

HEB 1700: Human Evolutionary Biology in Society

Instructor: Dr. Bridget Alex
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Course time: M 12 – 2 pm (and field trips outside class hours)

Location: MCZ 529

Enrollment: seminar limited to 14 students

Course description: What are the key concepts of Human Evolutionary Biology? Why and how should these concepts be shared with society and other fields like medicine, law, and education? This course will explore challenges, methods, and impacts of outreach in Human Evolutionary Biology. In the first unit we will identify socially relevant HEB concepts and discuss barriers to public understanding and acceptance of science. Then we'll explore methods to overcome these barriers, with guest lectures from museum directors, K-12 educators, journalists, and policy makers. In the final unit we will analyze case studies in which HEB concepts have been presented in public discourse and other fields. Throughout the semester, students will design, conduct, and evaluate an outreach project in collaboration with local K-12 programs and museums. Students will produce final reports, which summarize their project, its predicted and observed outcomes, and recommendations for future iterations.

For HEB Concentrators counts as **Junior Research Seminar** or **upper-level HEB elective**. This is a Mindrich Program Engaged Scholarship course.

Course goals:

- Determine key concepts of HEB relevant to society and other fields
- Identify barriers to public understanding and acceptance of science
- Compare methods of conducting and evaluating science outreach
- Critique examples of HEB concepts presented in the public or other fields
- Work collaboratively with community partners to develop an outreach project that spreads science beyond the college classroom

EXPECTATIONS & POLICIES

Assignments summary:

Pre-class survey.....	2 points
<i>Story Collider</i> reflection.....	20
Work plan.....	20
Site reflection.....	20
Project plan.....	30
Museum comparison.....	20
Discussion leader.....	20
Participation.....	26
Post class survey.....	2
Final Report.....	50
Total.....	210

Assignment Details

- 1) Pre/post class surveys:** Before the second week of class and after the last week students will complete a survey about your views on HEB in society. Neither survey is graded for content. You will receive full credit for completing them.
- 2) *Story Collider* reflection*:** Individual assignment. Reflect on how science is presented to the public in *Story Collider*, a live performance of “true, personal stories about science” (~2 pages double spaced).
- 3) Work Plan:** Group assignment. Summarize initial partner meetings and describe your group’s plan to develop your project. Include project goals, timeline, and resources needed for development. Delegate responsibilities among group members (2-3 pages).
- 4) Site reflection:** Individual assignment with group input. Observe your site and/or preexisting materials, discuss observations with group members, and write individual reflection. The reflection should describe observations and discuss how these will inform project development (2-3 pages).
- 5) Project Plan:** Group assignment. The final plan for your project, which describes the activity and provides preliminary data or observations from test-runs. Include the evaluation method, resources needed, and any written or visual materials that will be distributed. Should be written for partners (2-3 pages).
- 6) Museum comparison**:** Individual assignment. Compare how science is presented at the Harvard Museum of Natural History and the Boston Museum of Science (short answer responses).

7) Discussion leader: In small groups you will lead discussion of a case study, occurring Weeks 10-13. Responsibilities include choosing appropriate pre-class assignments and inviting guest speakers (if necessary and appropriate).

8) Participation: Active participant in class, fieldtrips, and final showcase. Come to class prepared to discuss the assigned reading. You are expected to listen to classmates and guests, and to contribute thoughtful comments, which demonstrate engagement with the assigned reading and flow of the discussion

10) Final Report: Individual assignment. Structured as a research paper, testing the hypothesis that your activity achieved its desired outcomes. Should provide background, justifying your activity with theory and evidence from published literature. Describe your methods of development, implementation, and evaluation. In the discussion, analyze both the process of development and results from evaluation, ending with recommendations for future iterations (10-12 pages, not including references, tables, figures).

*Students who cannot attend *Story Collider* must do an **Elective Outreach Review** of an example of HEB in the public sphere. Options include documentary films, podcasts, public lectures, and popular nonfictions texts (2 pages).

**Students who cannot attend the Museum of Science field trip must go independently. The class will cover MBTA transport and museum admission costs.

Assignment deadlines and extensions

Non-project assignments (e.g. *Story Collider* reflection, Museum comparison) and the final report are due by the dates posted on the syllabus. In most cases, extensions will be granted *provided they are requested at least 5 days prior to the due date*. Late submissions without prior permission will be penalized. Deadlines related to project progress (Work Plan, Site Reflection, Project Plan) will vary by group (dates posted on the syllabus are approximate).

Academic Integrity Policy

Discussion and the exchange of ideas are essential to academic work and community engagement. You are expected to collaborate with classmates, instructors, and community partners. **Group assignments should be produced collectively, but each group member should note their particular contributions.** Individual written work should reflect your own thoughts, inspired by class readings, conversations, and collaborative experiences. **You may seek feedback on written work, but must list on the submitted work the source of this feedback, including classmates, instructors, BSC, Writing Center, or tutors.** You must also adhere to standard citation practices and properly cite any books, articles, websites, lectures, etc. that have informed your work.

Class Materials and Expenses

Readings and videos are posted on the website. Funding is available for outreach project expenses, including transportation and materials. Expenses should be requested in the Work Plan (due 22 Feb) and Project Plan (due 5 April).

Field Trips

There are three class field trips. Travel and admissions will be covered by Harvard. If you cannot attend a field trip, notify the instructor ASAP to discuss alternatives.

Tuesday 12 February: – *Story Collider* live performance at Oberon Theater in Harvard Square from 8-10 pm (doors open 7:30 pm).

Friday 8 March – Museum of Science guided tour at 5:00 pm. You may travel with the group by MBTA from Harvard Square (leaving ~4:15 pm) or meet at MoS at 5:00 pm. After the tour (~1 hour) you may depart or remain as long as you choose.

Monday 25 March – NOVA Studios during class time. Tour and workshop on multimedia storytelling with Ari Daniel Shapiro. We will travel by MBTA bus from Harvard leaving just before 12 pm and staying at NOVA until 2 pm.

You must fill out a travel form for each field trip.

OUTREACH PROJECTS

Outreach projects are the foundation of this course and will take place over the course of the semester. In small groups you will collaborate with museum and K-12 educators to design an activity that spreads HEB concepts beyond the college classroom. You will be graded based on assignments staged throughout the semester, designed to assess your progress and connect your project to class themes. The projects vary in form, location, and participants. Some require particular time availabilities. The shared features of all projects are explained below, followed by descriptions of the particular projects.

Terms:

Students – Harvard College students enrolled in HEB 1700

Partners – collaborators at outreach sites (teachers, museum staff, program directors)

Participants – the community for which the activity is designed (K-12 students, museum guests)

Site – location of the outreach activity (school, museum, HEB space)

Project – overall process of designing, conducting, & evaluating outreach activity

Activity – the planned, bound science experience that participants complete, which is facilitated and evaluated by students (school field trip, classroom visit)

Product – output of the project, which could be referenced or used in the future (lesson plan, activity plan)

Phases

The exact timing of phases will vary by project and some phases will overlap.

Phase 1: Initial partner meetings (*Weeks 2-4*)

- Students meet with partners
- Establish project goals, constraints, and timeline
- Discuss knowledge and needs of participants
- **DUE FRIDAY 22 FEB: Work Plan**

Group assignment. Written document that summarizes initial partner meetings and describes your group's plan to develop your project. The Work Plan should include project goals, timeline, and resources needed for development, and it should delegate responsibilities among group members (2-3 pages).

Phase 2: Fieldwork and observations (*Weeks 4-7*)

- Students observe outreach sites and/or existing activities
- Discuss and synthesize observations with group members and partners
- **DUE THURSDAY 14 MARCH: Site Reflections**

Individual assignment with group input. Students will observe their site and/or preexisting activities, discuss observations among group members, and write individual reflections. The reflection should describe observations and discuss how these will inform project development (2-3 pages).

Phase 3: Project Development (*Weeks 7-9*)

- Design project and evaluation method
- Conduct test-runs of project, revise accordingly
- Meet with project partners and participants as necessary
- **DUE FRIDAY 5 APRIL: Project Plan**
Group assignment. The final plan for your project, which describes the activity and provides preliminary data or observations from test-runs. It should include the evaluation method, resources needed, and any written or visual materials that will be distributed. Should be written for partners (2-3 pages).

Phase 4: Project implementation (*Weeks 9-13*)

- Run final version of outreach project and evaluation methods
- Compile observations and data for reports

Phase 5: Showcase and reports

- **MONDAY 6 MAY 1-2 pm: Project Showcase**
Groups present projects in a celebratory (non-evaluative) showcase and reception.
- **DUE SATURDAY 11 MAY: Final Report**
Individual assignment. Structured as a research paper, testing the hypothesis that your activity achieved its desired outcomes. Should provide background, justifying your activity with theory and evidence from published literature. Describe your methods of development, implementation, and evaluation. In the discussion, analyze both the process of development and results from evaluation, ending with recommendations for future iterations (minimum 10 pages, not including references, tables, figures).

Elements

All HEB 1700 outreach projects will comprise the following elements:

- Sustained collaboration with community partners, who have outside perspectives and expertise
- Repeated interactions with participants through observations, interviews, surveys, and/or activities
- Ongoing reflection and evaluation of the process
- A product that is shared with partners that can be referenced or re-used to guide future projects and activities

Partners and Projects

1) Watertown Middle School (WMS) fieldtrip

Site: WMS, Harvard Museum of Natural History (HMNH), HEB Department

Partners: Wendy Derjue-Holzer, Education Director at HMNH; Tegan Condon, teacher at WMS

Participants: Watertown 8th graders

Description: Design a ~30 min “behind the scenes” activity in HEB for Watertown 8th graders on a field trip to HMNH. The activity should complement the Human Origins class at HMNH. Prior visit to WPS science class.

Requirements: Lead activities in HMNH or HEB on April 8th

2) 7th grade science lesson

Site: Ferryway School, Malden

Partner: Cheryl McDonough, science teacher

Participants: 4 sections of 7th grade science class

Parameters: Design and teach a lesson (4 times in one school day) that fits into the 7th grade science curriculum and covers Next Generation Science Standards related to HEB concepts. The lesson should aim to be inclusive and encouraging for under-represented minorities and recent immigrants.

Requirements: Partial school day observing, full school day leading activity.

3) Science Club for Girls (SCFG) Lesson

Site: Margaret Fuller Neighborhood House (71 Cherry St, Cambridge) and Harvard HEB or MCZ

Partner: Cristina Ullmann, Program Director of Science Club for Girls

Participants: 6-8th grade STEMInistas

Parameters: Design and lead a SCFG activity to precede their “Build an Animal Module” about adaptation and evolution. Activity should take place in the HEB-MCZ building complex, utilizing our facilities or collections.

Requirements: Observe SCFG on Saturday March 9th from ~9:45 am – 12 pm. Lead HEB visit on Saturday March 30th during same timeframe.

4) Other options with instructor permission:

- MIT Museum project (TBD)
- HEB Alumni survey – how HEB concepts impact your personal or professional life 5+ years after graduation
- Other programs – if you are already involved in a community engagement program, you may be able to design a project for that group

Jan 27	28 <i>Intro</i>	29	30	31	Feb 1	2
3 Project Phase I	4 <i>Science literacy & denialism</i>	5	6	7	8	9
10	11 <i>Evolution in America</i>	12 Story Collider 8pm	13	14	15 <u>Story collider review</u>	16
17	18 no class <i>Pres Day</i>	19	20	21	22 <u>Work plan</u>	23
24 Phase II	25 <i>Evaluating outreach</i>	26	27	28	Mar 1	2
3	4 <i>Museums</i>	5	6	7	8 MoS 5 pm	9
10 <u>Museum reflection</u>	11 <i>K-12 Education</i>	12	13	14 <u>Site reflection</u>	15	16 <i>Spring break →</i>
17	18	19	20	21	22	23
24 Phase III	25 <i>Media I NOVA ~12pm</i>	26	27	28	29	30
31	Apr 1 <i>Media II</i>	2	3	4	5 <u>Project plan</u>	6
7 Phase IV	8 <i>Creationism</i>	9	10	11	12	13
14	15 <i>Health & medicine</i>	16	17	18	19	20
21	22 <i>Sex & gender</i>	23	24	25	26	27
28	29 <i>Genetics; Policy</i>	30	May 1 <i>Reading period →</i>	2	3	4
5 Phase V	6 Showcase 1-2 pm	7	8	9 <i>Finals →</i>	10	11 <u>Final report</u>
12	13	14	15	16	17	18

COURSE SCHEDULE

NOTE: Readings subject to change. Consult course website for up-to-date readings.

Unit I: The State of HEB in Society

Unit I objectives:

- **List HEB concepts that everyone should understand**
- **Identify popular perceptions and misconceptions of these concepts**
- **Describe challenges of science outreach**
- **Develop a toolkit for evaluating outreach**

Week 1, Jan 28 – Introduction

KEY QUESTIONS

- What are the course topics, goals, and expectations?
- Why do you think HEB is relevant to everyday lives and other fields?
- What is community-based learning?

IN CLASS

Overview of course and outreach projects.
Brainstorm HEB concepts most relevant to society.

Week 2, Feb 4 – Public Understanding of Science

KEY QUESTIONS

- What are the risks and rewards of public engagement for scientists?
- How does the public regard science and scientists?
- What does the average citizen need to know about science?
- What are the barriers to public understanding & acceptance of science?

PRE-CLASS ASSIGNMENT

“Science’s Next Frontier? It’s Civic Engagement,” L. Lief. *Discover*. 11/13/2017.
<http://blogs.discovermagazine.com/citizen-science-salon/2017/11/13/sciences-next-frontier-its-civic-engagement/#.WlZzdUtrz-Z>

Priest, S. (2013). Critical Science Literacy. *Bulletin of Science, Technology & Society*, 33(5-6), 138–145. <http://doi.org/10.1177/1075547011408927>

Kahan, D. (2010). Fixing the communications failure. *Nature*, 463, 296–297.

Fiske, S. T., & Dupree, C. (2014). Gaining trust as well as respect in communicating to motivated audiences about science topics. *Proceedings of the National Academy of Sciences*, 111(Supplement_4), 13593–13597.

Diethelm, P., & McKee, M. (2009). Denialism: what is it and how should scientists respond. *European Journal of Public Health*, 19(1), 2–4.

Week 3, Feb 11 – HEB concepts and public perceptions

KEY QUESTIONS

- How well accepted and understood is human evolution in America?
- What are challenges of teaching, learning, and reporting evolution?
- Do citizens need to understand and accept evolution?

PRE-CLASS ASSIGNMENT

TBD

IN-CLASS

Guest: Rachel Gross, science writer, MIT Knight Fellow MIT, *Smithsonian* editor

FIELD TRIP: FRIDAY 12 FEB: *Story Collider*, Oberon Theater, Harvard Sq, 8 pm

Week 4, Feb 18 – no class Presidents’ Day

DUE: FRIDAY 22 FEB: Work Plan

Week 5, Feb 25 – Designing and evaluating outreach

KEY QUESTIONS

- How do we set outreach goals accommodating community knowledge, interests, needs?
- How do we evaluate the effectiveness of outreach?
- What are basic methods of survey and scale design?

PRE-CLASS ASSIGNMENT

Schwarz, N. (1999). Self-Reports: How the Questions Shape the Answers. *American Psychologist*, 54(2), 93–105.

Spicer, S. (2017). The nuts and bolts of evaluating science communication activities. *Seminars in Cell and Developmental Biology*, 70, 17–25. <http://doi.org/10.1016/j.semcdb.2017.08.026>

Skim the following and compare the questionnaires. Are any of the questions confusing or leading? Would any of the questions be useful for your project goals?

Nadelson, L., Jorcyk, C., Yang, D., Jarratt Smith, M., Matson, S., Cornell, K., & Husting, V. (2014). I Just Don’t Trust Them: The Development and Validation of an Assessment Instrument to Measure Trust in Science and Scientists. *School Science and Mathematics*, 114(2), 76–86.

Hawley, P. H., Short, S. D., McCune, L. A., Osman, M. R., & Little, T. D. (2011). What’s the Matter with Kansas?: The Development and Confirmation of the Evolutionary Attitudes and Literacy Survey (EALS). *Evolution: Education and Outreach*, 4(1), 117–132. <http://doi.org/10.1371/journal.pbio.0030364>

Drummond, C., & Fischhoff, B. (2017). Development and Validation of the Scientific Reasoning Scale. *Journal of Behavioral Decision Making*, 30(1), 26–38.
<http://doi.org/10.1006/drev.1999.0497>

Unit II: Science Outreach Methods

Unit II objectives:

- **Compare different outreach methods and venues**
- **Meet professionals from museums, education, and media**
- **Consider different career paths in science**

Week 6, March 4 – Museums

KEY QUESTIONS

- What are the goals of museums? Who do museums serve?
- What are different approaches to learning in museums?

PRE-CLASS ASSIGNMENT

Hein, G. E. (2006). Museum Education. In S. MacDonald (Ed.), *A Companion to Museum Studies* (pp. 340–352). Blackwell Publishing Ltd.

“Platform Power: Scaling Impact,” 9/27/2017. Nina Simon. *Museum 2.0 Blog*.
[http://museumtwo.blogspot.com/2017/09/platform-power-scaling-impact.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+museumtwo+\(Museum+2.0\)&utm_content=FeedBurner](http://museumtwo.blogspot.com/2017/09/platform-power-scaling-impact.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+museumtwo+(Museum+2.0)&utm_content=FeedBurner)

2 other posts of your choosing from *Museum 2.0*

“People Trust Museums More than Newspapers. Here is Why that Matters Right Now.” Colleen Dilenschneider. *Know Your Bone Blog*. <https://www.colleendilen.com/2017/04/26/people-trust-museums-more-than-newspapers-here-is-why-that-matters-right-now-data/>

2 other posts of your choosing from *Know Your Bone*

IN-CLASS

Guest: Wendy Derjue-Holzer, Education Director, Harvard Museum of Natural History
 Tour and reflect on learning experience in HMNH galleries.

FIELD TRIP: FRIDAY 8 MARCH: Museum of Science, Boston

We will visit the Museum of Science at 5:00 pm for a guided tour with Elizabeth Kong, Manager of Hall of Human Life.

DUE: SUNDAY 10 MARCH: Museum comparison

Week 7, March 11 – K-12 Education

KEY QUESTIONS

- How do we teach core concepts at different developmental levels?
- What are the advantages/disadvantages of science standards?
- What are non-traditional education methods?

PRE-CLASS ASSIGNMENT

Nadelson, L., Culp, R., Bunn, S., Burkhart, R., Shetlar, R., Nixon, K., & Waldron, J. (2009). Teaching Evolution Concepts to Early Elementary School Students. *Evolution: Education and Outreach*, 2(3), 458–473. <http://doi.org/10.1007/BF02461557>

Evans, M. (2000). The Emergence of Beliefs About the Origins of Species in School-Age Children. *Merrill-Palmer Quarterly*, 46(2), 221–254.

IN-CLASS

Guest: Victor Pereira, Lecturer and Master Teacher in Residence of the Harvard Teachers Fellows Program, Graduate School of Education

DUE: THURSDAY 14 MARCH: Site reflection

Spring Break, March 18 – NO CLASS

**Week 8, March 25 – Media I
NOVA Field trip, Multimedia Story Telling**

KEY QUESTIONS

- Why are stories an important tool of science communication?
- What are the advantages and disadvantages of different types of media?
- What is the process of producing video and audio stories?

PRE-CLASS ASSIGNMENT

Dingwall, R., & Aldridge, M. (2016). Television wildlife programming as a source of popular scientific information: a case study of evolution. *Public Understanding of Science*, 15(2), 131–152. <http://doi.org/10.4135/9781412990127.n17>

Scharrer, L., Rupieper, Y., Stadtler, M., & Bromme, R. (2017). When science becomes too easy: Science popularization inclines laypeople to underrate their dependence on experts. *Public Understanding of Science*, 26(8), 1003–1018.

IN-CLASS

Field trip: NOVA Studios, Boston
Tour and workshop with Ari Daniel Shapiro, producer, journalist, host *Story Collider*
Discuss how to tell stories about science.

Week 9, April 1 – Media II Science writing and journalism

KEY QUESTIONS

- How do you make science accessible without losing accuracy?
- How do journalists decide what research to cover?
- What is the process of reporting science news?

PRE-CLASS ASSIGNMENT

Chapter 1, Hayden, T., & Nijhuis, M. (Eds.) 2013. In *The Science Writers' Handbook* (pp. 3–8). Boston: Da Capo Press.

Optional: Chapter 3, if you want to learn how to pitch stories to publications.

Schäfer, M. S. (2011). Sources, Characteristics and Effects of Mass Media Communication on Science: A Review of the Literature, Current Trends and Areas for Future Research. *Sociology Compass*, 5(6), 399–412. <http://doi.org/10.2190/PMM9-DPUT-HN3Y-LMJQ>

Alex, B. “Unraveling a Secret.” *Discover Magazine*. October, 2017.

Pitch for “Unraveling a Secret”

Alex, B. “Yes, Some Greenland Sharks Are Old, but 400 Years Old?!” *Discover* online. 8/11/2016.

Press release for Greenland Sharks.

Nielsen, J. et al (2016). Eye lens radiocarbon reveals centuries of longevity in the Greenland shark (*Somniosus microcephalus*). *Science*, 353(6300), 702-704.

DUE: FRIDAY 5 APRIL: Project plan

Unit III: Case studies

Unit III objectives:

- Apply course learning to case studies
- Critique how HEB concepts are presented in public discourse and other fields

Note: The remaining weeks focus on particular HEB topics that often receive attention from the public and other fields. During class earlier in the semester (Week 5), we will form small groups that will determine the specific topics and materials for these case studies. The groups will assign at least one academic article and popular media article or video. They may invite a guest speaker, but are not required to do so.

Week 10, April 8 – Creationism

Week 11, April 15 – Health and medicine**Week 12, April 22 – Sex and gender****Week 13, April 29 – Genetics; Policy**

Guest: Bina Venkataraman, Lecturer in Science Technology & Society MIT, Director of Global Policy Initiatives at Broad Institute, former Senior Advisor for Climate Change Innovation in Obama White House

MONDAY 6 May: Project showcase. Celebratory presentations from 1-2 pm.

DUE: SATURDAY 11 MAY: Final Reports submitted by midnight.