

Botswana: Development in Southern Africa

Spring 2018

Ethical and Social Issues in Biotechnology in Southern Africa

Instructors:

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Course Description

In this course we will examine development in Southern Africa from the perspective of applications of biotechnology. We will focus on social and ethical issues related to research and implementation of biotechnologies applied to business including agriculture, health including genetic testing and pharmaceuticals, and to the characterization of human populations including eugenics and modern efforts to determine ancestry and migration patterns. As has been the case over time and globally, biotechnology or applied genetics can have critical political, economic, and social consequences. The driving social, political, and economic forces of what technologies are developed and applied will also be considered.

Learning goals

- Effective communication and collaboration
- Identification of social and historical dimensions of genetic practices and applications
- Gain appreciation of the impact of ethical considerations, social practices, and economic priorities on research and applications of genetic technologies in Southern Africa
- Students will gain an appreciation of an interdisciplinary approach to a topic of interest
- Understand the power and limitations of the scientific method so students can critically evaluate claims when scientific explanations and technology are invoked in discussions and applications of policy.
- Understanding fundamental technical concepts and ethical considerations of biotechnology

Course work

A wide variety of formats of coursework will be graded. Oral and written communication skills will be emphasized. Some assigned work will be collaborative. Students are encouraged to collaborate and converse about the readings, classroom discussions, documentaries and supplementary material. *Journal entries may reference or be influenced by these conversations although each student is responsible for writing their own entries. Always clearly acknowledge contributions to your work.*

Grading scheme

Final grades are based on a weighted average for the term. Grade cutoff points (in terms of percentage of total points) are as follows (as per the University of Botswana system): A =80-100%; B+ = 75-79.9%; B = 70-74.9%; B- = 65-69.9%; C+ = 60-64.9%; C = 55-59.9%; C- =50-54.9%; D+ = 45-49.9%; D = 40-44.9%; D- = 35-39.9%, E = < 35%.

Reading journal entries	30%
Active participation (including mandatory attendance)	20%
Short assignments and quizzes	30%
Research paper and presentation	20%

Reading Journal: purposeful comprehension, retention, application

Every student must outline reading assignments and keep a reading journal. Reading notes should be brought to class – think of them as your GPS for class discussion.

Each journal entry consists of notes from each reading assignment(s), as well as periodic requests for fact-gathering and information. Entries may incorporate comments or reflections about insights & ideas provoked by what you have learned from class discussion, other classes and conversations outside both. Occasionally prompts to include responses to specific questions or assignments may be provided during class.

Weekly journal entries combine outlines, reading notes and may include reflections – but they are **not** essays). For each item assigned, you should include a brief (1 paragraph or less) summary written in your own voice. Note: estimate writing is 4-8 pages a week.

- Please name files: Last name date journal: Gregg-Jolly 1-29-19 journal, for example. Do not include any special characters in the file name.

Active Participation in Class Discussion: be an active learner

Class discussion represents an *exchange of ideas*. It is a conversation among peers. Shared perspectives as well as differences of opinion further our own understanding of a topic. Critical thinking and an engaging exchange of ideas depends on listening carefully to another person's perspective and responding respectfully. The focus should be specifically on what and why there are points of agreement or disagreement -- how is one interpretation different and in what ways should it be valued as more or less persuasive?

All discussions need to be situated within or grounded by the context of assigned readings. These may be supplemented with (not substituted by) outside sources.

Always come prepared to lead a class discussion or to discuss one or more passages: this is why bringing your reading notes is very important They should include: What are the main points? Identify key passages. What is the significance of the work? What is the logic behind the author's discussion? What should we remember from the materials and why? How does the reading relate to previous readings, events in the news, and themes of this course?

COURSE SCHEDULE OF TOPICS (*subject to change)

I. Overview

What is biotechnology? Basics of recombinant DNA.

Examples of products and processes

Food and pharma

Genetic testing (disease and ancestry)

Social and ethical issues including safety, political power, economic forces, making ethical decisions, impact of use and misuse of products of biotechnology

II. Biotechnology for business

A. GMOs in agriculture

Introduction

Examples including Golden Rice, Kalahari watermelon

Politics of food

Regulation (South and Eastern Africa Consortium).

B. Other applications including mining and wild-life management

III. Health and biotechnology

A. GMOs and pharmaceutical research and development

B. Genetic testing

Overview of technology and related ethical issues

Accessibility in underdeveloped areas

Genetic markers related to HIV and TB, Collaborative African Genomics Network (CAfGEN)

C. Vaccine development (HIV and Ebola)

D. Gene drive technology to mitigate spread of malaria

Overview of technology. Safety, regulatory and ethical considerations.

IV. Applied human genetics

A. Eugenics

B. categorization and “racing” populations.

C. Ancestry and migration

Case study: San people and ethical conduct of research

Readings and assignments will be drawn from a variety of sources, including the following:

African Business Magazine. (2014). Can Africa handle GM? *African Business Magazine*. Retrieved from <http://africanbusinessmagazine.com/uncategorised/can-africa-handle-gm/>

Batlang, U., Tsurupe, G., Segwagwe, A., & Obipile, M. (2014). Development and application of modern agricultural biotechnology in Botswana: The potentials, opportunities and challenges. *GM Crops & Food*, 5(3). pp. 183-194. doi: 10.4161/21645698.2014.945887

Callaway, E. (2017). South Africa's San people issue ethics code to scientists. *Nature*, 543(7646). pp. 475-476. doi:10.1038/543475a

Chabrol, F. (2014). Biomedicine, Public Health, and Citizenship in the Advent of Antiretrovirals in Botswana. *Bioethics*, 14(2). pp. 75-82. Doi: 10.1111/dewb.12051

Council for Responsible Genetics (2017) CRISPR & Gene Drives GeneWatch 30 (1)

Crawford, N. G., Kelly, D. E., Hansen, M. E. B., Beltrame, M. H., Shaohua, F., Bowman, S., ...Tishkoff, S. (2017). Loci associated with skin pigmentation identified in African populations. *Science*. doi: 10.1126/science.aan8433

Dubow, S. 1995. *Scientific Racism in Modern Southern Africa*. Cambridge University Press.

Dubow, S. 2012. South Africa: Paradoxes in the Place of Race *The Oxford Handbook of the History of Eugenics* Ed. Bashford and Levine.

Falack-Zepeda, J., Gruère, G., & Sithole-Niang, I. (Eds.). *Genetically modified crops in Africa: Economic and policy lessons from countries south of the Sahara*. Washington, D.C.: International Food Policy Research Institute (IFPRI).

Galton, F. Chapter XXI. Race Improvement In *Memories of My Life*.

<http://galton.org/books/memories/chapter-XXI.html>

- Jacobsen, S.-E., Sørensen, M., Pedersen, S. M., & Weiner, J. (2013). Feeding the world: genetically modified crops versus agricultural biodiversity. *Agronomy for Sustainable Development*, 33(4). pp. 651-662. Doi: 10.1007/s13593-013-0138-9
- Kawasaki, S., et al. 2000 Responses of Wild Watermelon to Drought Stres: Accumulation of an ArgE Homologue and Citrulline in Leaves during Water Deficits. *Plant Cell Physiol* 41(7) pp.864-873.
- Lewis, C. P., Newell, J. N., Herron, C. M., & Nawabu, H. (2010). Tanzanian farmers' knowledge and attitudes to GM biotechnology and the potential use of GM crops to provide improved levels of food security. A Qualitative Study. *BMC Public Health*, 10(407).
<http://doi.org/10.1186/1471-2458-10-407>
- [Mabhaudhi, T., T. Chibarabada, & Modi, A. \(2016\) Water-Food-Nutrition-Health Nexus: Linking Water to Improving Food, Nutrition and Health in Sub-Saharan Africa. *Int J Environ Res Public Health* 13\(1\) 107.](#)
- [Naicker, L. \(2012\) The role of eugenics and religion in the construction of race in South Africa. *Studia Historiae Ecclesiasticae* 38\(2\):209-220.](#)
<http://uir.unisa.ac.za/bitstream/handle/10500/8122/Naicker.pdf>
- National Academies of Sciences, Engineering, and Medicine. 2016. Genetically Engineered Crops: Experiences and Prospects. Washington, DC: The National Academies Press.
- National Academies of Sciences, Engineering, and Medicine. 2017. Preparing for Future Products of Biotechnology. Washington, DC: The National Academies Press.
- Nolan, T. and Crisanti, A. (2017) Using Gene Drives to Limit the Spread of Malaria. *The Scientist*, 31(1). Retrieved from <http://www.the-scientist.com/?articles.view/articleNo/47755/title/Using-Gene-Drives-to-Limit-the-Spread-of-Malaria/>
- Paarlberg, R. (2009) *Starved for Science: How Biotechnology Is Being Kept Out of Africa*. Cambridge, MA: Harvard University Press.
- Paarlberg, R. (2014). A dubious success: The NGO campaign against GMOs. *GM Crops & Food*, 5(3). pp. 223-228. doi: 10.4161/21645698.2014.952204
- Pulice, G., Pelaz, S., & Matías-Hernández, L. (2016). Molecular Farming in *Artemisia annua*, a Promising Approach to Improve Anti-malarial Drug Production. *Frontiers in Plant Science*, 7, 329. <http://doi.org/10.3389/fpls.2016.00329>
- Qaim, M. (2010). Benefits of genetically modified crops for the poor: household income, nutrition, and health. *New Biotechnology* 27(5). pp. 552-557. Doi: 10.1016/j.nbt.2010.07.009
- RhODIS (Rhino DNA Index System) <http://rhodis.co.za/>
- Servick, K. (2017). How will we keep controversial gene drive technology in check? *Science*. Retrieved from doi: 10.1126/science.aan7127
- Scudellari, M. (2013). A Dime a Dozen: Affordable diagnostic tests tackle the world's most pressing health problems. *The Scientist*, 27(1). Retrieved from <http://www.the-scientist.com/?articles.view/articleNo/33761/title/A-Dime-a-Dozen/>
- Singh, J.A. (2008) Project Coast: eugenics in apartheid South Africa. *Endeavour*, 32 (1) doi:10.1016/j.endeavour.2008.01.005
- Skoglund, P., Thompson, J. C., Prendergast, M. E., Mittnik, A., Sirak, K., Hajdinjak, M., ...Reich, D. (2017). Reconstructing Prehistoric African Population Structure. *Cell*, 171(1). pp. 59-71. Doi: 10.1016/j.cell.2017.08.049
- Sköld, P. (2015) *Under the Same Sun: Parallel Issues and Mutual Challenges for San and Sami Peoples and Research*. Vaartoe/Centre for Sami Research (CeSam).
- Thomson, J. A. (2008). The role of biotechnology for agricultural sustainability in Africa. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 363(1492), pp. 905-913. Doi: 10.1098/rstb.2007.2191

- Waithaka, M., Belay, G., Kyotalimye, M., & Karembu, M. (2015). Progress and challenges for implementation of the Common Market for Eastern and Southern Africa policy on biotechnology and biosafety. *Frontiers in Bioengineering and Biotechnology*, 3(109). Doi: 10.3389/fbioe.2015.00109
- Wambugu, F. & Kamanga, D. (Eds.). (2014) *Biotechnology in Africa*. New York, NY: Springer.
- World Health Organization, vaccines <http://www.who.int/topics/vaccines/en/> and Vaccine Safety Basics <http://vaccine-safety-training.org/pharmacovigilance.html>
- Zimmer, C. (2017, October 12). Genes for Skin Color Rebut Dated Notions of Race, Researchers Say. *The New York Times*. Retrieved from <https://www.nytimes.com/2017/10/12/science/skin-color-race.html>