



Online Ethics Center  
FOR ENGINEERING AND SCIENCE

# **Class Plan: Enhancement, Anti-Aging Medicine & Life-Extending Biotechnologies (75min.)**

## **Description**

This class plan gives a selection of exercises out of which an instructor may build a class session around the [Enhancement, Anti-Aging Medicine & Life-Extending Biotechnologies case](#). The materials are suitable for upper division undergraduate courses in bioethics or the life and environmental sciences.

## **Abstract**

## **Notes**

**Class Plan: Enhancement, Anti-Aging Medicine & Life-Extending  
Biotechnologies (75min.)[\[1\]](#)**

## **Learning Objectives**

This material is based upon work supported by the National Science Foundation under Award No. 1355547, Karin Ellison and Joseph Herkert, Arizona State University sub-award Co-PIs. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Students will be able to:

- Think critically about the distinction between therapy and enhancement
- Evaluate ethical arguments for and against the pursuit of anti-aging medicine and life-extending biotechnologies
- Explain the difference between individual and group ethical obligations
- Describe how individuals, including scientists, can act on social responsibilities concerning human enhancement technologies and interventions

## **1. Before Class Assignment**

Readings:

- Partridge, Brad, and Wayne Hall. "The search for Methuselah." *EMBO reports* 8, no. 10 (2007): 888-891.
- Juengst, Eric T., Robert H. Binstock, Maxwell Mehlman, Stephen G. Post, and Peter Whitehouse. "Biogerontology, 'anti-aging medicine,' and the challenges of human enhancement." *Hastings Center Report* 33, no. 4 (2003): 21-30.

## **2. Introduction (20 minutes)**

### *2.1 Opening conversation (18 minutes)*

Ask students: "Given your readings, what are some kinds of technologies or interventions which you consider to be *anti-aging*?"

Students might cite examples of dietary changes and supplements, or some proposed molecular interventions still in the R&D phase, like:

- gene therapies to enable cells to produce additional enzymes to help clear accumulated waste from aging cells with dysfunctional lysosomes
- gene therapies designed to inhibit telomerase to combat age-related cancers

Then, ask students: "Are these examples cases of medical treatment/therapy or

enhancement? Why?"

*Note for instructor:* Life-extending technologies and anti-aging medicine are sometimes divided between “weak” life-extension research and “strong” forms. The former describes biomedical research aimed at preventing and treating common diseases, which occur in older individuals, such as certain forms of cancer, whereas the latter refers to slowing down or stopping the aging process and increasing the average human lifespan in a relatively quick and significant way (Partridge & Hall 2007; Partridge *et al.* 2009). It’s the latter, “strong” sense of life-extension or anti-aging research that has provoked most ethical concerns and discussions.

See also *1.1. Terminology* in: Juengst, Eric and Moseley, Daniel, "Human Enhancement", The Stanford Encyclopedia of Philosophy (Spring 2016 Edition), Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/spr2016/entries/enhancement/>.

## *2.2 Session overview (2 minutes)*

Outline for students that class today is designed to enable them to think critically about the distinction between therapy and enhancement. First, they’ll explore various ethical concerns and arguments about the prospects of “anti-aging medicine” and life-extending technologies. Second, they will consider the ethical responsibilities of individuals (including scientists pursuing this research) and groups and institutions regarding anti-aging interventions.

## **3. Activity: Case Study (30 minutes)**

### *3.1 Have students read case description (5 minutes)*

Marissa frequently visits her elderly parents who live a few hours away from her to make sure they are healthy and comfortable in their retirement community. During her most recent trip last weekend, her father was excited to tell her about a special news report he watched on biomedical research on anti-aging interventions and rejuvenation biotechnologies, and that these new scientific breakthroughs could soon extend natural lifespans by decades. He became so enthusiastic about this new science that he looked into the prospects of undergoing gene therapy as an anti-aging measure for both himself and his wife, Marissa's mother.[\[2\]](#) But then, he explained to Marissa how furious he was to find out that his expensive health insurance plan would not cover this intervention because it considers it to be a case of enhancement rather than a case of medical treatment.

Marissa's father is really upset because he envisioned a retirement filled with travel and other activities with his wife, but lately, several small ailments have interrupted their plans. He thinks the people at the insurance company just don't understand what it's like to experience aging and they are just being stubborn and unsympathetic.

Meanwhile, Marissa's mother heard from the neighbors that the local university's medical center is conducting a research study on a new "anti-aging therapy." The study, she explained to Marissa, is to test a new drug that inhibits something called telomerase which is linked with age-related cancers.[\[3\]](#) Her neighbor then suggested that they might be able to access that anti-aging intervention without any financial cost as research subjects. But, her father says he doesn't want to be a guinea pig. Marissa's mother told Marissa that she thinks she can bring him around by reminding him of all the things they still want to do, places they want to visit, etc., and how tired she is of managing the pain in her joints and how she fears her memory is getting worse everyday.

Marissa told her mother to not do anything before she gets a chance to look into this new biomedical research and that she'd also review her parents' insurance plan. Marissa feels conflicted after their conversation. Of course, she wants her parents to be healthy and happy, and to enjoy their retirement for as long as possible. But, she's not convinced that the anti-aging procedures are necessary or that they are even safe or effective. And, what if her retired parents live for another forty years? Marissa thinks it would be wonderful for her young children to have their grandparents around for that long, but she also worries about whether her parent would be able to maintain their living standards with the rising cost of living.

To Marissa, these prospective changes seem all too sudden.

### 3.2 Small group brainstorming (10 minutes)

Break class into groups of 3-6.

Have each group discuss the questions accompanying the case description:

1. If Marissa finds out that these particular therapies happen to be low risk, would she still have reasons to be concerned with these interventions? If so, why?
2. If the non-experimental therapy is deemed low-risk and has the potential to prevent age-related illnesses, should private health insurance cover the cost? Or, should the intervention be considered an enhancement rather than healthcare or therapy? What are some implications of defining these interventions one way or the other?
3. Consider the case in which Marissa's parents live in a country with universal health care. Should these types of interventions be considered as preventative health measures? What implications might this have on our conception of aging and the way we organize and prioritize certain life plans?

### 3.3 Discuss questions as a class (15 minutes)

Instructor should guide discussion to address the following points from the commentary:

Concerns about the prospects of sustaining increasing populations and shifting demographics, could lead to drastic alterations of social and economic structures, such as (Fukuyama 2003; Binstock 2004):

- the feasibility and implementation of social security policies or the provision of healthcare
- the disruption of social arrangements and human relationships (e.g. family structures, rates of marriage and divorce, reproductive and child-rearing practices)
- the persistence of tyrannical governments or the slower rate of social change and social progress

These concerns have to do with *justice* and *fairness* (i.e. the fair distribution of benefits and burdens in society), and will have consequences for individuals,

society, and the environment.

Concerns about the appropriate goal of biomedical research and healthcare (Partridge & Hall 2007; Gems 2003):

- whether extending life is or ought to be a goal of biomedicine
- the meaning and value of aging – are we pathologizing a natural process?
- implications for our notions of human dignity and identity, and our claims to human rights

Critics of anti-aging interventions-(Leon Kass, Daniel Callahan, Francis Fukuyama):

- Kass and Fukuyama take issue with interfering with the natural life cycle, or the traditional human life expectancy
- Callahan is concerned with consequences of social unrest or social strife that could result from increasing human lifespans, such as the radical changes to our social institutions, notions of personal identity, and economic structures (Turner 2004).

Advocate, Aubrey de Grey, “Strategies for Engineered Negligible Senescence” (SENS) Research Foundation:

- the right to live is a fundamental human right, which translates into a moral duty for the medical community to pursue research into life-extension technologies and anti-aging interventions (de Grey 2005)
- the moral obligation to save life in medicine is the same as the duty to extend it (Partridge & Hall 2007)

#### **4. Activity: How can scientists act on social responsibilities? (15-20 minutes)**

Have each group address the following question: “How can scientists act on their social responsibilities regarding their pursuit of anti-aging interventions?” (Binstock 2004)

*Introduction:* Ellison and Wellner outline four ways scientists can act on social responsibilities:

- Educate
- Contribute to policy processes

- Advocate
- Donate Services

In this activity, you will explore ways individuals and groups of scientists act on social responsibilities concerning anti-aging pseudoscience.

*Context for students:* In his article, “Anti-Aging Medicine and Research: A Realm of Conflict and Profound Societal Implications” (2004), Robert Binstock addresses the social responsibilities biogerontologists have to address and debunk the claims and promises made by anti-aging pseudoscience. Here is an excerpt:

*In the spring of 2002, three scientists who have undertaken research on aging for many years—Jay Olshansky, Leonard Hayflick, and Bruce Carnes—launched a war of words to discredit a burgeoning anti-aging medicine movement. They published an article in Scientific American entitled “No Truth to the Fountain of Youth” in which they declared that,*

*The hawking of anti-aging “therapies” has taken a particularly troubling turn of late. Disturbingly large numbers of entrepreneurs are luring gullible and frequently desperate customers of all ages to “longevity” clinics, claiming a scientific basis for the anti-aging products they recommend and, often, sell. At the same time, the Internet has enabled those who seek lucre from supposed anti-aging products to reach new consumers with ease. (1, p. 92).*

...

*There are good reasons for a public health campaign against some aspects of anti-aging medicine. Although certain anti-aging medicine practices such as promoting exercise and appropriate nutrition can be beneficial, others can be harmful or ineffective. For example, studies have indicated that some short-term anti-aging hormone treatments can have adverse effects such as diabetes and glucose intolerance, and that long-run administration of growth hormone to older persons may potentially elevate the risk of cancer. Similarly, hormone replacement therapy consisting of estrogen plus progesterin for postmenopausal women has been shown to elevate their risks of dementia and of breast cancer, coronary heart disease, stroke, and pulmonary embolism.*

*Moreover, the mere ineffectiveness of some anti-aging interventions can also have deleterious consequences for the welfare of patients and consumers. Engaging in an ineffective anti-aging therapy may preclude patients from participating in other regimens that could be beneficial, and waste money that could be used for helpful medical interventions.*

*There are also issues of economic harm from anti-aging medicine. For some treatments, the sums involved can be substantial. Growth hormone replacement costs between \$7500 and \$10,000 annually according to one report, and “longevity clinics” are charging as much as \$2000 per day. Granted, the majority of older people and baby boomers interested in anti-aging interventions are not able to spend such sums. But even those who can buy comparatively inexpensive mineral waters and ineffective dietary supplements are caused some degree of economic harm.*

*Reflection #1: Answer these questions with respect to the examples in the excerpt.*

- Who is involved in these activities?
- How are they acting on social responsibilities? Does this activity fit into one of the categories outlined by Ellison and Wellner or add a new area?

*Reflection #2: Considering what you know about anti-aging medicine and life-extending biotechnologies and McFarland’s framework\* for analyzing social responsibility in science and engineering, do biogerontologists who work on developing anti-aging interventions have social responsibilities with respect to the marketing of anti-aging pseudoscience?*

<b>Factors</b>	<b>Has this characteristic?</b>
Critical need	

Proximity	
Absence of other sources that can help	
Ability to help effectively, without substantial harm to self	

*Notes for instructor:*

- Consult Binstock's "Anti-Aging Medicine and Research: A Realm of Conflict and Profound Societal Implications" (2004) for additional context and examples of how scientists involved in this research can/should be proactive in shaping and constraining some of the social and environmental ramifications that may result from anti-aging interventions.
- \*For *Reflection #2*, consult: McFarland, Michael C. "The public health, safety and welfare: an analysis of the social responsibilities of engineers." *Technology and Society Magazine, IEEE* 5, no. 4 (1986): 18-26.

### **5. Wrap up (10-15 minutes)**

Show short video of edited excerpt from Gary Marchant's presentation:

Lincoln Center for Applied Ethics. "Ethics@Noon: Anti-Aging." *YouTube* Video, 52:07. September 25, 2015. [https://www.youtube.com/watch?v=UCmf\\_oFjkAs](https://www.youtube.com/watch?v=UCmf_oFjkAs)

Recommended minutes: 12:18-15:59

Ask students to think about the main arguments for and against anti-aging presented by Dr. Marchant in video excerpt. Then, ask students to draw up a short list of (2-3) ethical questions representative of the core issue(s) in the ethical disagreements about anti-aging enhancements.

### **Required Materials and Equipment**

- One short YouTube video:
  - Excerpt from Gary Marchant's *Ethics@noon: Anti-Aging*
- One activity handout:
  - Case study & discussion questions
- Discussion activities
  - whiteboard to keep track of discussion

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[2] For example, scientists are discussing the possibility of using gene therapy to enable cells to produce additional enzymes to help clear accumulated waste from aging cells with dysfunctional lysosomes.

[3] Telomerase is an enzyme that works to lengthen the tips of chromosomes called telomeres. Changes in the length of telomeres over time is associated with the deterioration of human cells and cancer.

### **Rights**

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### **Resource Type**

Instructor Materials

## **Parent Collection**

Human Enhancement Collection

### **Topics**

Controversies

Human Enhancement

### **Discipline(s)**

Biotechnology

Genetics and Genomics

Life and Environmental Sciences