expression, including the ways in which genes are regulated. Understanding the consequences of differences in gene expression on aging rate, and the consequences of aging on gene regulation will continue to have profound impacts on our ability to manipulate the aging process. This symposium on gene regulation in aging will focus on how genes are regulated by the aging process and can be regulated differently to affect the aging process. We have an expert on the regulation of gene expression in the immortal germline and soma of the hydra, Dr. Celina Juliano. Dr. Roger Brent is an expert on the mechanisms of cell to cell variation in gene expression. Dr. Monica Driscoll is an expert on both the genetics of aging and gene expression changes with age. Finally, Dr. Alex Mendenhall’s studies are focused on understanding intrinsic (epigenetic) variation in the regulation of gene expression as a cause and consequence of aging. Together these experts will present their research as it relates to gene regulation and the aging process.

HOW THE SAME GENETIC PROGRAM RUNS DIFFERENTLY IN INDIVIDUAL ANIMALS TO AFFECT AGING AND DISEASE
Alexander Mendenhall, Bryan Sands, and Soo Yun, University of Washington, Seattle, Washington, United States

Monozygotic human twins will age at different rates. The same is true for isogenic laboratory animals. Some of these differences in the rates of aging are caused by differences in the expression of genes. And, some of the differences in gene expression between isogenic individuals are caused by seemingly non-heritable, stochastic epigenetic differences. Here we discuss how differences in chaperone expression can influence aging and a model of Ras-driven neoplasia risk and survival in the model nematode Caenorhabditis elegans. We review evidence suggesting differences in epigenetic silencing machinery contribute to differences in chaperone gene expression. We suggest models for germline and somatic epigenetic regulation of chaperones. We discuss potential means of targeted epigenome modification, and potential implications for human health during aging.

MECHANISMS OF DEVELOPMENT AND REGENERATION IN HYDRA
Celina Juliano, Jack Cazet, and Abby Primack, University of California, Davis, Davis, California, United States

Hydra vulgaris is a small and simple aquatic animal capable of whole-body regeneration and has negligible senescence. The entire animal, including the nervous system, is composed of about 25 cell types, and can regenerate from a fragment of tissue as small as ~300 cells. In addition, all cell types are continually renewed in the uninjured adult as part of normal homeostasis; every differentiated cell type is replaced approximately every 20 days, which likely contributes to its lack of aging. The remarkable features of Hydra are enabled by three distinct populations of stem cells that support the three lineages that make up the adult Hydra – the ectodermal epithelial lineage, the endodermal epithelial lineage, and the interstitial lineage (includes the neurons). A major goal of our laboratory is to understand the gene regulatory networks that control the specification of all Hydra cell types in the uninjured (homeostatic) state and then understand how injury triggers these differentiation pathways at unexpected locations during regeneration. Using high throughput genomics approaches such as scRNA-seq, ATAC-seq, and Cut&Tag, we have transcriptionally defined every cell type in Hydra and identified putative transcriptional regulators for each cell type. This includes the 11 neuronal subtypes that comprise the nerve net that spans the entire length of the Hydra body. We are currently leveraging these data to conduct functional testing of key putative regulators and to identify injury inputs into cell specification events during regeneration.

MISEXPRESSION OF GENES LACKING CPG ISLANDS IS A SHARED TRAIT OF MAMMALIAN AGING
Samuel Beck, Boston University School of Medicine, Boston, Massachusetts, United States

Changes in the 3-D architecture of chromatin are observed in various diseases and are also a hallmark of aging. Disruption of the nuclear lamina and associated heterochromatin are commonly observed in various aging contexts, including premature aging diseases, cellular senescence, and normative aging. Although these conserved structural changes have been reported for over two decades, their impacts on transcription and contribution to age-related degenerative changes remain unknown. By performing a large-scale computational analysis and experimental validation, here we show that genes lacking CpG islands (CGI- genes), which form heterochromatin when transcriptionally silent, are globally misexpressed in aged nuclei with disrupted chromatin architectures. We demonstrate that CGI- gene misexpression is a common feature of mammalian aging and explains the molecular basis of various age-associated defects, ranging from loss of cellular identity and increased transcriptional noise to age-associated chronic inflammation. Our findings reveal that CGI- gene misexpression is directly associated with age-related physiological deterioration, thus providing a novel biomarker of aging.

A SIMPLE ANIMAL MODEL OF EXERCISE REVEALS A MOLECULAR DETERMINANT OF LONG TERM HEALTH MAINTENANCE
Monica Driscoll, Rutgers, The State University of New Jersey, New Brunswick, New Jersey, United States

At all stages of life, both dynamic gene expression changes and events that “lock in” particular programs that promote health and maintenance are critical factors in aging trajectories. We have a long-term interest in the fundamental biology of healthy maintenance, a topic that has led us to consider multiple facets of healthspan. A powerful whole-organism intervention with maintenance-promoting, anti-disease, anti-aging impact is exercise. The molecular and cellular mechanisms that mediate long-term systems-wide exercise benefits, however, remain poorly understood, especially as applies to “off target” tissues that do not participate directly in training activity. We are investigating the basic biology of exercise benefits using the simple 959-celled model C. elegans. We found that multiple daily swim sessions are essential for exercise adaptation, leading to enhanced expression of muscle structural genes and improved locomotory performance. Importantly, swim exercise training enhances whole-animal health parameters such as mitochondrial respiration and mid-life survival, increases functional healthspan of pharynx and intestine, and enhances nervous system health by increasing learning ability.
of adults and protecting against neurodegeneration in models of tauopathy, Alzheimer's disease, and Huntington’s disease. Remarkably, swim training only during early adulthood induces long-lasting systemic benefits that in several cases are still detectable well into mid-life. Our investigation of the molecular requirements for long-term maintenance (“legacy effects”) revealed that deletion of the sole C. elegans extracellular superoxide dismutase gene SOD-4 changes this pattern. sod-4 mutants are able to swim train to gain measurable benefits, but do not maintain the healthspan improvements that wild type animals do, defining extracellular SOD-4 as a powerful mid-life maintenance factor associated with exercise experience. Our talk will discuss transcriptomic analysis of exercise and SOD-4, as well as our current understanding of the molecular mechanisms operative. Notably, mammalian extracellular SOD ecSOD has been shown to promote exercise associated health and protection against oxidative stress insults (PMID: 32220789 Yan, Spaulding 2020), implicating ecSOD in a conserved role for health maintenance and underscoring potential for therapeutic translation.

SESSION 3820 (PAPER)

LABOR FORCE PARTICIPATION: A GLOBAL PERSPECTIVE

CHANGES IN SUBJECTIVE WELL-BEING DURING RETIREMENT TRANSITION: A 10-YEAR COHORT STUDY OF AGING ADULTS IN CHINA
Shuai Zhou, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

The literature on retirement adjustment remains inconclusive whether retirement transition is a stressor or a relief. This study examined the effects of retirement on subjective well-being of Chinese ageing adults in various phases of retirement. Drawing on a representative sample of “baby boomers” born in 1945-1965 (N = 3,328) from the China Family Panel Studies (2010-2018), the author examined the within-individual changes in subjective well-being, measured by life satisfaction and confidence in the future, using time-distributed fixed-effects regression technique. After adjusting for a wealth of potential confounders such as financial standing and health, the data reveal that the two outcomes of interest started increasing at two years before retiring. In addition, the improvements persisted in four or more postretirement years. Urban adults experienced greater well-being boost than rural residents during the immediate pre- and post-retirement period, but not in two or more postretirement years. Furthermore, the subjective well-being of urban females and rural males increased upon retirement and fluctuated significantly, whereas rural females and urban males experienced a stable increase in subjective well-being since the first preretirement year. Results suggest that the transition into retirement generally represents a relief for urban ageing adults in China, but the well-being improvements are stratified by residency and gender. Therefore, retirement policies should ensure subjective well-being of disadvantaged pre-retirees and attend to the needs of retired urban women and rural men.

DETERMINANTS OF RETIREMENT-AGE WOMEN'S LABOR FORCE PARTICIPATION: A RUSSIA AND THE US COMPARISON
Oksana Dikhtyar, Miami University, Oxford, Ohio, United States

Factors such as one's health, education, marital status, and family caregiving were found to be associated with people’s retirement timing. Few studies looked at those factors separately for men and women and few cross-cultural studies were conducted on the topic. Women tend to accumulate less income and retirement savings throughout their working careers compared to men due to having more intermittent careers and lower paying jobs. Women, in general, live longer than men and are more likely to be divorced or widowed at older ages. Thus, they must spend fewer financial resources over a longer time in retirement. One possible solution is to continue employment after reaching pensionable age. Therefore, it is important to know factors that affect women's labor force participation at or after pensionable age. This quantitative study examines the relationship between women's personal and family factors and their labor force participation after reaching pensionable age in Russia and the U.S. Using data from the International Assessment of Adult Competencies (PIAAC) survey, we analyzed a sample of Russian women ages 55 and older and American women ages 66 and older. For retirement-age Russian women, having highest level of education, living in a larger household, and having spouse or partner in the labor force were positively associated with women’s labor force participation. Likewise, American women of pensionable age with more education and a working spouse were more likely to be in the labor force. Implications for policy and future research are discussed.

RE-EMPLOYMENT MANDATE IN SINGAPORE: EMPLOYMENT AND HEALTH OUTCOMES
Ngee Choon Chia1, Cynthia Chen2, Jemima Koh1, Kia Yee Lim1, and Yuet Yan Tsoi1, 1. National University of Singapore, Singapore, Singapore, Singapore, 2. National University of Singapore, Singapore, Singapore

Older workers can be a crucial resource to meet manpower needs for aging society. This is especially so for countries where older adults are expected to live longer and healthier. In 2012, Singapore implemented the Retirement and Re-employment Act (RRA) which obliged employers to offer re-employment to eligible workers. With RRA, mature workers have the flexibility to work beyond retirement age. Using the Retirement and Health Study (RHS) data and regression discontinuity design, we find that, after adjusting for education, marital status, housing asset and expenditure, the re-employment mandate helps delay retirement in the sample by 8.7%, with a larger impact of 9.1% among the males, as compared to the females of 7.3%. More non-retirees reported that they have very good or excellent health compared to retirees. Retirement leads to increase in healthcare utilization. Does the work environment affect how one responds to retirement option? We observe a correlation between post-retirement wellbeing and stress at work. Our study also suggests that mandatory re-employment offers are less effective in encouraging those in physically demanding jobs to continue working. Re-employment mandate helped raise the employment rate for workers in