Longevity Institute at Northwestern Medicine
Northwestern University Feinberg School of Medicine

Introduction
The complex biological changes associated with aging affect nearly every aspect of a person’s health, yet we are learning that some people are less affected than others by these changes. Aging inevitably occurs with time in all organisms and emerges on a molecular, cellular, organ, systemic, and aggregate individual level with genetic, hormonal, and environmental modulators. Individuals with the same chronological age exhibit differential trajectories of age-related decline, and it follows that one’s biological age does not always equal a person’s chronological age.

Through the new Longevity Institute at Northwestern Medicine, our investigators across many disciplines are studying populations that seem resistant to some of the negative consequences of aging in an attempt to figure out exactly what makes them different. Examples includes carriers of a unique genetic variant in a Swiss Amish community in Adams County, Indiana, and a remarkable but heterogenous group of cognitively young octogenarians termed “SuperAgers.”

Studying populations that exhibit resistance to age-related decline opens an exquisite window into how aging works and hints at future therapies and lifestyle interventions that could help mitigate its undesirable effects. In addition, numerous scientists at Northwestern University Feinberg School of Medicine are already deeply engaged in efforts to reveal important contributors to aging at the molecular and cellular levels. This multifaceted discovery effort has the potential to identify new mechanistic insights into the biology of aging and catalyze the development of new therapeutic approaches to prolong the human healthspan.

The Biology of Aging
Biological aging is associated with a reduction in the body’s potential to repair its tissues and organs. This is known as senescence, the process through which old cells lose their regenerative capabilities. This inevitable reduction in our intrinsic reparative capacity manifests as a decreased physiological reserve in response to stress, which in turn leads to the development of disability and disease. Arterial walls stiffen and blood pressure rises, vision deteriorates, hearing becomes less sensitive, reproductive capacity is lost, and lung capacity is reduced, to name a few examples.

Douglas Vaughan, MD, Irving S. Cutter Professor of Medicine and chair of the Department of Medicine, has spent years studying aging-related disease and senescence. According to Dr. Vaughan, nearly every organ system has a specific aging-related physiological alteration that can be measured. It is now clear that aging is a biologic, rather than chronologic, process. This new insight is providing expansive opportunities for measurement (diagnostics) and modification (therapeutics). Northwestern has been at the forefront of this revolutionary work in the field of aging with Dr. Vaughan’s leadership and the devoted work of faculty colleagues across disciplines.
Vision for Longevity Institute

Through the Longevity Institute, we are on a path to make Northwestern one of the world’s leading centers for basic and clinical research in the field of aging. Over the last decade, our clinicians and scientists have built a diverse portfolio of programs and research in this field. Our faculty are now considered global leaders in the genetics of aging, neurodegenerative disease, aging and the lung, and basic molecular mechanisms of senescence and aging. In fiscal year 2020, Northwestern investigators were awarded nearly $40 million in research funds from the National Institute on Aging. This portfolio of research focused on aging and aging-related morbidity is one of the fastest growing at the medical school over the last five years, an exciting trend likely to continue.

The potential impact and magnitude of an institute at Northwestern dedicated to aging cannot be overstated, as aging affects all humans and is the most important risk factor for the leading causes of morbidity and mortality in the world, including cardiovascular disease, cancer, neurodegenerative diseases (i.e. Alzheimer’s disease), type 2 diabetes, and chronic lung disease. By creating the Longevity Institute at Northwestern Medicine, we have the opportunity to pursue several bold, interrelated goals that will be driven by four complementary and highly interdisciplinary centers.

Northwestern Center for Basic and Translational Biology of Aging

This center will provide for a cognitive and programmatic consolidation of existing programs in the area of aging and longevity. Research now and in the future on both campuses includes a footprint in the Simpson Querrey Biomedical Research Center in Chicago and space in Evanston. As the program grows, we may need to further expand the footprint. This dedicated space will enable the aggregation of the scientists involved in aging research, the creation of key multiuser core research facilities, the development of vertically-aligned research programs using relevant experimental models for aging including C. elegans (roundworms), D. melanogaster (fruitflies), D. rerio (zebrafish), M. musculus (mice), and H. sapiens (humans), and the recruitment of additional investigators to complement and expand our existing research faculty.

An important component of the Northwestern Center for Basic and Translational Biology of Aging includes the unique opportunity to establish a permanent Northwestern satellite in Berne, Indiana, in order to expand and accelerate efforts to genotype and deeply phenotype the adult members (approximately 12,000 individuals) of a unique Swiss Amish community. This remarkable kindred is a founder population that harbors a novel gene mutation that appears to protect against biological aging. Northwestern would be positioned to reveal the results of this multigenerational “natural experiment” and yield institutional distinction for identifying and validating a genetic variant in humans with a multifaceted and robust impact on human aging.

Center for Healthspan Extension at Northwestern Medicine

Our goal is to create the preeminent clinical center in the nation for measuring the biological age, the velocity of aging, and the impact of interventions on biological age and aging-related morbidity in humans. First, we will assemble a multidisciplinary team to collaborate on the development and refinement of a proprietary set of genetic, molecular, physiological, and structural measures that reveal biological age in humans. Second, using measures defined and refined in the center, we will develop an extensive database that allows us to measure and track the trajectory of aging in humans. Third, this center will enable Northwestern Medicine’s participation in multicenter trials and provide a clinical laboratory for testing new therapeutic approaches to delay aging-related morbidity and modify the slope of aging in humans.

The Center for Healthspan Extension also will catalyze the creation of a first-of-its-kind training program for clinicians focused on the biology of aging and its measurement. These individuals will have a unique set of skills that will allow them to contribute to and lead future clinical investigations in human aging at Northwestern and around the world.
Center for Population Science of Aging
Here we will build on our existing strengths at the University and medical school in defining the genetic, molecular, proteomic and metabolomic signatures of aging using the power of large human biorepositories and datasets. It is increasingly clear that epigenetic changes in DNA provide an increasingly precise index of biological age and predict the development of aging-related morbidity and mortality. Northwestern’s investments and expertise in epigenetics will be leveraged in novel investigative partnerships with Northwestern and Feinberg investigators (primarily faculty in the Department of Preventive Medicine) that lead or have access to biorepositories, physiologic data, and clinical endpoints from large prospective studies. This center will catalyze breakthrough opportunities made possible by collaboration between biochemists, geneticists, clinical epidemiologists, and bioinformaticians.

Center for Nanoscience and Aging
Northwestern is one of the leading institutions in the world in nanoscience. Using targets discovered and validated by colleagues in the Longevity Institute, the Center for Nanoscience and Aging will focus on the development of new diagnostic and therapeutic devices and agents that leverage our enormous expertise in bioengineering and chemistry. The center will deliberately emphasize the development of intellectual property (devices, small molecules, biologicals, siRNAs, or related gene targeting approaches) for preclinical testing and advancement into early stage clinical trials in humans. This group will be expected to promote the development of partnerships with private investors, foundations, and industry to build a portfolio that secures and expands the financial underpinnings of the Longevity Institute and supports the goals of the institute in perpetuity.

Geroscience Academy
As an academic institution, an essential part of our mission involves the training and education of future clinicians and scientists. Accordingly, one of the fundamental aims of the Longevity Institute involves the creation of a formal curriculum informed by a dynamic and evolving awareness of the science of aging. Members of the institute will collaborate to develop educational materials and lead courses on the biology of aging for medical and graduate students.

The Geroscience Academy also will engage thought leaders and the community in critically important issues relevant to aging and longevity, including discussions that address the ethical, economic, political, and societal ramifications of extending the human lifespan. Coupled with these efforts, the institute will sponsor a lecture series on the topic of aging that is accessible globally online. Finally, the creation of a substantial cash prize that will be awarded to an internationally recognized leader in the science of aging will provide an exciting opportunity for our trainees and Longevity Institute members to meet and interact with luminaries in the field on an annual basis.

An Invitation to Partnership
With the creation of the Longevity Institute of Northwestern Medicine, we will have an opportunity for Northwestern to take a leadership role in the rapidly advancing field of aging. At present, there is no comparable program devoted to the science of aging in the world that excels in all of the domains corresponding with the centers included in the Longevity Institute. With the right vision, leadership, and philanthropic and institutional investments, Northwestern University Feinberg School of Medicine and Northwestern Medicine can achieve that goal and be a driving force in science that prolongs the healthspan of people and improves the human condition worldwide.

For more information about giving to the Longevity Institute, please contact:
Tiffany Scaparotti
Assistant Dean for Development
Northwestern University Feinberg School of Medicine
Email: tiffany.scaparotti@northwestern.edu
Phone: 312-503-3088