



CLONES & GENOMES – USEM 1580 – SPRING 2016 (10/27/15)

Course Description

“The cloning of humans is on most of the lists of things to worry about from science, along with behavior control, genetic engineering, transplanted heads, computer poetry and the unrestrained growth of plastic flowers.”

Lewis Thomas (1913-1993) Physician, cancer researcher and self-described Biology Watcher.

“Sex will always be the preferred way of having children. Cloning is...far too expensive and a lot less fun than the original method.”

Keith H. Campbell (1954-2012) Developmental biologist and co-creator of Dolly.

“The role of the scientist is to break the laws of nature.”

Steen Willadsen (1941-) Developmental biologist and first to clone a mammal from embryonic cells.

“Common sense tells us that if scientists find ways to greatly improve human capabilities, there will be no stopping the public from happily seizing them.”

James D. Watson (1928-) Co-recipient with Francis Crick and Maurice Wilkins of the 1962 Nobel Prize in Physiology or Medicine for determining the double helical structure of DNA.

Do human clones already exist? What’s the difference between reproductive and therapeutic cloning? Can deceased or even extinct animals be cloned? Can DNA testing be performed on human embryos before they are implanted? Who has the right to know *your* DNA sequence? Can gene therapy be performed in humans? What is our current understanding of these fascinating and controversial questions (and many more!) and what are the experimental approaches used to answer them? Welcome to Clones & Genomes: The New Biology.

Course Objectives

The overall goals of this USEM are for you to:

1. Gain an understanding of contemporary research in reproductive and therapeutic cloning, stem cell research and the applications of these rapidly advancing fields to the treatment of diverse human diseases.
2. Understand the enormous impact of the human genome sequence on genetic testing and the diagnosis and treatment of genetic diseases.
3. Consider these topics from scientific, historical, ethical, religious and societal perspectives and in doing so gain an appreciation for the vital importance of scientific literacy in today’s society.

Meeting Time and Location 1:00 – 2:50 PM Weds. PLSB 403

Instructor Information

Mike Wormington, Associate Professor of Biology. My hometown is Overland Park, Kansas, and I attended the University of Kansas (Go Jayhawks!) where I earned my BA with Honors in Biology and my PhD in Biochemistry. I was an NIH Postdoctoral fellow at the Carnegie Institution for Science, Dept. of Embryology, in Baltimore, MD. I joined the UVa Biology faculty in 1989. My longstanding research interest is the regulation of gene expression during oogenesis and embryogenesis and the interplay between genetic and metabolic reprogramming. When I'm not in the lab or teaching, I spend my time with my wife Susan, who's the Art Director at UVa's Darden School of Business. Our two daughters and sons-in-law and our 3 year old granddaughter Sophie keeps us busy. I'm also a search and rescue, disaster relief mission pilot and director of operations for the Virginia wing of the US Civil Air Patrol which is the civilian auxiliary of the United States Air Force.

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Office Hours: By appointment

Collab Website

The USEM 1580 Collab Course site is an important resource that you will use to access assigned readings and to take online quizzes. The Resources section will contain pdf files of assigned readings and any pertinent powerpoint slides for each unit of the course. These readings will come from essays, review articles, primary research papers, and two out of print books; *Clone: The Road to Dolly and the Path Ahead* by Gina Kolata; and *Bioethics and the New Embryology* by Scott Gilbert, Anna Tyler and Emily Zackin. Each reading assignment will have an associated list of questions that will serve as the basis for class discussions. Since this will be a discussion-based course, you will be expected to complete the assigned reading and go over the pertinent questions *before* the class in which they will be covered.

Course Format

I will typically begin each topic with an overview to introduce new concepts, terminologies, and methodologies. You will then break up into small groups where you will discuss each reading assignment using the associated questions as prompts. Time permitting we'll then reconvene the entire class to collectively share each group's perspectives, questions, and comments. I will organize the groups once the class roster "settles" after the first couple of class meetings. You will work in the same group throughout the semester. Many of the topics we will discuss are necessarily controversial (e.g., when does life begin? the use of human embryos to derive embryonic stem cells, pre-implantation genetic testing), and you may disagree with many scientific methodologies and their applications for any of a number of completely legitimate ethical, moral, political or religious reasons. That's fine. However, the goal of this course is for you to understand and appreciate the underlying science and diverse perspectives you will encounter with these topics. You don't need to agree with them, but you do need to understand them. Science *per se* is intrinsically amoral (i.e., neither good nor bad). That said, the scientific community bears enormous responsibility for envisioning how advances can be applied and educating the public accordingly. We will discuss several examples where reproductive and genetic technologies have been beneficially applied and where their misuse resulted in horrific consequences. However, you'll see that it is often next to impossible to discern when a given

avenue of research leads down the proverbial “slippery slope” to where it should have been stopped. Nobody will be criticized for sharing their opinions or disagreeing with points made in the various articles or by your classmates or me. We will always show the greatest respect and consideration for everyone’s opinions. Remember, the validity of an argument is not enhanced by the volume or intensity with which it is made. We would all do well to heed the following advice of the great journalist and social critic H.L. Mencken “*Assume that your opponent is as decent a person as you are and just as honest, and perhaps, after all, right.*”

NEW FOR S16 – Clones & Genomes is a Device-free class

Laptops and cell phones cannot be used during class. Many faculty in diverse disciplines, have come to the realization that electronic devices increasingly prove to be a distraction, particularly in discussion-based courses. They reduce personal interactions and conversations. As such, you will need to download the assigned articles, print them and bring them to class to refer to them during discussions. There is growing evidence that students both comprehend and retain information more effectively when they write down comments, note questions and highlight passages of interest on a printed document as opposed to doing these on a computer screen. Electronic devices make it all too easy to try and multitask during a class. Guess what? It doesn’t work. To see for yourself, check out this short video by UVa Psychology Professor Dan Willingham who demonstrates that “multitasking is wishful thinking.”

<http://www.youtube.com/watch?v=34OZ-dsNkBw>

Evaluation and Grading

Unlike many of the courses you will take at UVa, this course does not have exams. Instead, my goal is for you to independently explore the topics we will consider and to actively participate in small group and entire class discussions. Your learning will be assessed by:

- **Attendance: 20% of course grade.**
- **Participation in Discussion: 80% of course grade.**
 - You have to attend class and you have to participate once you’re here. I know you have an opinion on virtually any given topic so here’s your chance to express it freely. There will be a reading assignment for every class. You will be expected to contribute to small group and entire class discussions. Asking thoughtful questions contributes to discussions! You will email me a self-assessment score summarizing your overall participation each week using the following scale:

- 0 = unexcused absence from class; correlates to a letter grade of D
- 1 = attentive, but little or no contribution to discussions; correlates to a letter grade of C
- 2 = occasional productive contributions to discussions; correlates to a letter grade of B
- 3 = significant and active participation; correlates to a letter grade of A. *An assessment of "3" must include several sentences specifically describing your participation*

Your discussion group leaders will also independently assess your participation using the same criteria and I will consider both their assessment and yours in determining your final course grade.

Prohibition of Posting Course Materials on 3rd Party or Social Media Websites

UVa policy prohibits posting of course notes and materials on 3rd party websites or social media. Students cannot post audio or video recordings of classes or discussions, lecture notes or any material that is posted on Collab, on *any* internet site. Many of the resources provided in this course are copyright protected. Fair Use laws allow you to use this material in the context of this

course, but prohibit its unlimited copying and distribution to anyone else. Violation of this policy may result in disciplinary action by the University Judiciary Committee.

Honor Statement

I trust every student in this course to fully comply with all of the provisions of the UVa honor system. If you believe that an honor violation has been committed in this *or any course*, it is *your* responsibility to initiate an honor case irrespective if I am (*or any course instructor is*) aware of it or not and you can do this without bringing it to my (*or any course instructor's*) attention. If, in my judgment, it is beyond a reasonable doubt that a student has committed an honor violation that student will receive an immediate and irrevocable grade of 'F' (0%) for that quiz irrespective of any subsequent action taken by the Honor Committee.

Important College Dates

- Add Deadline: Weds. Feb. 3
- Drop Deadline: Thurs. Feb. 4
- Spring Break: Mon. Mar. 7 – Fri. Mar. 11 (No class)
- Withdrawal Deadline: Weds. Mar. 16

USEM 1580 S16 – TOPICS FOR DISCUSSION

1. Historical origins & the biological premise for cloning. Experimental embryology in the 19th & 20th centuries. The impact of scientific misconduct on reproductive cloning.
2. The biology of somatic cell nuclear transfer (SCNT).
3. The science & ethics of human reproductive cloning.
4. Embryonic stem cell research, therapeutic cloning & induced pluripotent stem cells – Promises, Perils, Policies & Politics. The impact of scientific misconduct on therapeutic cloning and stem cell research.
5. When does life begin?
6. 63 Years of DNA: Double helix to human genome.
7. Genes & politics: Eugenics & better living through genetic enhancement.
8. The science & ethics of somatic cell & germline gene therapy
9. The human genome: Genetic testing & whose DNA is it?