

Re: Reproductive Excess: Is Required

Source: <http://sci.tech-archive.net/Archive/sci.bio.evolution/2005-04/msg00658.html>

- *From:* Tim Tyler <tim@xxxxxxxxxxxx>
 - *Date:* Fri, 29 Apr 2005 13:20:48 -0400 (EDT)
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Walter ReMine <science@xxxxxxx> wrote or quoted:

> Tim Tyler wrote:

- >> The most problematical sections I could find in
- >> a brief look through Haldane's paper were where
- >> Haldane constantly assumes the selective force
- >> is small:
- >
- > I say: Haldane used small selection coefficients (s approaching 0+) for
- > four reasons:
- > 1) Because that is said to be typical of evolution, (and is still
- > believed so today).
- > 2) Because small selection coefficients (s approaching 0+) gives the
- > absolute lowest total cost of substitution, and thereby increases the
- > number of substitutions in the available time.
- > 3) Because it was the only way to achieve closed-form equations for the
- > total cost of substitution (which was necessary in the days before
- > readers had easy access to computers).
- > 4) Because under that assumption, the total cost of substitution
- > becomes approximately constant, which allowed him to generalize his
- > argument. That is, the total cost of 30 is rather independent of s , so
- > long as s is small.

Point 2 is questionable (see the bottom of this message).

Low selection pressures encourage drift-like phenomena – which do indeed lead to many substitutions per generation, though they are not really the same sort of substitutions Haldane was considering – since they are due to chance effects.

High selection pressures can also lead to rapid rates of alleles reaching fixation, though – if the the high selection pressure is applied to a diverse population suddenly.

Haldane's use of an assumption about small selection pressures itself is not really a /problem/ – since it is so clearly stated.

However, assuming low levels of selection – and *then* going on to conclude that evolution due to selection is slow – does seem rather

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like assuming what you are trying to prove.

- >> ... [Haldane] picks another figure – apparently out of
- >> thin air (1 substitution every 300 generations).
- >
- > Haldane's paper did not explain his argument well, but his conclusion
- > was not "picked out of thin air". In effect, his argument can be stated
- > like this: On average, the total cost of substitution is 30, and paid
- > in stallments of .1 per generation. Thus it takes $30/.1 = 300$
- > generations to pay for one substitution. Thus the substitution rate
- > is limited to one per 300 generations.

Haldane writes:

``To be concrete, if a species had immigrated into an environment where its reproductive capacity was half that obtainable after selection had run its course, so that $I = \ln 2 = 0.69$, n would be 43. This represents, in my opinion, fairly intense selection, of the order of that found in *Biston betularia*, where it has had a rapid effect because it was concentrated on a phenotypic change due mainly to a single gene. I doubt if such high intensities of selection have been common in the course of evolution. I think $n = 300$, which would give $I = 0.1$, is a more probable figure. Whereas, for example, $n = 7.5$ would reduce the fitness to e^{-4} , or 0.02, which would hardly be compatible with survival."

Here Haldane clearly confirms that high selection pressures lead to rapid rates of allele substitution (of the type he is considering) in his model.

Haldane is /apparently/ working backwards from the "300 generations" figure to the selection pressure that would generate it.

Since no other support for the "300 generations" figure is provided, that doesn't seem terribly scientific.

Is 0.1 a realistic selection pressure in – say – humans? It certainly looks like one that does not take phenomena such as sperm selection and miscarriages into account.

The probability of a random man being a parent is not very high:

<http://www.ash.org.uk/html/action/planner.html>

....says: "65% of all men are fathers".

<http://www.phac-aspc.gc.ca/publicat/work-travail/report1/>

....gives a figure for professional men of 0.77, which it claims is larger than is typical of the general population.

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So: Haldane's figure of 0.1 immediately looks far too low – after only considering the number of childless males – before infant mortality, and variations in the number of children are taken into account.

Jim Tyler <http://timtyler.org/> tim@xxxxxxxxxxx Remove lock to reply.

• *References:*

- ◆ ***Reproductive Excess: Walter's False Premise***
 - ◇ *From:* Jim McGinn
- ◆ ***Re: Reproductive Excess: Is Required***
 - ◇ *From:* Walter ReMine

- Prev by Date: ***Felsenstein's evasive behavior (was: Remine's offensive behavior)***
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