

# A Unified Stem Cell Curriculum for Higher Education

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PROGRAM ON STEM CELLS IN SOCIETY  
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## Abstract

Developing, implementing and teaching stem cell biology courses in higher education presents special challenges and opportunities. These include:

- institutional appetite
- departmental turf
- multidisciplinary topics
- subject matter expertise
- student demand
- need for public outreach
- a young and rapidly evolving field

Here we describe a successful approach to undergraduate and citizen stem cell education developed by the Stanford University Program on Stem Cells in Society with assistance from The Program in Human Biology and the Program in Continuing Studies

## Course Detail

### Human Biology 157

- Winter quarter 2006 and 2007
- 10 weeks, 3 upper class credits
- 20, 90' lectures
- 10, 60' discussion sections
- topics based on assigned reading of one research paper discussed during lecture
- Average enrollment: 36
- Average audit/guest: 15
- 15 instructors
- eight departments, three schools and two universities represented

### Continuing Studies 053

- Winter/summer quarter 2006-07
- 10 weeks, three credit hours
- Average enrollment: 25
- students include Stanford faculty, staff, biotech executives and other professionals
- 10, 110' sessions
- 7 instructors
- includes Stanford faculty, biotech scientists and executives from the California Institute of Regenerative Medicine

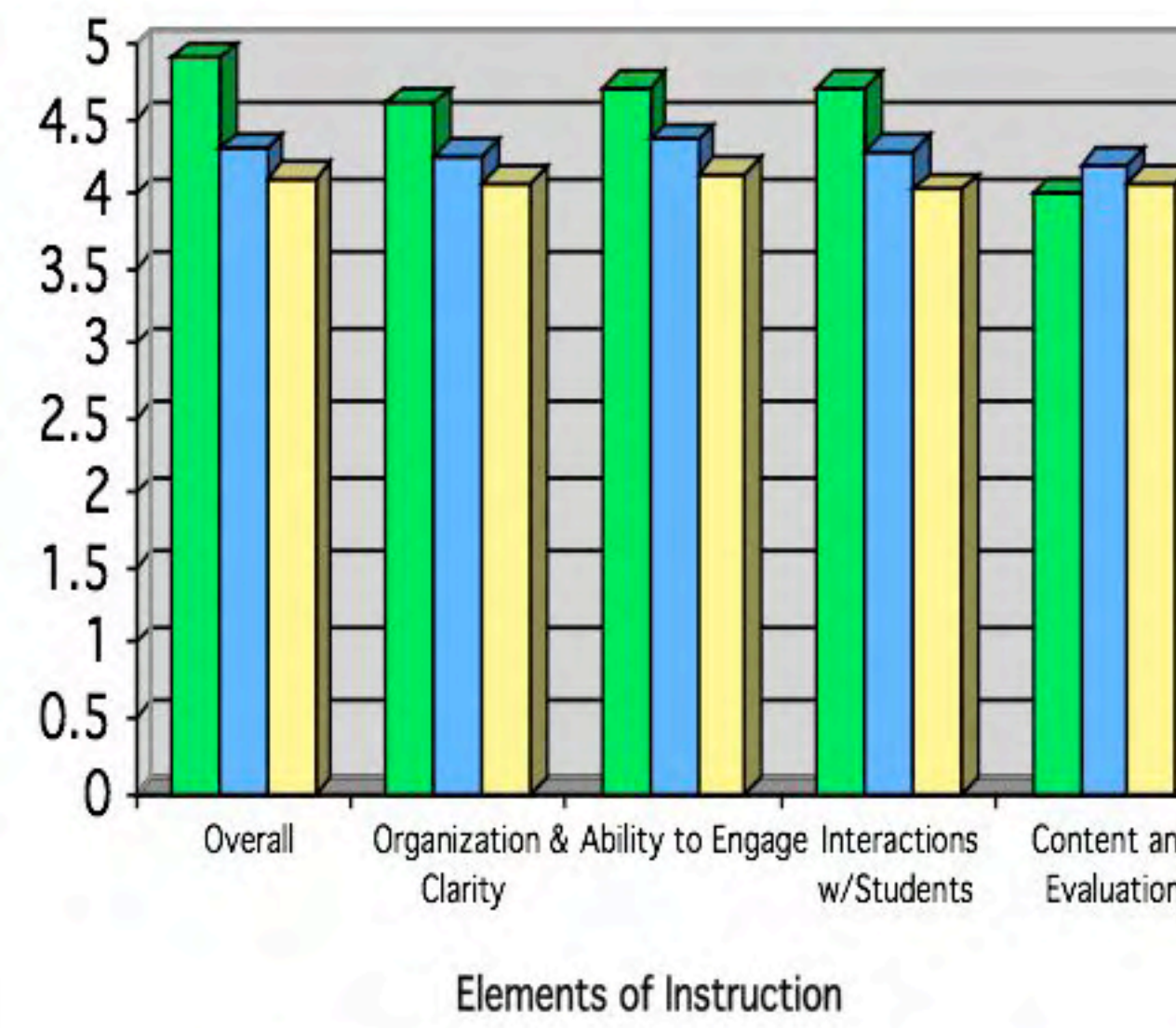
## Curriculum

### Major Topic Areas

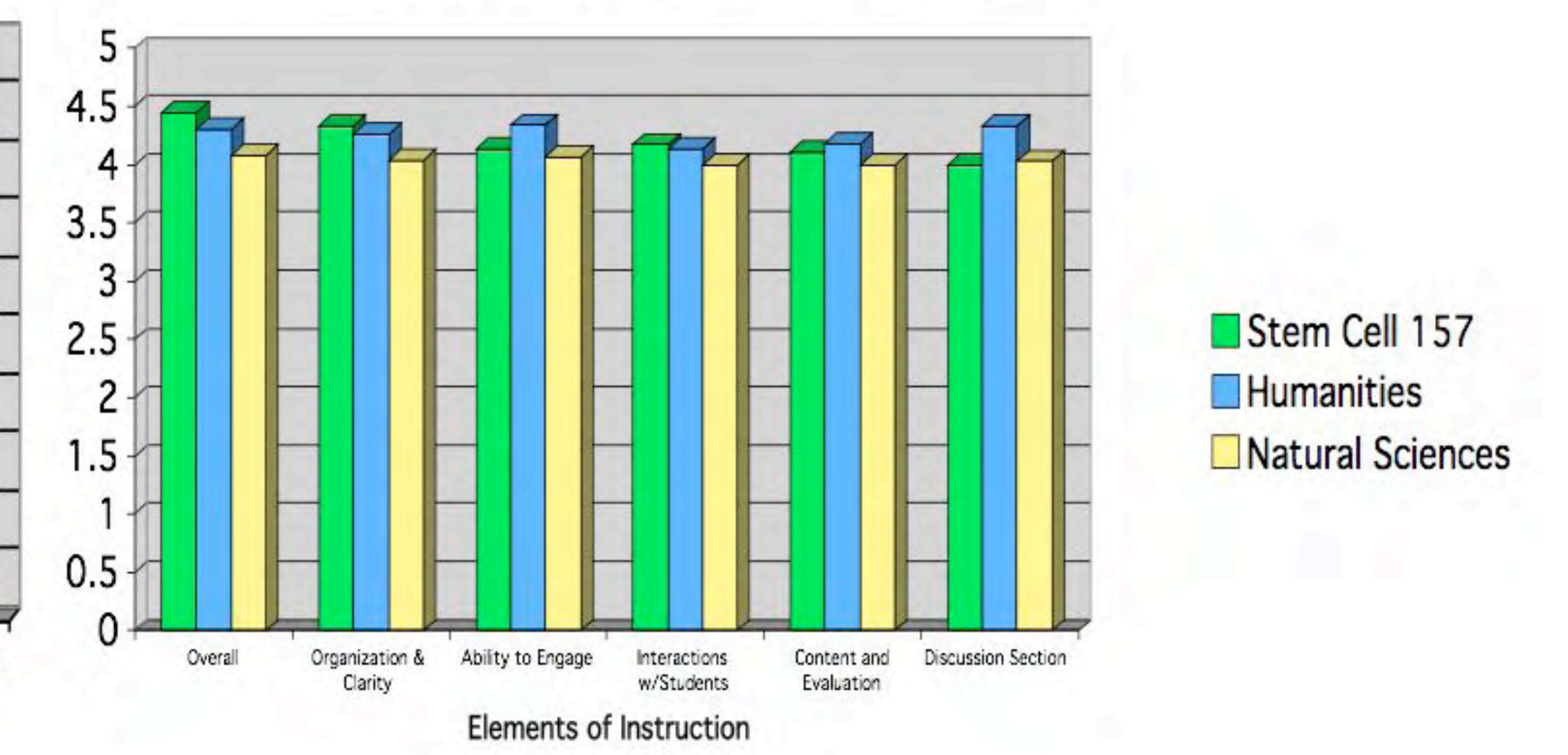
1. Gene expression and signaling
2. Introduction to stem cells
3. The niche
4. Neural stem cells
5. Hematopoietic stem cells
6. Cancer and the cancer stem cell
7. Imprinting and gametogenesis
8. Embryology and Reproduction
9. Embryonic stem cells
10. Derivation and nuclear transfer
11. Reprogramming
12. Ethics: moral status of the embryo
13. Ethics: research and clinical trials
14. Law: IP, regulation and oversight
15. Policy: national and international

## Student Evaluations & Testimonials

Student Evaluations, 2006 (74% response)



Student Evaluations, 2007 (87% response)



- “K.P. was an excellent section leader, the best I ever met in my educational career” T.Y.
- “This was by far my most interesting class this quarter, and perhaps even at Stanford. I had come into the class expecting more of a focus policy and ethics side, but I've come to see that a strong grasp of the biological concepts are essential to inform both policy and ethics.” K.K.M.
- “It was easily one of my favorite academic experiences at Stanford and quickly sparked my interest in the area of stem cells. I am a student advisor for the Human Biology program and have strongly encouraged students to take the class next year.” L.R

## Sample Discussion Readings

- Rideout, et al. “Correction of a genetic defect by nuclear transplantation and combined cell and gene therapy.” *Cell*, 2002.
- Hochedlinger, K. and Jaenisch, R. “Nuclear programming and pluripotency.” *Nature*, 2006.
- Meilander, G. “The point of a ban, or how to think about stem cell research.” *The Hastings Center Report*, 2001

The CourseWork web tool provides a central hub for course information. It includes sections for Course Materials (lecture notes, readings, video links), Announcements (course events, seminars, and local news), and Syllabus (exam dates, required readings, and exam questions). The interface is user-friendly and accessible from any device.

CourseWork web tool includes lecture notes, videos, syllabus, readings, exams, enrollment information and grades

Announcements include course information, stem cell events, seminars and symposia held on campus and in the Bay Area

Course materials include lecture notes, required readings, video streaming links and exams

Video streaming is available for all lectures. The interface allows students to watch lectures at their own pace, with options to pause, play, and seek. The video content is high-quality and includes clear audio and video of the instructor.

Video streaming available after each lecture

Interactive approach, with journal-club style discussion sections

The syllabus for Human Biology 157 is structured as follows:

- Jan 9 Introduction** - Roel Nusse
- Jan 11 Expression and Signaling** - Roel Nusse
- Jan 14 Introduction to Stem Cells** - Miss Fuller
- Jan 18 The Stem Cell Niche** - Miss Fuller
- ADULT STEM CELLS**
  - Jan 23 Neural Stem Cells** - Julie Baker
  - Jan 25 Hematopoietic Stem Cells** - Julie Baker
  - Jan 30 Cancer and Cancer Stem Cells** - Irving Weissman
  - Feb 1 Tissue Engineering** - Julie Baker
- EMBRYONIC STEM CELLS**
  - Feb 6 Imprinting and Gametogenesis** - Miss Fuller
  - Feb 8 Review** - Miss Fuller
  - Feb 13 Midterm** - Miss Fuller
  - Feb 15 Embryology and Reproduction** - Julie Baker
  - Feb 20 Embryonic Stem Cells and Derivation** - Julie Baker
- THE MAGNIFICENT EGG**
  - Feb 22 Nuclear Transfer** - Julie Baker
  - Feb 27 Nuclear Reprogramming** - Baker/Bergholz
- ETHICS AND POLICY**
  - Mar 1 Ethics, Part 1** - David Madigan
  - Mar 6 Ethics, Part 2** - Christopher Scott
  - Mar 8 Law** - Henry Greely
  - Mar 13 Policy** - Christopher Scott
  - Mar 15 Review** - Christopher Scott
  - Mar 19 Final Exam** - Christopher Scott

The course includes a variety of question types to assess student understanding. Multiple choice questions test basic concepts, while short essay questions require students to apply their knowledge and analyze complex scenarios. The questions are designed to be challenging and thought-provoking.

- Sections test the understanding of concepts presented in class
- Multiple choice, fill-in, T/F and short essay questions form the basis of midterm and final examinations
- Citizen classes require an 8-10 page paper