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## [6] Intelligent Design

### 0. Outline

**1. Introduction**

**2.  $\Pr(O \mid DA)$**

## 1. Introduction

- In the previous lectures we considered two potential hypotheses about the origins of complex adapted organisms:
  - genesis by 'chance' alone (*CH*)
  - evolution by natural selection from primitive ancestry (*DA*).
- But of course, there is also a long and venerable history of inference from various attributes of the living world to a third hypothesis:
  - genesis as a result of the activity of an intelligent designer (*ID*)
- Some famous philosophical sources:
  - Cicero's *De Natura Deorum* (1st c. BC),
  - Aquinas' *Summa Theologiae* (13th c.),
  - Paley's *Natural Theology* (late 18th / early 19th c.).

## 1. Introduction

- There has been a regain of interest in this hypothesis since the late 1980s with the birth of the 'Intelligent Design' movement in the USA, championed by Dembski, Behe, Johnson, etc. (aka the 'neo-creos').
- Part of the success of the *ID* movement can be attributed to the fact that the new creationism has freed itself from some of the unpopular theological baggage of the creationism of old.
- Neo-creationism is typically (officially) fairly agnostic with regards to the attributes of the would-be designer, aside perhaps from its rationality and power to carry out its plans as intended.
- In particular, the evidential bearing of religious oral or written testimony isn't taken into consideration in the inferential process: neo-creationism aims to be scientifically kosher.

## 1. Introduction

- Evolution vs *ID* isn't (yet?) a big issue in the UK but there is currently a *huge* controversy on the other side of the pond, partly due to attempts to have *ID* taught alongside evolutionary theory in the biological sciences curriculum.
- In what follows, I will stick to my policy of restricting discussion to likelihood comparisons and focus on creationist claims concerning the respective likelihoods of *ID* and *DA*: does the data favour *ID* over *DA*?
- *Claim 1*:  $\Pr(O|DA) = \text{low}$ . This is the main focus of discussion in creationist circles.
- Part of the reason for this is that they commonly think that establishing Claim 1 suffices to rule out *DA* (e.g. Dembski [1998]).

## 1. Introduction

- They are wrong in thinking this, for reasons that we have established previously.
- *Claim 2*:  $\Pr(O|ID) = \text{high}$ . This is – quite surprisingly - a claim that very seldom explicitly appears in the creationist literature.
- Let's start with Claim 1 and move on to Claim 2 in due course.

## 2. $\Pr(O|DA)$

- As we saw in lecture 4, Darwinists are acutely aware of the importance of being able to establish the existence of a sequence of no-too-improbable transitional forms of increasing fitness between primitive organisms and their more complex contemporary counterparts.
- I gave you the following quote from Darwin himself:
  - ‘If it could be demonstrated that any complex organism existed which could not possibly have been formed by numerous, slight modifications, my theory would absolutely break down’ (Darwin *The Origin of Species* Ch 6)
- Of course, Darwin didn’t think that this had been demonstrated at the time. Indeed, he followed up the previous statement with:
  - ‘But I can find out no such case.’

## 2. $\Pr(O|DA)$

- But as I pointed out, whether or not such cases could be demonstrated, Darwin was somewhat overreacting:
  - The theory wouldn’t “absolutely break down”, it would only have a considerably lower likelihood (some of the transitions in the evolution of organismic form would just be much more improbable) – not a good result, but by no means terminal.
- In a number of publications, shining star of American neo-creationism (and career biochemist) Michael Behe has recently make a big deal out of this issue of the possible existence or not of gradual sequences of increasingly fit organismic forms (Behe [1996], Behe [2001]).

## 2. $\Pr(O|DA)$

- Behe's view:

- (i) Given the state of biological knowledge biology in Darwin's time, Darwin had no reason to doubt the possibility of the existence of the relevant series of small steps of increasing fitness leading to current complex adaptive form.

- (ii) Times have changed: contemporary biochemistry / functional anatomy / etc. demonstrates that while there may be some structures for which such pathways might exist, there are a number of other structures for which this *isn't* the case (in particular various microbiological structures).

## 2. $\Pr(O|DA)$

- How does contemporary science demonstrate this?
- Behe: because (a) it has unearthed the existence of 'irreducibly complex adaptations' (ICAs) and (b) such adaptations would be unlikely to be observed on the hypothesis that current organisms were the solely the product of natural selection.
- So what is an 'irreducibly complex adaptation'? According to Behe [2001:247]:

- An ICA is 'a single system which is composed of several interacting parts that contribute to the basic function and where the removal of any one of the parts causes the system to effectively cease functioning'

## 2. $\Pr(O|DA)$

- This is a little vague. From context, it can be gleaned that Behe means, more precisely:

A system  $S$  is an ICA iff:

- (1)  $S$  composed of  $n > 1$  parts  $P_1, \dots, P_n$ .
- (2)  $S$  has a disposition  $F$  such that (i) by virtue of  $S$  having  $F$ , possession of  $S$  increases the fitness of its bearer (ii) were  $S$  to lack any one of  $P_1 \dots P_n$ , it would thereby lose  $F$ .

(Note: on this definition, ICAs don't seem to have much to do with 'complexity' as such, which is standardly taken to involve not only a decomposability into parts but also decomposability into *qualitatively heterogeneous* parts. Nevermind.)

## 2. $\Pr(O|DA)$

- Behe provides a wealth of detailed microbiological examples:
  - the bacterial flagellum,
  - the blood clotting system,
  - etc.
- I don't want to dwell too much on these cases; I refer you back to the article for further details.
- Behe [2001:247-248] seems to think that establishing that these cases are ICAs is a big deal. I don't think so. They seem plausible enough ICAs.
- More interesting is the issue of why the existence of ICAs should be unlikely conditional on the truth of the Darwinian view...

## 2. Pr(O | DA)

- According to Behe, this is obvious. The argument, in 3 lines:  
‘An irreducibly complex system cannot be produced by slight successive modification of a precursor system since any precursor to an irreducible complex system is by definition nonfunctional’  
[Behe 2001: 247]
- Simple and apparently devastating. I’ll give you a second or two to ponder...
- *Issue 1: the definition of an ICA makes no mention of the term ‘precursor’.*  
(Note: a potential ‘precursor’ is simply a system from which the ICA in question could have been derived.)
- Obviously, a fortiori it makes no claims wrt the functionality or non-functionality of the possible precursors of an ICA.

## 2. Pr(O | DA)

- Of course, what the definition of an ICA *does* do is to make claims about the functionality of any system composed of a proper subset of the component parts of an ICA.
- But that is a different matter altogether.
- To make any claim of this kind about the nature of the possible immediate precursors of an ICA is to make *a substantial empirical claim.*
- Behe’s apparent tacit substantial empirical claim:  
The immediate precursor of an ICA must be a system composed of a proper subset of the parts of the original ICA.
- But this is simply false: mutations can not only add, but also delete or modify parts.

## 2. Pr( $O \mid DA$ )

- *Issue 2: the definition of an ICA doesn't make any claims regarding absolute nonfunctionality; it makes claims regarding nonfunctionality with respect to 'the basic function' of the ICA.*
- What the definition of an ICA says with respect to the functionality of any system  $S^*$  composed of a proper subset of the component parts of an ICA  $S$  is this:

The fitness-enhancing disposition  $F$  (i.e. the 'basic function') of  $S$  is lost in  $S^*$ .
- This doesn't rule out there being a *further* disposition or set of dispositions  $F^*$  possessed by  $S^*$  by virtue of which possession of  $S^*$  would increase the fitness of its bearer.

## 2. Pr( $O \mid DA$ )

- So, for two obvious reasons, Behe's conceptual argument that ICAs *couldn't* 'by definition' be produced by 'successive slight modifications of a precursor system' just doesn't go through.
- In fact, it turns out that there are a number of fairly plausible hypotheses as to how they *could* be so produced.
- One such scenario, that Sarkar [2007] calls '*lost functional redundancy*', involves a series of precursors sharing the 'basic function' of the ICA in question...



## 2. $\Pr(O|DA)$

- Orr [1996-1997] gives a widely-cited account of this process, a possibility apparently first considered by Nobel prize winning geneticist H.A. Muller early in the century:

‘An [ICA] can be built gradually by adding parts that, while initially just advantageous, become – because of later changes – essential. The logic is very simple. Some part (*A*) initially does some job (and not very well perhaps). Another part (*B*) later gets added because it helps *A*. The new part isn’t essential, it merely improves things. But later on, *A* (or something else) may change in such a way that *B* now becomes indispensable. This process continues as further parts get folded into the system. And at the end of the day, many parts may all be required.’

## 2. $\Pr(O|DA)$

- Note: I have no specific biological examples here but in the context of a *slightly* different issue, a similar logic underlies the evolution of ‘obligate mutualism’ between species, in which relations of mere mutual ‘help’ can turn into relations of mutual dependence (e.g. pollination can involve obligate mutualism).
- Another kind of scenario involves a series of precursors that *don’t* share the ‘basic function’ of the ICA...
- In this model – call it ‘*co-optation of existing structures*’ - the ICA is gradually build up by recruiting and modifying (‘co-opting’) for a new function structures that had previously been selected on the basis of their subserving different functions altogether.

## 2. $\Pr(O|DA)$

- Sarkar [2007] provides a number of real-world examples of ICAs at the biochemical level with respect to which a scenario of evolution by co-optation of existing structures is widely recognised as being plausible.
- He notably cites the widely-discussed case of the recent evolution of the PCP degradation pathway in various soil bacteria.
- The degradation of PCP is carried out by three different enzymes (PCP hydroxylase, TCHQ dehalogenase and DCHQ dioxygenase), each of which is necessary for the degradation to take place: the degradation pathway is therefore an ICA.

## 2. $\Pr(O|DA)$

- It turns out however that all three enzymes are *already* involved in other biochemical processes (for instance, the first and third are involved in the breaking down of other chlorophenols, besides PCP): the ICA in question was simply formed by reusing old materials for new purposes.
- I'll put a copy of the Sarkar chapter on the Moodle...

## Reference

- Behe, M. [1996]: *Darwin's Black Box*. New York: Free Press.
- Behe, M. [2001]: 'Molecular Machines', in R. Pennock (ed.) *Intelligent Design and its Critics*, Camb. Mass: MIT Press.
- Dembski, W. [1998]: *The Design Inference: Eliminating Chance Through Small Probabilities*. Cambridge: CUP.
- Orr, H. [1996-1997]: 'Darwin vs Intelligent Design (again)', *Boston Review*, Dec-Jan, 28-31.
- Sarkar, S. [2007]: *Doubting Darwin?* Oxford: Blackwell.

## Next lecture: 'Intelligent Design (ctd.)'

- No reading