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BIOLOGICAL SCIENCES

Telomere erosion as an intrinsic mechanism of species extinction: the sudden and complete disappearance of the passenger pigeon 100 years ago

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ABSTRACT

Correspondence re: Hung, C. M., et al. 2014. "Drastic population fluctuations explain the rapid extinction of the passenger pigeon." *Proc Natl Acad Sci U S A* no. 111 (29):10636-41. doi: 10.1073/pnas.1401526111.

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DATE RECEIVED:
September 04, 2014

DOI:
10.15200/winn.140984.49964

ARCHIVED:
September 04, 2014

KEYWORDS:
evolution, extinction, telomere erosion

CITATION:
Reinhard Stindl, Telomere erosion as an intrinsic mechanism of species extinction: the sudden and complete disappearance of the passenger pigeon 100 years ago, *The Winnower* 1:e140984.49964 (2014). DOI: 10.15200/winn.140984.49964

In North America, the passenger pigeon population was estimated at 3-5 billion individuals in the mid-1800s. A few decades later, the last individual died at the Cincinnati Zoo in 1914 during an unsuccessful breeding program (Hung et al. 2014). Hung and colleagues concluded from sequencing data that the passenger pigeon frequently experienced dramatic population fluctuations, possibly due to habitat change. According to their hypothesis, the passenger pigeon simply did not recover from the last population low, because of human hunting activities.

However, according to their genetic data (Hung et al. 2014), a population low equals 300,000 to 500,000 individuals living on the North American continent, which makes the hunting-to-extinction scenario rather unlikely. In the same article, the authors cite the mysterious and sudden extinction of the Rocky Mountain grasshopper, a widespread agricultural pest (Hung et al. 2014). Yet, there are no reports of massive grasshopper hunting activities in the late 1800s and there was no widespread use of insecticides until several decades later.

Since more than 99.9% of all species, which have ever lived on this planet, have become extinct (Raup 1991), the reported cases of the sudden disappearance of pigeons and grasshoppers might be the rule, not the exception. The mysterious observations could point to an intrinsic mechanism of species extinction, an old and forgotten European concept of organic evolution (Stindl 2014). There is a reason why intrinsic causes of extinction and saltatory speciation are not listed in contemporary biology textbooks anymore. It is the lack of any known mechanism, which can act over hundreds or thousands of species generations. Even Otto H. Schindewolf, one of the best-known supporters of the saltatory evolution model, could not provide any mechanistic explanation for his paleontological findings (Stindl 2014).

Barbara McClintock described broken chromosome ends (eroded telomeres) as leading to chromosomal instability and activated transposable elements (McClintock 1984) that are capable of rewiring the genome (Kunarso et al. 2010). Whereas it is a scientific fact that telomeres erode in somatic tissues during aging, they are thought to remain stable in the germ line of a species. However, the results of a large multigenerational telomere study on healthy subjects (Eisenberg, Hayes, and

Kuzawa 2012), especially regarding the loss of the positive grandfather effect on offspring telomere length in the maternal line, deliver indirect proof of telomere erosion in the human lineage (Stindl 2014). If telomeres erode in the female germ line, the long telomeres in old men`s testes would be no age effect, but a birth cohort effect. Accordingly, transgenerational telomere erosion is the ideal candidate for a biological clock that can accomplish sudden extinctions of widespread and successful species (Stindl 2014).

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APPENDIX

Submitted to PNAS 08/15/2014, rejected 08/20/2014.