

Einstein scientist's finding highlighted as 1 of 15 'evolutionary gems' by Nature

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A study on genetic variation led by a scientist at Albert Einstein College of Medicine of Yeshiva University was selected by Nature as one of 15 "evolutionary gems" of the past decade. The 15 studies were selected by Nature in the current issue to "illustrate the breadth, depth and power of evolutionary thinking," as part of the publication's celebration of Charles Darwin's 200th birthday and 150th anniversary of its most celebrated publication "The Origin of Species." Darwin, the father of the theory of evolution, was born on February 12, 1809.

The study, authored by Aviv Bergman, Ph.D., professor and chair of systems & computational biology at Einstein, and Dr. Mark Siegal, Ph.D., an assistant professor of biology at NYU, delves into a concept called "evolutionary capacitance," which addresses stability of species in the face of accumulated genetic variation. A central question of this concept is whether species that remain relatively constant for millions of years, and then undergo swift and significant change, store the potential for these sudden alterations, unleashing a flood of otherwise hidden variation at times of environmental stress.

Early research on fruit flies showed that key proteins involved in the regulation of developmental processes are "chaperoned" by a protein called Hsp90. The production of this Hsp90 increases in times of stress. Hsp90 is occasionally overwhelmed by other processes and the proteins it normally regulates are left to run free, yielding a flurry of otherwise hidden variations.

Drs. Bergman and Siegal explored whether evolutionary capacitance is unique to Hsp90, or rather, found more generally. Using numerical simulations of complex gene networks and genome-wide expression data from yeast strains in which single genes had been deleted, they demonstrated that most, and perhaps all, genes hold variation in reserve that is released only when they are functionally compromised. Their findings, published in 2003, suggested that evolutionary capacitance goes wider and deeper than Hsp90.

This research has inspired additional study into fundamental questions in biology, such as the evolution of sexual reproduction and the evolution of gene and genome duplication, as well as inquiries relevant to biomedical research. Those include the hypothesis that healthy aging among centenarians may be the result of buffering mechanisms against age-related diseases, while cancer may be the result of a breakdown of mechanisms that protect against disease. This hypothesis is currently under investigation.

For more information about Dr. Bergman's research:

www.aecom.yu.edu/bergman/projects.html

Source: Albert Einstein College of Medicine

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