OFFICIAL ABSTRACT and CERTIFICATION

Paternal Stress in Drosophila melanogaster

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It is widely known that gene expression is influenced by the environment. One mechanism for altering gene expression involves epigenetic changes, alterations in the structure of DNA. During the formation of sex cells, it is believed that most epigenetic signatures are erased and thus, parental contribution to offspring is largely genetic. This present study develops a system using paternal sublethal stressors to model environment induced epigenetic modifications in progeny that circumvent the erasure process. Female gametes (eggs) contain a large amount of proteins and other nongenetic components that can influence the development of their offspring, making detection of epigenetic inheritance more difficult. Male gametes (sperm) contribute primarily DNA and thus are better candidates for detecting epigenetic inheritance. Heat shock and starvation are major stressors which produce large changes in gene expression that promote enhanced survival under stressful conditions. Using D. melanogaster as a model system, it was found that progeny of males exposed to these sublethal-stresses experienced a reduction in stress resistance that further decreased as the frequency of paternal stress increased. Analyses of mutants in the insulin signaling pathway suggest that insulin signaling is not required for the transgenerational effects observed. It is hypothesized that chromatin remodeling explains the observed effects. Potential evolutionary advantages of the phenomenon are discussed.

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