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POSTER ABSTRACTS – SESSION 1 (DEC. 15, 2014)

**Quantitative real-time characterization of single-cell aging: from phenotypes to lifespan**

**Awardee:** Murat Acar

**Award:** New Innovator Award

**Awardee Institution:** Yale University

Cellular aging is the dynamic process of accumulating genetic and molecular changes in cells. Age-associated damage to cellular structures results in the deterioration of physiological functions, leading to cell death. A variety of diseases such as cancer, type 2 diabetes, and Alzheimer's disease are linked to cellular aging; yet, our understanding into the mechanisms of cellular aging and how these mechanisms are coupled to the initiation of various disease states is very limited. For example, we know very little about how chromosome instabilities occur in old cells. A basic understanding on the set of genes and gene networks responsible from directly regulating lifespan and the mechanisms used in this regulation is also missing. This lack of understanding is contributed by the fact that cellular aging is a complex phenotype to measure and comprehensive studies on aging require the application of novel experimental approaches and technological platforms. Using the replicative aging of the yeast *Saccharomyces cerevisiae* as an experimental model, I propose to apply quantitative single-cell and single-molecule tracking approaches with the goal of: (1) uncovering the effect of bistable galactose metabolism on single-cell aging; (2) investigating how chromosomes become unstable with aging; (3) exploring the links between cellular aging and protein misfolding in single cells. To facilitate real-time measurements of replicative lifespan, we will utilize a microfluidics platform that automates the separation of daughter cells away from their mothers. Aging mother cells will be time-dynamically imaged until they no longer produce daughter cells. Results from these projects will broaden our limited understanding on how single-cells age by elucidating which genetic and phenotypic changes accompany or drive the aging process. For several decades, the labor-intensive nature of the conventional micromanipulator-based aging platforms has limited the research progress in the aging field. The inability of the colony-based aging assays to quantify aging phenotypes at the single-cell level was another important deficiency, as there are usually cell-to-cell variations in aging among the cells forming a colony. Using microfluidics platforms to automate single-cell lifespan measurements will overcome these deficiencies and limitations, and has the potential to transform the field of aging.