

Emily

I'm a bit confused about some of the things that this paper is based on. For example, what happens for gene regulation to occur? And what are regulatory mutations? I guess I'm getting a bit lost in the terminology.

Leah

I'm a little confused about cis-regulatory elements. The paper says they mutate more frequently than other regulatory proteins because their effects are not as pleiotropic. But when I looked up cis-regulatory elements, it said that cis-regulatory elements are ones that are located on the same strand as or near the gene they regulate. How does this make their effects less pleiotropic?

Joo Hyun

Could we go over more about the pleiotropy of mutations and how come mutations in non-coding and coding sequences can have different degree of pleiotropy?

Matt

The article states that gene duplication, cis-regulatory elements, alternative promoters, and RNA splice sites all contribute to redundancy and compartmentation, both of which are important in achieving "evolvability"-the capacity to generate tolerable, heritable variation" (1160). I understand how gene duplication is related to decreased pleiotropy, but I am less clear on how the other genetic features are. Could we briefly go over that?

Max

The author of this paper talks about how he argues that "the evolution of complex traits such as brain size, craniofacial morphology, cortical speech and language areas, hand and digit form, dentition, and body skeletal morphology must have a highly polygenic and largely regulatory basis." What other prevalent arguments are there out there? What else do people believe has caused these evolutionary changes and what leads them to believe these arguments at this time?

Hanna

On page 1161, the regulatory proteins that control pigmentation in fruit flies are described as "highly conserved," and unless I'm reading this entirely wrong, it seems to suggest that this is a valuable characteristic for the wide variety of pigmentation patterns. Why does a highly conserved regulatory protein make more diversity possible? I would think the opposite is true.

On page 1161 Carroll talks about studies that have shown that evolution at a particular loci has affected morphological traits and that they have, "firmly eliminated coding

sequences as a possible cause and thereby implicated regulatory sequence evolution at loci encoding pleiotropic transcription factors." What kind of experiments and results gave such conclusive evidence to implicate regulatory instead of coding sequences for evolution at these loci?

JP

Is regulatory sequence evolution governed by the same rules and mechanisms as coding sequence evolution? How do the two differ?

Kevin M

Is albinism in cave fish caused by mutations in regulatory proteins? Is the differing locations of mutations in this locus evidence for separate coding sequence mutations?

Kevin C

Regarding the FOXP2 gene, the expected differences in the gene between humans and apes should be around 2000 nucleotides, but there are only 2 different ones. Is this because the gene is so vital to language development (among other things), and thus has been conserved?

Ben

As organisms and their gene regulatory systems become more complex does the likelihood of a nonlethal regulatory gene mutation go down? If that is the case will the rate of the evolution of drastic anatomical changes in complex organisms go down, and further is there a statistical limit to the evolution of more complex organisms?

Stephanie

Under box 1, it says that "certain features of animal genetic regulatory systems influence "evolvability"—the capacity to generate tolerable, heritable variation. For instance, redundancy reduces constraint on change by circumventing or minimizing the potentially deleterious effects of some mutations."

Are there any studies of the diversification of life that suggest organisms can be selected for the ability to evolve?

Are species, or genera, with greater gene redundancy more likely to successfully colonize (and evolve to suit) newly available habitat? Are bacteria with more gene redundancy more likely to evolve drug resistance?