



## CLONES & GENOMES – BIOL 1559 – FALL 2015 (7/22/15)

### 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 BIOL 1559 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 Times and Location** 9:30–10:45 AM Tues. & Thurs. GIL 166

### **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 live in North Carolina 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 in PLSB 200: 2–3 PM Mon. and by appt.

### **Collab Website**

The BIOL 1559 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.*”

## Weekly Quizzes

There will be a weekly online quiz posted on Collab after class each Thursday to assess your understanding of the topics covered during that week’s meetings. The quizzes will typically consist of 10 multiple choice and/or true/false questions. You’ll receive an email from Collab when a new quiz has been posted. There is no time limit to complete the quiz before the submission deadline of 9 AM the following Tuesday. You can log on and off Collab multiple times while completing the quiz, but you can only submit your answers once. Collab will automatically submit partially completed quizzes at 9AM each Tuesday and answers will be posted at that time. The quizzes are open book, open note format and you can refer to any pertinent material, including the pptx slides, while you are completing them. The intent of the quizzes is for you to review the topics we addressed and not to memorize factoids. However, *quizzes must be completed and submitted individually. By enrolling in this course, you are affirming on your honor that you have neither received nor given aid while completing the weekly quizzes.* You’re certainly welcome and encouraged to discuss the questions and answers with your classmates *after the submission deadline* and we can discuss them in class as well. Again, I cannot overemphasize that you are required to complete the quizzes *individually* and not work with other students while you are doing them. Learning is indeed collaborative, but assessment is necessarily individualistic.

## Evaluation and Grading

Your learning will be assessed by:

- **Weekly online quizzes: 50% of course grade.**
- **Participation in Discussion: 50% 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 three times during the semester (Oct. 1, Oct. 29, Dec. 8) using the following scoring:
    - 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*

I recommend you honestly and objectively self-assess your participation after each class to track how you’re doing. You can give yourself a fractional score (e.g., 2.5)

## Prohibition of Posting Course Materials on 3<sup>rd</sup> Party or Social Media Websites

UVa policy prohibits posting of course notes and materials on 3<sup>rd</sup> 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 BIOL 1559 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: Tues. Sept. 8
- Drop Deadline: Weds. Sept. 9
- Fall Reading Days: Mon. Oct. 5 & Tues. Oct. 6 (No class)
- Withdrawal Deadline: Tues. Oct. 20
- Thanksgiving Break: Weds. Nov. 25 – Fri. Nov. 27 (No class)

## BIOL 1559 F15 – TOPICS FOR DISCUSSION

1. Historical origins & the biological premise for cloning. Experimental embryology in the 19<sup>th</sup> & 20<sup>th</sup> 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. 62 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?