the behaviour is observed by *others* and eventually evolutionarily rewarded because of that: natural selection thus turns out to favour strategies that base the option to cooperate on the 'reputation' of the recipient. Once human language is in play, this mechanism is particularly effective: reputations spread by gossip and innuendo. As the Harvard biologist David Haig has put it, 'For direct reciprocity you need a face; for indirect reciprocity you need a name'.

A fourth circumstance in which cooperation can win out occurs in what is now called 'spatial selection' (sometimes called 'network reciprocity'), in which defection does not naturally dominate as in well-mixed populations, because individual co-operators here form *clusters* which protect and enhance the success of their cooperation. It turns out that one can graph such clusterings of cooperation, and that a surprisingly simple rule determines whether 'network reciprocity' will *favour* cooperation: the benefit-to-cost ratio in fitness terms must exceed the average number of neighbours per individual in the 'cluster'.

*It is with Nowak's so-called 'fifth' rule, however ('group selection'), that disputation sets in again with force. Here it is hypothesized that the focus on the individual co-operator or defector must give way to a group analysis, for even in the fourth 'rule' the so-called 'clusterings' involved still fundamentally relate to a competition between individuals. In 'group selection', however, the group is the explanatory unit, not the individual. This is the phenomenon on which Darwin himself had such a notable and prescient intuition in his late work, *The Descent of Man*. As he put it there (explicitly using the language of 'sacrifice'): 'There can be no doubt that a tribe including many members who ... are always ready to give aid to each other and to sacrifice themselves for the common good would be victorious over other tribes; and this would be natural selection'.*

*On this vision of cooperation, a population is divided from the start into groups and in some cases groups of co-operators fare better than groups of defectors. The reasons for this continue to be debated, and much depends on how one models 'group selection' mathematically: it is here that the defenders of 'Hamilton's Rule' display their greatest scepticism given their unshakeable commitment to an individualistic and solely kin-related account of all cooperative phenomena. However, as Nowak and his colleagues stringently argue, in a competition between co-operator groups and defector groups, pure co-operator groups can indeed be demonstrated to grow faster than pure defector groups. Darwin was on to something here then, it seems, even though most theoreticians*

*who remain committed to Hamilton's rule vigorously deny that he was right.*

Now what conjoins all five of these *different* evolutionary mechanisms outlined by Nowak is what he calls a 'payoff matrix in which 'cooperation' can be shown to be favoured in repeated choices between the two basic strategies of cooperation and defection. And what is particularly fascinating about this discovery is that it explains the paradoxical fact that - whereas defectors always win out initially in a well-mixed population - they do so *at the cost of* declining average fitness in the population as a whole, if too many defect. Defection in this sense 'undoes itself' in excess; whereas cooperation, in its various forms, is the mysterious key to the *regeneration* of fitness. Further, there is intriguing though unfinished evidence (from the later work of Maynard Smith and Szathmáry, especially), that the great transition moments in the history of evolution (from individually-replicating molecules to chromosomes; from prokaryotes to eukaryotes; or from asexual reproduction to sexual reproduction, for instance), were rendered possible only as a result of a phase of preparatory stable cooperation: cooperation was thus the matrix of these crucial transitional developments. Across the whole history of evolution, it seems, the countervailing propulsion of cooperation has played a central and creative role.

As a result of the mathematical clarification of these pervasive cooperative mechanisms, then, and of their necessity for populations' regeneration and flourishing, Nowak has gone so far as to describe cooperation as a 'third principle' of evolution, alongside mutation and selection. This claim too, of course, remains controversial. Yet according to him and his colleagues, together these three principles can account for the recurring 'structures' of evolutionary processes, and thus for certain consistent stochastic regularities within them. For Nowak, in other words, the mathematicalisation of cooperation has revealed what he calls 'dynamic' or repetitive patternings in evolution, patternings which fan out to include creative and explicable *group* phenomena. For Nowak's detractors, however - staunch defenders all of Hamilton's rule - cooperation is simply another index of individual genetic determinism amidst the random flux of evolutionary mutation and selection.

For such a position, too, even motivated *human* 'altruism' is reducible to a mere manifestation of genetic determinism: as E. O. Wilson wrote in his earlier days (along with the philosopher of science, Michael Ruse), 'Ethics is a collective *illusion of the genes*, put in place to make us good co-operators. *Nothing more but also nothing less*'. It was that earlier position of Wilson's that played so decisively into Dawkins's hands: the distinctive 'selfish gene' ideology was up and running.

But which account of cooperation do we now favour, and on what grounds?

## **II: Why Evolutionary Cooperation Raises (Meta) Ethical and Teleological Questions**

This first part of my lecture has necessarily been the longest, since we cannot begin to understand the current controversy over cooperation unless we comprehend something of the technical and mathematical contours of the theoretic debate. But now it is time to take philosophical stock and to move to my second level of analysis, that of the often-buried 'absolute presuppositions' which I mentioned at the outset. For it may by now already be clear that neither the contested mathematics of cooperation, as such, nor even the many empirical biological evidences which accompany it, can by themselves resolve the meaning-making impasse which we have uncovered in the theorizing of cooperation.

Fundamental ethical and metaphysical issues are at stake and have to be faced and probed; and it is by no means *obvious* that the pervasive and reductive story of the 'selfish gene' is the 'best explanation' philosophically when the rich and wide variety of cooperative phenomena are considered with an open mind. We may recall for a moment how Richard Dawkins felt obliged to add an extra chapter on cooperation to the second edition of his *The Selfish Gene*, since the phenomenon might have seemed to raise a threat to his central argument about pervasive genetic 'selfishness'. On the contrary, argued Dawkins (utilizing rather emotively the ghoulish example of sacrificial blood-sucking bats): 'Nice Guys' do indeed 'Finish First' because, of course, their 'niceness' is really only the propulsion to genetic advantage all along.

Yet a mark of the strange *aporia* to which the debate has subsequently led is the form which the initial 'rebuttal' of Nowak, Wilson and Tarnita's critique of 'inclusive fitness' took in an enraged letter to the journal *Nature*. In it, strikingly, there was no attempt by the 137 signatories to respond to the actual mathematical critique supplied in the original article (and it is doubtful that many, if any, of them even understood it); it was enough that the hegemony of Hamilton's account of 'inclusive fitness' had been challenged at all. Here was an 'absolute presupposition' the complainants shared about their core explanation of cooperation, and it brought to the surface a host of other (entirely contestable) ethical and metaphysical commitments.

These are well evidenced in an instructive blog by Steve Pinker and friends ('The False Allure of Group Selection'), in which Pinker reiterates his commitment to a reductive genetic rendition of 'natural selection', so attractive - he insists - precisely because it is 'so mechanistic'. Deploring 'group selection' theorizing as merely 'fuzzy', he reiterates his accustomed reduction of human ethical sensibility to selfish genetic coding, albeit sometimes disguised as 'altruism' under the reputational pressures of 'indirect reciprocity'. Yet the problem here, as one of Pinker's interlocutors, Herbert Gintis immediately ripostes on the same blog, is that Pinker simply refuses to take seriously the mounting empirical evidence for a wide-spread (perhaps even universal) basic moral sensibility in humans, one which can in no obvious way be reduced to purely *genetic* propulsion.

The lesson from this revealing interchange seems to be this: if the strategy of reducing all ethics to genetics,

*tout court*, is under question because the purported mathematical 'demonstration' of 'inclusive fitness' is also in trouble, then it cannot be that a desperate *reassertion* of Hamilton's rule on the grounds of a preference for mechanistic 'simplicity' is a convincing ploy of rebuttal. Instead it smacks of vicious circularity.

In contrast, I urge that the stage is now open for a rich philosophical debate about the various ethical theories that might best and most convincingly cohere with the evidences of evolutionary cooperation and its human motivational variant, altruism; and about what accompanying 'meta-ethical' principles will appropriately protect such an endeavour. For it is by no means obvious that a narrow utilitarian calculus here wins the day, especially once the hegemony of Hamilton's rule is challenged. Indeed, as I argue at much greater length in my 2012 Gifford Lectures, either a developmental 'virtue ethics' founded in 'natural law', and/or an evolutionarily re-worked Kantian theory of the 'categorical imperative', appear much better contenders, and the debate needs to go on. We need to focus on the argument to the 'best explanation'. The great advantage of an 'evolutionary' approach to ethics, of course, is that it has the capacity to explain how certain profound ethical sensibilities are hard-wired into the human psyche, seemingly from a more ancient evolutionary source.

But it would be a grave mistake to conclude from this that all forms of human altruism are explanatorily reducible merely to states of enlightened evolutionary 'selfishness' and short-term utilitarian goals. Indeed, what we might call 'excessive' forms of productive altruistic sacrifice are regularly manifested in human culture, and taught as 'higher forms of righteousness' by both prophets (Jesus included) and philosophers. How we then theorize these (whether as meaningless cultural 'spandrels', or as manifestations of a more demanding and universal form of human altruism yet to be fully realized in response to previously-unparalleled global threats of war, terrorism, and ecological disaster) is one of the most pressing ethical issues of our time. The point however is that this debate must be joined *philosophically*, and cannot be foreclosed by dogmatic and questionable presumptions within the field of evolutionary biology itself.

A second, and equally important philosophical debate spawned by the evolutionary evidences of cooperation concerns the very way we choose to think about the 'metaphysics' of evolution, that is, about its fundamental 'being' (or 'becoming') - its basic structures and patternings. We have already noted the penchant, in reductive genetic accounts of cooperation, to a concomitant foreclosure on these metaphysical questions: evolution on this view is - *ex hypothesi* - wholly random and unpurposive; the evolutionary tape, as Stephen Jay Gould once famously remarked, can never be re-wound or repeated in any form. And it comes with no implicit value or meaning either.

But again the material we have surveyed in the first section of this paper surely already gives the lie to such a dogmatic presumption. Indeed, the intimations of certain forms of 'structure' and 'purposiveness' in the story we have told seem increasingly hard to deny. Consider again the discovery that cooperation manifests itself through the whole spectrum of evolutionary life, and with remarkably consistent formations and patternings which can now be mathematically modelled. Consider again the suggestive discovery by Maynard Smith and Szathmáry that at key moments in the evolution of more complex forms of life, stable cooperation formed a vital and productive matrix of transition in this larger perspective on evolution's 'tree of life': a picture of creative repetitious patterning thus emerges at a second, and different, level of evolutionary significance, right across the story of evolution.

Consider too the remarkable behaviours in manifestations of cooperation found amongst some of the higher mammals (meerkats and whales, to cite significant and evocative examples), which evidence powerful cooperative ingenuity and flexibility in the face of multiple threats to flourishing, and already prefigure something of the intentional and empathetic dimensions of developed human altruism. Consider, finally, the growth and extension of purposive altruism amongst humans themselves, which on occasions may take intensified or extended or even ecstatic form to respond to particular cultural and international crises, moving well beyond the immediate genetic or even national group. We do well of course always to remind ourselves that manifestations of evolutionary cooperation and altruism are not 'good' *per se* (Pinker likes to point out that human cooperation figured large in Nazi programs just as it does today in suicide bombings); but that is precisely why these human phenomena beg - as we have already argued - careful critical ethical theorization and moral adjudication. There is no naive ethical meliorism implied in my analysis, as Darwin, the Victorian, sometimes succumbed to.

What I am urging, however (against all theoretic fashion in evolutionary biology, which still roundly eschews *all* talk of 'teleology') is the attribution of certain forms of patterned and pervasive cooperative structure to different levels of the evolutionary spectrum, including the purposive forms which arise in intentionally-motivated higher-mammal cooperation and human altruism. To suggest such, of course, is to make a *metaphysical* proposal about evolution's fundamental ontology, or of evolution's 'dynamics', as Nowak more incautiously likes to call it.

But once we get this far we are already implicitly raising probing questions about evolution-as-a-whole. And this, of course, brings me to my third and last section. And here I shall be brief but (I trust) suggestive.

### **III: The Question of God: Recasting 'Natural Theology' According to 'Spiritual Sense'**

There is a tradition of spiritual contemplation from the ancient world which I wish to retrieve in this last section on 'natural theology'. According to this tradition, which had its roots in Platonic and neo-Platonic forms of philosophizing and from there passed into certain strands of early Christianity, a form of *spiritual practice* is assumed as a necessary complement to scientific, philosophic or theological reasoning at its broadest. In the

exposition of the great third-century Alexandrian theologian, Origen, this practice takes a classic three-fold form of ascent. There is, first, the preparatory phase termed *ethikē*, in which the contemplative's moral sensibility is preliminarily sharpened and purified. But then comes the stage which particularly concerns me in tonight's context, and this is called *physikē* – the patient learning of a contemplative posture which seeks to attend to the world-as-a-whole and its distinctive patternings, and thus to intuit God's purposes in and for it. Finally there is contemplation proper, *enoptikē*, by which the contemplative is united even more directly with God in Godself.

Why is this (seemingly arcane and outmoded) Origenistic tradition of importance for my attempted retrieval of a certain form of 'natural theology' in the context of an assessment of the evidences of evolutionary cooperation? The reason, first, is that Origen saw in his three-stage contemplative progression not only an ethical purification for the knowing subject but also a sensory and intellectual transformation: to learn to 'see' (and in particular to see the world-as-a-whole as suffused with the divine) was an act of 'spiritual sensation' which could not be hurried in its development, but would in due course involve a subtle but profound change in the knowing subject itself, a new integration of the moral, the intellectual and the affective. Moreover, this new 'seeing' was for Origen no mere optional preference or perspective: it was a growth in *actual insight*, a new depth of penetration into reality itself. Such was the alignment of contemplative practice and intellectual questing in the philosophical tradition that Origen wove into his new-found Christianity.

It is such a practice of contemplative intuition of *physikē* – seeing the world (or in this case evolution) as-a-whole – which commends itself to me as a form of 'natural theology' which avoids some of the traps of the available contemporary alternatives mentioned at the outset. This contemplative unification does not, as such, pretend to be an *argument* for God's existence as such, note, but instead creatively probes the richness of the human epistemological response (noetic, affective, moral) required for any such argument to have final, personal force. Even a probabilistic set of cumulative arguments for God such as Richard Swinburne famously presents still requires, I suggest, some such extra epistemic or spiritual account of what finally *sways* the surveyor of the arguments personally. For this one needs the transformed contemplative gaze.

Moreover, this alternative vision of 'natural theology' is a particularly creative alternative, I submit, to a problem that the great Enlightenment philosopher Kant struggled with all his life, and finally bequeathed to us in strangely unresolved form. For him, order or teleology in nature always seemed in one sense strangely obvious, even after his so-called 'critical' turn (hence what he calls the 'physico-theological' argument for God's existence still continues to allure him, even in his mature philosophy of the first *Critique*). And yet after that critical turn he could never finally attribute teleology (let alone divine teleology) directly to nature itself, since such ordering and purposiveness was now reserved for the realm of the human subject.

A characteristically modern split therefore opened up between the world considered scientifically and objectively (as to 'pure reason'), and the world considered-as-a-whole and 'as if' ordained to God (as to 'practical reason'). And hence 'natural theology' in any available modern sense eluded the later Kant's grasp. Kant was of course absolutely right to stress that the act of perceiving the world-as-a-whole is crucially different from the 'scientific' investigation of any one part of it. It is however this 'gap' between the world-in-itself and the human willing subject which the more ancient contemplative tradition of 'spiritual sense' dares to seek to bridge. The possibility of such an epistemic alternative would of course have been denied by Kant himself, according to the dictates of his own particular critical thought; and yet the longing for it, as I read him, still hangs around more than one of his later texts (notably, the first and third *Critiques*).

Likewise, and as I have unfolded in the logic of tonight's lecture, the ethical and metaphysical decisions called forth out of consideration of the workings of evolutionary cooperation are ones that cannot in the first instance be avoided philosophically, granted the complexity and suggestiveness of the scientific evidences. But the final tug to see evolution's meaning *as a whole* goes into this different and less familiar realm, no longer strictly evolutionary science nor yet philosophy of science, although it is evoked and inspired by them both. This is instead a realm of spiritual intuition or 'spiritual sensation', a realm in which one first wonders that there is anything at all, and then learns to wonder at the remarkable possibility that what there is discloses divine meaning-as-a-whole.

Such at any rate is contemplative 'natural theology', or *physikē*, which I dare to commend to you afresh. Whilst it does not claim to deliver either a deductive or inductive argument for God's existence, what it does deliver is something more subtle and spiritually more interesting: a *changed* epistemic perception of the evolutionary whole as suffused with divine meaning and unity of purpose. As such it represents, I submit, a serious intellectual rival to the unitary meaning deemed (by some) to be supplied by Hamilton's rule. Indeed, on reflection we might playfully call that alternative a 'natural *a*-theology', one in which all meaning is staked on reductive genetic physicalism.

## Conclusions

It has been the burden of this lecture to insist that 'natural theology' is an undertaking that may continue to have a profound intuitive and spiritual appeal despite the successive assaults of modern empirical philosophy and science upon it. The current debate about the ultimate meaning of evolutionary cooperation has been taken as a revealing indication and example of this phenomenon: whilst reductive genetic accounts of cooperation dogmatically expostulate against the idea of *any* ethical and teleological meaning encoded in it (but ironically thereby subscribe to a unitive anti-meaning posture), I have impenitently argued otherwise.

The first lesson here is that science and theology must never eschew the crucial mediating role of critical *philosophy* (especially ethics and metaphysics) in any negotiation between the two disciplines. But even more important is the issue of the particular *epistemological* status of a 'natural theological' argument. I have argued here that a 'natural theological' approach is not of quite the same genre as an argument for God's existence on the basis of empirical evidences; but nor is it a mere *optional* 'theology of nature' (a matter of imposing preordained personal theological preference, front-loaded with assumed dogmatic content). Rather, through reflecting on the remarkable patternings revealed in cooperative phenomena throughout the evolutionary spectrum, there arises the possibility of a *distinctive* epistemic and spiritual response: this goes beyond the mere recording of mathematical regularity towards a wrestling with the ethical and teleological questions encoded in cooperation, and climaxes in the fundamental idea of what might unify and resolve those questions.

It is the spiritual and philosophic force of such questioning which ultimately concerns me here: what does it take to 'see' the world as unified, to see it as God's, if not via a personal transformation which involves desire and affect as much as dispassionate cognition? This is, to be sure, no 'clinching' evidential argument for God's existence, nor is it part of evolutionary science *per se*. Yet – as I trust I have persuaded you – it is no mere fideism or naive 'experientialism' either. It is instead a unified spiritual thought-experiment evoked precisely by critical reflection on evolutionary cooperation and its ethical and metaphysical meanings; from here we are invited into a sustained and demanding contemplative act. In transforming and reordering one to the very possibility of God's suffusive presence in the world, such contemplation may itself evince a new creative posture of hope.

## **Response to the Boyle Lecture delivered by Sarah Coakley**

### **Christopher Insole**

There are few theologians today who combine, as Sarah Coakley does, such theological learning and sensitivity, with an insightful curiosity and courtesy in relation to disciplines such as evolutionary biology and philosophy. She has presented today, and throughout her work, a model of how to go about virtuous interdisciplinary thinking: never being tribal, impatient, dogmatic or rushed, but always patient, thoughtful, well-informed and nuanced. I would like to thank Professor Coakley for her lecture today, and for her wider contribution to the academy and intellectual culture.

In my response, I will first of all draw out a strand of Professor's Coakley's lecture, with which I am in strong agreement, suggesting ways in which her methodology deserves to be extended. I will then move onto an area where I have some remaining questions about the approach recommended to us this evening.

W.H. Auden, in his poem 'Unpredictable but Providential', wrote the lines:

As a rule, it was the fittest who perished. The misfits,  
Forced by failure to migrate to unsettled niches,  
who altered their structure and prospered.

W.H. Auden

As a thesis in evolutionary biology, Auden's suggestion about the fate of the 'fittest' must, by definition, fail. But as an exposé, and commentary, upon the wider cultural and political misunderstanding of what it means in evolutionary terms to be 'fit', Auden is exactly on the money. 'Fitness' in evolutionary biology is always a relational term, where an organism is fit, or well-adapted, relative to an aspect of the environment in which it finds itself, where this environment includes the population of which the organism is a member. Being 'fit' might include being fast, or strong, or fierce, in some cases; but we are misled if these examples dominate. Being 'fit' is also about having that funny shaped beak which becomes useful because of a change in the environment, or the moth being the right color, or the snail having a particular banding pattern on its shell.

Professor Coakley speaks, correctly, about the 'ideology' that pervades some secular 'philosophy of biology', where 'fitness' is read in terms of selfish and individual advantage. This insight could be carried through more aggressively to a range of cultural misunderstandings of the phrase 'survival of the fittest'. Professor Coakley shows us that our choice of examples, images, lexicon, and metaphors really matters, and that behind this choice lurk unexpressed philosophical and ethical commitments. When emotions are not talked about or explored, they actually do more work, and more dangerous work. Just so with philosophical and ethical assumptions.

Thinking carefully and critically about our choice of language involves, as Professor Coakley recommends, an unflinching ethical reflection, which has the potential to challenge and transform us. It can also open up the world around us. Cultural depictions of nature and evolution are never neutral and innocent. We know this with self-satisfied righteousness, when we watch the YouTube clip of the ghastly Nazi teacher hectoring his 12-year old pupils about the Darwinian support for National Socialism, as two poor stag-beetles, not unreasonably, have a go at each other, because stuffed in a jam-jar under a bright light. Relishing in the awfulness of such clips, the mirror which tells us that we are the 'fairest of them all', should not distract us from implicit ideologies closer to home.

Some have found in the gentlest of genres, the BBC nature program, the most effective form of social control, through supposedly neutral observation of the natural. In the 1980s, nature programs ghoulishly followed ravenous lions, roaming the Savannah like serial-killers, thrillingly completing the aggressive takeover of antelopes. The force of such depictions, some cultural commentators found, was implicitly to invite an almost moral sympathy with the 'victim', the doe-eyed panic, and the throbbing vein in the throat, and then to endorse the difficult message that non-intervention is the only rational and 'objective' course of action. More cooperative and stable aspects of the social life of animals are generally edited out of the final production.

Accordingly, we imbibe the message that nature is savage, fierce, competitive, and individualistic, with weaker organisms being consumed, and with the invitation to take this manfully, and not be found weeping on the sofa, or writing a letter of complaint to the Times. As to whether such depictions evoke any wider cultural attitudes in the 1980s, in the words of the House of Cards' fictional Conservative Prime Minister Francis Urquhart: 'I could not possibly comment'. Although I would underline that similar examples have been identified, which reflect attitudes across the whole political spectrum. A recent cultural commentator has found in BBC's *Springwatch*, with its constant and exhausting invocations to tiny bits of inevitably ineffectual activism, through interference in the life of tiny creatures (including placing security cameras in bird-boxes), a projection of a political left which no longer knows what it is for.

So when Professor Coakley invites us to look at the diversity of explanatory models that deserve to be employed when thinking about evolution, she is correct that concepts such as 'cooperation', and even 'altruism' to the point of sacrifice, are just as appropriate and descriptive, analogously at least, as terms such as 'competition' and 'struggle'. And, furthermore, our choice of lexical field is never innocent, but involves, mostly subconsciously, philosophical, theological, ethical, and, I would add, political decisions.

But I am aware that Professor Coakley intends something far more ambitious in this evening's lecture, and here I have more difficulties. She navigates a ship, avoiding a Scylla and a Charybdis: on the one hand refusing a natural theology which moves from patterns of supposed order in the world, to the existence of God; and on the other hand aspiring to more than a 'theology of nature', which offers a 'Christian interpretation of evolution from an already-presumed basis in systematic theology and revelation'. Like many other contemporary theologians, I have been content to picnic on this particular rock, accepting evolution, of course, but relating it to an already-presumed set of theological commitments, without trying to suggest that evolutionary biologists might need more teleological or even theological categories, in order to do their work. Professor Coakley's challenge is disquieting, for theologians as well as for biologists, I think, and the atmosphere at the picnic has become rather pensive. But I'm not yet convinced it is safe to jump in the water, and here is why.

Professor Coakley is eager to avoid a certain sort of Enlightenment natural theology, which attempts 'an argument for God's existence on the basis of empirical evidences'. And at every stage, the argument presented this evening has been more muted and nuanced than such projects, speaking not of proofs that God exists, but of 'meaning-making impasses', which reflection upon God and the 'spiritual senses' can illuminate. But I think what characterizes natural theology on the Enlightenment model is something deeper than the move from empirical evidence to the conclusion that God exists, whether this is claimed to be a definite or merely probable result. The pattern underlying Enlightenment natural theology is more this: first of all, we observe patterns of order in the natural world; secondly, and this is the often buried but crucial premise, we find it surprising that there is such order; and thirdly, given this surprise, we move, in some sense, and in some way, towards divinity as an explanation for this surprising order. The second move is crucial, because unsurprising order, something we could expect to happen upon the basis of naturalistic and scientifically understood principles, hardly cries out for further explanation, even if the order is very extensive and initially mind-blowing (as the emergence of complex organisms was for people before Darwinian explanations).

The argument presented this evening, by Professor Coakley, is always poised, nuanced and subtle, but it seems to me to share this movement of thought, characteristic of Enlightenment natural theology. We begin with observing patterns of order in evolution. Two types of evidence are presented: cases of cooperation and altruism, and the way in which mathematical patterns and structures can be traced in evolutionary development. We then have the claim that, on current prevalent models of evolutionary biology, dominated by the ideology of the 'selfish gene', such cooperation and such patterns are inexplicable, and hence 'surprising'. And, finally, we move, suggestively but emphatically, to the categories of teleology and divinity, as being the only way to resolve a 'meaning-making impasse'. We do not prove God's existence, but we do arrive at a 'changed epistemic perception of the evolutionary whole as suffused with divine meaning and purpose'.

Well, what is the problem with such patterns of natural theology (order, surprise at the order, the move to divinity)? The problem, which has repeatedly surfaced in the history of ideas, is that the reaction of surprise at the order is always vulnerable to better explanations and models, which, if not available now, come along eventually. I am convinced that some of the order that we have been shown this evening, cooperation, altruism, and mathematical patterns and structures in evolutionary development, might well stretch the capacity of evolutionary biologists who insist on what Professor Coakley calls 'genetic determinism' and the 'ideology of the selfish gene'. And certainly extrapolations from evolution to ethics and politics needs to be heavily censured and refuted. But it is not the case that the only two options open to us are a reductive world-view of deterministic selfish genes, and the spiritually-rich move to teleology, divinity and the spiritual senses. We should not move too quickly, I fear, from the failure of the former, to a presumption that the latter is required. We need first of all to

stop off en-route, and hear some more considered and nuanced accounts from the more reflective and philosophically sophisticated quarters of evolutionary biology.

If we visit these quarters, we can find accounts of why the evidence of order presented this evening, cooperation, altruism and mathematical patterns and structures in the development of evolution, is in fact not surprising, and adequately explained and investigated by current models in the discipline. Putting it briskly, this is how the story might go. 'Fitness' is not at the level of the individual at all, but nor is it at the level of the 'group'. Rather, we have to go below the level of individual organisms. Fitness is at the level of a specific physical trait (the 'funny shaped beak') that lends itself to survival and reproduction in a particular environment, which environment includes other members of the same species. Any specific fitness is a propensity to produce a specific outcome. One cannot talk about a propensity without specifying what it is for. This seems obvious, but it has important implications. A trait can contribute to the propensity of an organism to have  $x$  number of descendants after one generation, or, it can contribute to the different propensity of an organism to have  $y$  number of descendants after two generations, which is different from the propensity of an organism to have  $z$  number of descendants after some other specified number of generations. Because the 'selfishness' of the gene works at such a micro-level, far below any individual, it should be clear that it has no immediate application for ethics, psychology or politics.

Furthermore, there is no theoretical reason at all to be surprised if some of the traits in the mix contribute to altruistic and cooperative actions (in various senses of these terms, which would need to be teased out). It would be strange if they did not. And because different traits contribute to an organism's propensity for survival and reproduction, with different degrees of success, depending upon how many generations one takes into account, and given that a major part of the environment is the population of similar organisms, we need not be surprised if some traits that lead to cooperative and altruistic behaviors, win over in the long-run, at least, in certain environmental conditions.

Nor is there anything deterministic about such a picture, in that evolutionary biologists work always with complex probabilities. A propensity to survive and reproduce is not a guarantee, and it can be that the 'fitter' organism does not have the best reproductive outcome: the conspicuous butterfly might just happen to be luckier than the camouflaged butterfly, but there is no doubt that the latter is 'fitter'. Nor is there merely 'random mutation'; always we are dealing with complex patterns of probability. Evolutionary biologists attend to at least five mechanisms: random mutations are one of them, alongside natural selection, gene flow (a reiterated pattern of organisms breeding with neighbouring organisms, enabling the geographical spread of traits), gene drift (the way in which even fitness-neutral traits will be differently distributed, by chance, across generations), and recombination (whereby genetic material is broken and joined to other genetic material, at the level of the chromosome).

Nor need the mathematicised patterns and structures that can be mapped upon the development of evolution cause any 'meaning-making impasse', once we understand that it is the propensities to fitness, at the level of traits, which are the causal mechanisms. The mathematicised patterns are descriptions of the cumulative outcomes of these causal processes. There is nothing 'spooky' in the mathematical pattern, and the patterns does not itself cause, or feeding back-into, evolution, any more than mathematical patterns in divorce-rates directly cause any particular marriage breakdown.

Of course, I am no position to make an emphatic judgement about the success of evolutionary biology to explain itself, on current models. But it is the possibility and plausibility of this sort of story which makes me unwilling to make the move from patterns of order in evolutionary biology to the need for theology. I agree with Professor Coakley that we need good philosophy, to make sure concepts do not drift anachronistically, and that we need good evolutionary biology. I'm not yet convinced, though, that evolutionary biology, just to be itself, and to do its limited but important task, needs the categories of theology or teleology.

When the philosophy and evolutionary biology are done well, I think that we remove the deleterious and ideological impact upon ethics, psychology and politics. There are no particular ethical lessons from evolution at all, any more than there are from the movement of the planets. Ethics needs to engage with a world shaped by evolution, just as it does with a world in which planets orbit the sun, but neither give us direct ethical results or guidance. Thomas Aquinas' criticism of astrology is instructive here. He objects that astrology suffers from an over-crude materialism, reading off ethical and political truths from the movement of the planets. It does not matter that astrology accurately charts this movements of the planets. Aquinas correctly cuts astrology loose, and does not try to theologize it. And from the errors of astrology, come the purified insights of astronomy, less portentous for morality and history, but, at least, more focused on its proper task. We might recommend a similar course of action in the case of another over-crude materialism, evolutionary ethics, which theologians can cut loose, confident that, in the end, it will be the fitter evolutionary biologists themselves who wield the knife, as the astronomers did for astrology.

When embarking between Scylla and Charybdis, Professor Coakley commented that she did not merely want to offer a 'theology of nature', a 'Christian interpretation of evolution from an already-presumed basis in systematic theology and revelation'. In some ways, this is the most remarkable and humbling statement in the lecture. If I had 'merely' done such a thing, I would consider it a successful life's work, and, in my estimation, this is in fact what Professor Coakley has achieved, and done so marvelously. It also seems to me that to do such a thing is

very fitting and traditional. Thomas Aquinas reflects upon all sciences that deal with penultimate matters, in relation to God, but he does not therefore insert specific theological content into these sciences, not least because they are precisely limited to penultimate matters. In my view, Professor Coakley provides the best Christian interpretation of evolution in our generation: the most informed about evolution and theology, the most textured and differentiated, and the most spiritually moving. Only someone of Professor Coakley's stature would be disappointed not to have done more.

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