Re: Junk DNA: A hypothesis

Source: http://sci.tech−archive.net/Archive/sci.bio.evolution/2005−01/0589.html

---

From: Tim Tyler (*tim_at_tt1lock.org*)
Date: 01/25/05

Date: Tue, 25 Jan 2005 13:04:37 −0500 (EST)

Larry Moran <lamoran@bioinfo.med.utoronto.ca> wrote or quoted:
> On Sun, 23 Jan 2005 22:54:57 −0500 (EST),
> Tim Tyler <tim@tt1lock.org> wrote:
> > Larry Moran <lamoran@bioinfo.med.utoronto.ca> wrote or quoted:

> >> Why would stretching out a gene by inserting introns be an adaptation?
> >
> > Since I don't seem to have conveyed the idea: some diagrams of three
> > genes, A, B and C − and some junk − represented by "."s.
> >
> > 1) ..AAAAAAA.BBBBBBBB.CCCCCCCCCCC..
> >
> > 2) .....AAAAAAA.....BBBBBBBB.....CCCCCCCCCCC.....
> >
*> > Cut DNA string 1 into two pieces and there's a *high* chance*
> > of cutting one of the genes in half.
> >
*> > Cut DNA string 2 into two pieces and there's a much *lower**
> > chance of cutting one of the genes in half.
>
> First, let's make sure we understand that recombination doesn't chop
> genes. [...]

It chops alleles.

> Homologous recombination is between two homologous chromosomes
> and the exchange is reciprocal.
>
> Here's the result if you have two alleles of the A and C genes as
> represented by a lower case "a" and "c".
>
>
> ..AAAAAAA.BBBBBBBB.CCCCCCCcCCC..
> X
> ..AAaAAAA.BBBBBBBB.CCCCCCCCCCC..
>
> |
> |

> \/
>
> ..AAAAAAA.BBBBBBBB.CCCCCCCCCCC..
>
> ..AAaAAAA.BBBBBBBB.CCCCCCCcCCC..
>
> No genes are disrupted by this process. In most cases we can't even recognize
> exactly where the crossover has taken place.

That's because you failed to choose an example that meet the minimum requirements for two alleles that can suffer from recombination during meiosis − namely that they differ in at least two base pairs.

> Secondly, the frequency of recombination depends on the length of the
> sequence.

A false assumption when comparing different organisms.

> Let's take your hypothetical sequences and add two more units to the second
> one.
>
> ..AAAAAAA.BBBBBBBB.CCCCCCCCCCC..
>
> .....AAAAAAA.....BBBBBBBB.....CCCCCCCCCCC.....
>
> The first sequence has 32 bp and the second one has 64 bp. Let's assume, for
> the sake of argument, that the frequency of recombination is one crossover
> every 32 bp. Thus, in the first case there's a probability of 26/32 = 0.81
> that a crossover will take place within a gene.
>
> In the second case there will be two crossovers. The probability of one
> crossover within a gene is 26/64 + 26/64 = 0.81.
>
> I fudged the numbers so they would come out equal and the "probability"
> calculation isn't very accurate but I think you get the picture. There
> is no obvious protection from intergenic crossovers by adding more DNA
> as long as the recombination rate is unchanged.

So: the assumption that the recombination rate is unchanged is incorrect.

To reiterate, the theory suggests that organisms with more junk DNA can preserve their genes from being deleteriously chopped in half during recombination by reducing the frequency of crossovers per unit length of DNA.

They can do this without decreasing the frequency with which functional genes are recombined − since the functional genes are further apart.

> Furthermore, let me reiterate the point that there's nothing dangerous
> about homologous recombination within a coding region. There's no "danger"
> that your supposed solution is solving. It's a strawman from the get−go.

[...]

> For what possible reason would the alleles in those genes not take kindly
> to having a crossover site within them? How would they even know? You
> can't just hand−wave your way through this discussion. Give me a concrete
> example of what you mean.

[...]

> What exactly is that mechanism? What exactly do you mean by a gene that
> is "sensitive" to being divided?

Here are two similar sentences, which are sensitive to recombination.

"The lady picked up the purple book."
"The lady picked up the maroon book."

These sentences have /very/ similar meanings.

However after sentence−crossover we might get, for example:

"The lady picked up the marple book."

The meaning has changed − suddenly there are connotations of Agatha Christie!

−−
_____
|im |yler http://timtyler.org/ tim@tt1lock.org Remove lock to reply.