

HONR 202: THE BIOLOGY OF AGING, SPRING 2023

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Section Description: Most chronic diseases, including cancer, diabetes, neurodegeneration, and cardiovascular disease, are highly age-dependent. Clearly, “age” refers to “biologic age” – not chronologic age—because the age of onset is relative to a species’ lifespan. This suggests that a common biologic aging program drives disease susceptibility in general. Over the past 20-30 years, it has become clear that aging and age-related diseases don’t simply represent time-dependent accumulation of damage to cells and tissues. Instead, all cells in the body are programmed to undergo a process called “cell senescence”, which is an irreversible cessation of cell division. Elegant work over the past several years has shown that cell senescence is the major factor underlying human aging. Moreover, interventions that prevent cell senescence extend longevity in model organisms and possibly in humans as well.

The goal of the proposed course is to capture and convey the excitement generated within this area of study. It should be noted that the study of aging is particularly relevant to our Appalachian region, and supports WVU’s land-grant mission.

The course curriculum accompanying this letter integrates cell biology, molecular biology, immunology, nutritional science, exercise physiology, psychology and social sciences into a coherent multi-dimensional framework that will: i) deepen the students’ appreciation for the biological process of aging, whilst expanding their horizons with regard to new and exciting concepts in biology in the larger sense – an important contribution to the students’ general education, whether they major in biological sciences or not; and ii) provide tantalizing evidence for dietary/lifestyle choices and other age-modulating factors that extend the longevity and healthspan of themselves and their loved ones. To my knowledge, there is no comparable course at WVU. The course will be of both intellectual and practical interest to students with a wide variety of backgrounds and interests.

Students should have some background in biological sciences (broadly defined), although students from other backgrounds will be considered on an individual basis.

GEFS and Learning Goals

The proposed course will be offered under the rubric of HONR 202: Honors Science and Technology. We will address General Education Foundation (GEF) areas (*in italics*) as follows:

-Make connections between scientific developments, technological advancement, scientific methods of inquiry and an

-Critical LEAP Goal 1: knowledge of physical and natural world analysis, and today’s world.

-Employ intellectual and practical skills of systematic methods of analysis to the natural and physical world, understand scientific knowledge as empirical, and refer to data as a basis for conclusions in a way that is relevant to modern life

This course will apply multidisciplinary approaches in biological sciences and social sciences, including psychology, toward an intellectual and actionable understanding of aging. Within biology itself, the course will be highly interdisciplinary, demonstrating the power of integrating molecular/cellular biology, genetic studies on model organisms and population-based sciences together, to form robust conclusions. Social sciences will play a dominant role in this course as well, in light of contemporary understanding of the important effects of psychological and social factors in shaping cellular and organismal aging vs. longevity responses, via the newly revealed mechanisms arising from the biology addressed here.

Exercise personal or social responsibility through the careful and rigorous application of methods of scientific inquiry and technological advancement, and by applying the results of that inquiry to personal, local, national, and/or international situations and problems.

Chronic diseases of the elderly have become an international crisis. This is especially true in areas such as West Virginia where the local average age is above the national average. Medicine has become adept at treating these individual diseases to increase lifespan, while posing a severe burden on our healthcare system and on chronically treated elderly patients alike. It is our urgent societal responsibility to address the aging process itself, thus preventing chronic diseases and extending “healthspan” in a much more natural way.

This course will not only impart the excitement emerging from our increasingly profound understanding of the aging process, but also convey a sense of how important a contribution this field can make to our health as individuals and society.

Section-Specific Learning Goals and Outcomes:

Upon successful completion of this course, the student will:

1. Understand the molecular, cellular and genetic factors that control longevity or aging.
2. Appreciate and be able to articulate the process of “cellular senescence” in the context of aging.
3. Understand how diet, exercise and psychological factors affect aging, and be able to apply this knowledge.
4. Learn newly emerging interventions that extend longevity and develop the intellectual framework for formulating new interventions.
5. Learn how socioeconomic factors affect aging and healthspan.
6. Understand the strengths and weaknesses of how society currently cares for the elderly.

