SENATE COMMITTEE ON CURRICULAR AFFAIRS

COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

Name	User ID	College	Department
SANDY FEINSTEIN	SXF31	Berks College (BK)	Not Available
BRYAN WANG	bsw13	Berks College (BK)	Not Available

Academic Home: Berks College (BK)

Type of Proposal: ☒ Add ☐ Change ☐ Drop

Course Designation

(CMLIT 183Q) From Beast Books to Resurrecting Dinosaurs

Course Information

Cross-Listed Courses:

BIOL 183Q(BK)

Prerequisites:

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title:	Beasts
Discipline:	General Education
Course Listing:	Inter-Domain

Special categories for Undergraduate (001-499) courses

Foundations

☐ **Writing/Speaking (GWS)**

☐ **Quantification (GQ)**

Knowledge Domains

☐ **Health & Wellness (GHW)**

☒ **Natural Sciences (GN)**

☐ **Arts (GA)**

☒ **Humanities (GH)**

☐ **Social and Behavioral Sciences (GS)**

Additional Designations

☐ **Bachelor of Arts**

☐ **International Cultures (IL)**

☐ **United States Cultures (US)**

☒ **Honors Course**

☐ **Common course number - x94, x95, x96, x97, x99**

☐ **Writing Across the Curriculum**

First-Year Engagement Program

☐ **First-Year Seminar**

Miscellaneous

☐ **Common Course**

GE Learning Objectives

☐ **GenEd Learning Objective: Effective Communication**
☐ **GenEd Learning Objective: Creative Thinking**
☐ **GenEd Learning Objective: Crit & Analytical Think**
☐ **GenEd Learning Objective: Global Learning**
☒ **GenEd Learning Objective: Integrative Thinking**
☒ **GenEd Learning Objective: Key Literacies**
☐ **GenEd Learning Objective: Soc Resp & Ethic Reason**

Bulletin Listing

Minimum Credits:	3
Maximum Credits:	3
Repeatable:	NO
Department with Curricular Responsibility:	Berks College (Pre-Major) (BKBK_BKCOM)
Effective Semester:	FA 2018
Travel Component:	YES
Description Of Travel Component:	Includes one-day field trip to a natural history museum and/or zoo.

Course Outline

A brief outline or overview of the course content:
Honors course integrating comparative literature and biology to explore how nature has been described, explained, and represented over time.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:
2 weeks. Classical Natural History and Early _Scientia_
- Aristotle and Pliny
- Aesop and Ovid

2 weeks. Medieval Appropriations and Authority
- Albertus Magnus
- Isidore's _Etymologiae_
- Early Christian Classification: Physiologus, Aberdeen bestiary, Chaucer

1 week. Introducing Taxonomy
- Linnaeus
- Satirical literary taxonomy: Swift

1 week. Scientific Methods in Transition in Words and Pictures
- Bacon and Cavendish
- Lear and Potter

2 to 3 weeks. Evolutions
- Darwin's Poetic Life
- Descent with Modification
- Forming Species
- Family Trees
- Inheritance

2 to 3 weeks. Reducing Life: Molecules
- The Double Helix
- DNA as Metaphor
- The Central "Dogma"
- Tinkering with a Common Language
- Letters and Relationships

2 to 3 weeks. Connections: Past, Present, and Future
- Genomes
- Poetic Mapping
- Big Data
- Resurrecting Dinosaurs?
- Designing and Engineering Life

Course Description:

In this honors course, we'll explore changing perspectives on life and approaches to studying life. More specifically, we'll examine, through an historical lens, humankind's quest to describe and explain and, ultimately, to expand the diversity of the living world. We begin with early attempts to classify living things—for example, Aristotle and Pliny. We then see how medieval bestiaries appropriated classical ideas about nature while adding to them in the context of Christian historia . In the Enlightenment, Linnaeus's taxonomic work provided a new way of naming and systematizing organisms. On the other hand, the nascent scientific methods of Sir Francis Bacon anticipate the shift from the descriptive to the theoretical and mechanistic that accompanied Darwin's first sketch of a phylogenetic tree and the theory of evolution. We consider new theories, methods, and language in our examination of Watson and Crick and the double helix, molecular biology, and genomics. The course concludes with a glimpse at future possibilities enabled by what was studied previously in the course: genetic engineering, synthetic biology, and de-extinction.

The course's original structure offers the experiential engagement of the sciences through laboratory experiments and fieldwork along with the workshop and directed discussions characteristic of the humanities seminar. The content and type of "readings" also reflect both areas and include primary and secondary sources in a variety of media. A visit to a natural history museum and/or zoo provides important physical contexts where students learn about type specimens, live specimens, and how scientists today use collections. They will assemble and curate their own zoological collection, juxtaposing various approaches to describing and classifying animals. The integration of the humanities and the sciences into a single course, along with the incorporation of significant experiential work, helps students gain a broad and deep understanding of and appreciation for each of these intellectual disciplines and for life itself.

The name(s) of the faculty member(s) responsible for the development of the course:

- Name: BRYAN WANG (bsw13)

Title:
Phone:
Address:
Campus: BK
City:
Fax:

- Name: SANDY FEINSTEIN (SXF31)

Title:
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Address:
Campus: BK
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Fax:

Course Justification

Instructional, Educational, and Course Objectives:
This section should define what the student is expected to learn and what skills the student will develop.
This course seeks to introduce students to natural philosophy and biology and to how the methods and language used to describe and explain nature have changed over time. Specifically, it exposes students to the processes of observation, reasoning, and experiment underlying early as well as more recent efforts to gather, record, and disseminate ideas about nature. Consequently, students will gain an understanding of how science as scientia (knowledge) changed to the codified experimental science practiced today.
Through experiential work (learning by doing), students will engage with and employ a range of materials and methods of inquiry in the humanities and the sciences to address natural phenomena.
Students will also practice integrative thinking to synthesize and transfer knowledge and ideas in and between the humanities and the sciences.
Students will develop their textual, linguistic, and scientific literacy.
They will demonstrate knowledge of major cultural currents, issues, and developments through time and informed understanding of scientific claims and construct evidence-based explanations of natural phenomena.
Finally, students will increase their competence in critical thinking and communication about foundational topics, texts, and ideas in the humanities and the sciences.

Evaluation Methods:
Include a statement that explains how the achievement of the educational objective identified above will be assessed. The procedures for determining students' grades should be specifically identified.
Three assessment categories—class preparation and participation (journal, log/notebook); course projects (research paper, zoological collection, a scientific report); and tests (midterm, final exam)—will count equally in the determination of final grades. We've described these components with some sample assignments below.
Students will prepare for class by completing the assigned "reading" (text or multimedia) and responding to the reading in a journal. Journal entries may respond to prompts for reflection or to focus questions that highlight key principles. The juxtaposition of reflection and questions reflect the ways humanists and scientists have historically approached problems. These formative assessments will be graded primarily for completeness and good faith effort.
In-class activities will rely on discussion and debate as well as hands-on activities that range from illustration to computer modeling, a walk in the forest to the creation of fluorescent bacteria. Students will document their experiential work in a field log/research notebook that will be graded for completeness and detail.
In addition to preparing students for class, journals also provide a place to think out possible directions for future assignments. Many entries will respond to prompts intended to probe topics at a deeper level and/or treat a given theme integratively. For example, one prompt will ask students to identify an unfamiliar word, concept, or creature from the reading. Next, students will

explore what the word or concept means in the context of their own experience and then that of the reading. They are asked to find at least two sources of the word, concept, or creature representing two different scholarly contexts—one, an article in the humanities that examines, say, the bestiary creature or classical representations, and, another, in a context they understand to be "scientific." This exercise introduces students to the different ways scholars approach nature in their disciplines and also serves as a way to brainstorm ideas or pre-write in anticipation of the paper described below. Therefore, the grade is based on the completeness of the assignment and the depth of the response.
Students will complete several course projects designed to review concepts and encourage integrative and other higher-level thinking. They will write a paper that examines a key word, chosen by the student, in the context of at least one pre-Darwinian text and one post-Darwinian text, accounting for the change in meaning over time. In a scientific lab report that introduces how contemporary scientific literature disseminates information, students will report on the context, aims, methods, results, and significance of their own work in the laboratory, creating a genetically modified organism. In another project, students will collect a zoological portfolio that they curate throughout the term with various nomenclature schemes, modes of classification, and descriptions that reflect different historical periods and levels of scientific understanding. Rubrics will assess each of these projects—research paper, lab report, and zoological portfolio—according to development of ideas (including integration), content accuracy, and adherence to formal stylistic expectations.
A midterm exam will review key concepts and integration of ideas in the pre-Darwinian section of the course; the final exam will emphasize post-Darwinian work, but review those ideas within the framework of the entire course and therefore will comprehensively evaluate student understanding and integration.

Relationship/Linkage of Course to Other Courses:
This statement should relate the course to existing or proposed new courses. It should provide a rationale for the level of instruction, for any prerequisites that may be specified, or for the course's role as a prerequisite for other courses.
There are no prerequisites because we'd like to attract and engage all students drawn to the subject, honors students and others looking for a stimulating educational experience, students seeking an outlet for their many interests as well as an intellectual home. We want to welcome non-science students (and non-humanities students) who would benefit from an integrated study of science and literature and improving their literacy in both disciplines, but who may not have had the room, the desire, or the need to complete a pre-requisite course in the major—and yet who may then be inspired to pursue one discipline or the other.
Although there are no pre-requisites for this course, we believe its integrative nature makes it appropriate for the 200-level.
We do not envision it as a prerequisite for any existing course.
The course could be seen as related to CHEM/ENGL 233, Chemistry and Literature. A key difference, however, is that in From Beasts Books to Resurrecting Dinosaurs, students practice the distinct methodologies of the sciences such as fieldwork and laboratory experiments. Naturally, the content of Beasts differs from that of CHEM/ENGL 233 as well.
Beasts discusses several topics related to evolution and molecular biology that are also covered in BIOL 110 (Biology: Basic Concepts and Biodiversity), and like BIOL 110, Beasts introduces these topics without expectation of prior knowledge beyond high school biology. However, the integrative focus of Beasts, its emphasis on primary sources, and the variety of materials used in each learning module distinguish these sections of the course from those of BIOL 110. Furthermore, at Berks, BIOL 110 is a four-credit course that includes one credit of lab in a meeting separate from the lectures. In contrast, the experiential learning activities in Beasts are an inextricable component of the course—Beasts is a three-credit course with the one credit of "lab" (experiential work) incorporated into the "lectures" (other classroom work)—an arrangement that promotes closer integration of theory and practice. Other courses currently offered at Berks that combine lab and lecture components within meetings of a three-credit class include METEO 3, GEOG 10, and GEOSC 20.

Relationship of Course to Major, Option, Minor, or General Education:
This statement should explain how the course will contribute to the major, option, or minor and indicate how it may function as a service course for other departments.
From Beast Books to Resurrecting Dinosaurs addresses GH and GN domain criteria and the integrative studies component of the General Education Curriculum.
Additionally, reading Aristotle and Pliny and those who adapted and appropriated their works can be foundational for those with an interest in literature, rhetoric, and medieval studies. Moreover, introducing students to an approach that integrates reading and experiential learning through lab work (the latter no longer required for liberal arts majors) may ultimately contribute to generating as yet undiscovered ideas and, thus, prove life-changing to a student's view of his/her discipline and the world.
As noted in the previous section, the course shares some topics with BIOL 110, the first biology course taken by students who intend to major in biology, and is intended to stimulate interest in the living world, but is not designed to fulfill requirements of the biology major.

A description of any special facilities:
The class will be taught, at least in part, in a biology or biochemistry and molecular biology laboratory.

Frequency of Offering and Enrollment:
alternate years. 20 students.

Alignment with General Education Objectives

☐ **EFFECTIVE COMMUNICATION – the ability to exchange information and ideas in oral, written, and visual form in ways that allow for informed and persuasive discourse that builds trust and respect among those engaged in that exchange, and helps create environments where creative ideas and problem-solving flourish.**

☒ **KEY LITERACIES – the ability to identify, interpret, create, communicate and compute using materials in a variety of media and contexts. Literacy acquired in multiple areas, such as textual, quantitative, information/technology, health, intercultural, historical, aesthetic, linguistic (world languages), and scientific, enables individuals to achieve their goals, to develop their knowledge and potential, to lead healthy and productive lives, and to participate fully in their community and wider society.**

☐ **CRITICAL AND ANALYTICAL THINKING – the habit of mind characterized by comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating a conclusion. It is the intellectually disciplined process of conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by,**

observation, experience, reflection, reasoning, or communication, as a guide to belief and action.

☒ **INTEGRATIVE THINKING – the ability to synthesize knowledge across multiple domains, modes of inquiry, historical periods, and perspectives, as well as the ability to identify linkages between existing knowledge and new information. Individuals who engage in integrative thinking are able to transfer knowledge within and beyond their current contexts.**

☐ **CREATIVE THINKING – the capacity to synthesize existing ideas, images, or expertise in original ways and the experience of performing, making, thinking, or acting in an imaginative way that may be characterized by innovation, divergent thinking, and intellectual risk taking.**

☐ **GLOBAL LEARNING – the intellectually disciplined abilities to analyze similarities and differences among cultures; evaluate natural, physical, social, cultural, historical, and economic legacies and hierarchies; and engage as community members and leaders who will continue to deal with the intricacies of an ever-changing world. Individuals should acquire the ability to analyze power; identify and critique interdependent global, regional, and local cultures and systems; and evaluate the implications for people's lives.**

☐ **SOCIAL RESPONSIBILITY AND ETHICAL REASONING – the ability to assess one's own values within the social context of problems, recognize ethical issues in a variety of settings, describe how different perspectives might be applied to ethical dilemmas, and consider the ramifications of alternative actions. Individuals should acquire the self-- knowledge and leadership skills needed to play a role in creating and maintaining healthy, civil, safe, and thriving communities.**

What component(s) of the course will help students acheive the General Education Learning Objectives covered in the course? Provide evidence that students in the course have adequate opportunities to achieve the identified learning objectives.

Key Literacies:

Reading assignments will help students develop textual and scientific literacy. Students will prepare for class by reading texts available in the public domain or through the University libraries in electronic format, guided by journal exercises and focus questions that highlight salient points. For example, in their first introduction to phylogenetic trees, students will read an excerpt from Alfred Russel Wallace's "The Origin of Species and Genera" and a series of short articles from the Understanding Evolution website (University of California Museum of Paleontology and the National Center for Science Education) before answering focus questions regarding speciation, phylogeny, and shared derived characters. In preparing for a class on genomics, students will view several videos, including the TED Talk "How to read the genome and build a human being," and then, in a journal entry, defend the speaker's assertion that "our mothers are 3D printers." (In class, they will deconstruct and ultimately rebut that argument.) Thus, students gain experience with interpreting material in a variety of media and contexts.

In-class experiential work also reflects that variety, requiring students to compute, analyze, and create using a wide range of material. Hands-on activities will include a class-constructed bestiary, with each student contributing (in words or with an image of an existing or fictional creature), thereby suggesting the ways different hands contributed to the making of a medieval manuscript. Later exercises will incorporate the emphasis on visual representations of nature, such as Edward Lear's natural history illustrations. Through fieldwork, students will learn to gather specimens, observe them closely, and to "illustrate"—in words or pictures—extant, local fauna and flora. Later, contrasting these early and still used methods, they will approach the laboratory bench and the computer to construct phylogenetic trees based on anatomical and molecular homologies and employ recombinant DNA techniques to create genetically modified bacteria.

Other in-class activities—discussion, debate, and presentations—offer the students opportunity to develop their creative habits and oral communication skills. For instance, during the module on evolution, students in small groups will prepare presentations that explain, from specific historical points of view, the unity and diversity found among living things. This assignment could recreate Victorian contexts: one kind of performance might have students acting as the Linnaean Society of 19th century England; another, as the governing body of the Church of England in that same era. Their classmates, as the audience for these positions, will pose questions consistent with what they have learned about each culture and context. These activities complement out-of-class written work in journals and course projects throughout the course, including the research paper and scientific lab report, that encourage students to engage more deeply with the concepts and themes presented in the readings and in class and foster the kinds of literacy needed for scholarship, personal growth and success, and productive citizenship.

Integrative Thinking

Readings in the course balance early natural history—classical and medieval—with contemporary scholarly articles on related topics, and students will read from primary sources (or translations) as well as popular accounts and creative representations throughout the course. For example, we juxtapose Watson and Crick's description of DNA structure with May Swenson's poetic use of the double helix as metaphor (and use of metaphor to describe the double helix). The shared or overlapping content and themes introduced through the readings will be reinforced in class discussions to help develop and enact integrative thinking.

Directive journal assignments are intended to facilitate understanding of the distinct methodologies and language usages of the readings and in the two disciplines and thereby help students "synthesize knowledge across multiple domains, modes of inquiry, historical periods, and perspectives" as well as see the relationship among these perspectives. For example, after learning about Darwin's conception of a "tree of life," students will contrast the idea of ordering life as a branching tree as opposed to the "great chain of being" posited by earlier thinkers, and then will discuss which perspective on life, ladders or trees, seems to hold more weight in modern society.

In the zoological collection project, students assemble images of creatures that reflect either ideas of classical natural history and the bestiaries or of more recent scientific discoveries—and then curate those representations by naming and organizing them according to different schemes used throughout history. This assignment provides another means for students to demonstrate their understanding of the different ways nature has been analyzed, explained, and represented, and how new methods reflect culture, refined technologies, and evolving ideas about the natural world and life itself.

In a more developed way, the research paper that examines the changing meaning of a key word using pre-Darwinian and post-Darwinian sources requires students to reflect on, research, and analyze distinct approaches to a shared subject.

These assignments and creative projects, as well as the discussions we engage in during class, will prepare students for the

transfer of knowledge and integrative thinking required on the mid-term and final exams.

How will students be assessed to determine their attainment of the Learning Objective(s) of General Education covered in this course? This assessment must be included as a portion of the student's overall performance in this course.

Literacy development through pre-class and in-class work will be assessed in the journal entries that will help focus student attention on key points in the reading and in student participation in discussions, debates and the log/notebook that records experiential work. The conscientious completion of the assignments—that is, the wrestling with ideas, even thoughts about what seems confusing or uncertain—will be assessed as successful.

The research paper and zoological collection/portfolio will be graded for the development of ideas—including their integration, the accuracy of content, and the adherence to stylistic expectations as defined by a rubric.

Students will also demonstrate literacy development in their scientific lab report, which will be evaluated according to a rubric.

A midterm exam will review key concepts and integration of ideas in the pre-Darwinian section of the course; the final exam will emphasize post-Darwinian work, but review those ideas in the context of the entire course and will comprehensively evaluate student understanding and integration.

General Education Domain Criteria

General Education Designation: Inter-Domain

GH Criteria

☒ **Explain the methods of inquiry in humanities fields and describe how the contributions of these fields complement inquiry in other areas**

☒ **Demonstrate competence in critical thinking about topics and texts in the humanities through clear and well-reasoned responses**

☐ **Critically evaluate texts in the humanities– whether verbal, visual, or digital– and identify and explain moral or ethical dimensions within the disciplines of the humanities**

☒ **Demonstrate knowledge of major cultural currents, issues, and developments through time, including evidence of exposure to unfamiliar material that challenges their curiosity and stretches their intellectual range**

☐ **Become familiar with groups, individuals, ideas, or events that have influenced the experiences and values of different communities**

What components of the course will help students acheive the domain criteria selected above?

Readings in natural philosophy and medieval bestiaries are key to understanding how _scientia_ (knowledge) becomes science. They introduce students to how natural philosophers and clerics classified the natural world, and then how these systems are adapted over time. The importance of naming, too, the words used to describe nature, also continues over time: Latin is used today in naming new species, and often the choices are based on what is understood of etymologies, as in Pliny and Isidore. That is, the readings and subsequent discussions of them emphasize "developments through time" starting with "unfamiliar material that challenges their curiosity and stretches their intellectual range."

Journal: requires students to respond to questions about the texts. These responses are intended to build on one another so students can see connections and think critically about those connections.

Paper: provides an opportunity for students to demonstrate methods of inquiry in the humanities and how they complement later inquiry in the biological sciences. Since students will be comparing usage of a word, they must think critically about the texts they choose and the contexts out of which they arise.

Zoological Portfolio/Collection Repository: In the first half, the labeling requires students to engage methods of inquiry in the humanities that will complement and contrast the items collected in the second half that conform to contemporary science.

GN Criteria

☒ **Explain the methods of inquiry in the natural science fields and describe how the contributions of these fields complement inquiry in other areas**

☒ **Construct evidence-based explanations of natural phenomena**

☒ **Demonstrate informed understandings of scientific claims and their applications**

☐ **Evaluate the quality of the data, methods, and inferences used to generate scientific knowledge**

☐ **Identify societal or philosophical implications of discoveries in the natural sciences, as well as their potential to address contemporary problems**

What components of the course will help students acheive the domain criteria selected above?

The readings (texts, animations, and videos) will introduce key concepts to students, with journal prompts and focus questions helping them engage with the critical material needed to understand the ideas and methods scientists use to study and explain life. Class activities will largely entail discussion and debate, analysis of primary literature, and experiential work in which students apply, extend, and synthesize their understanding of scientific claims and methods of inquiry and construct their own evidence-based explanations of natural phenomena, as indicated in the following three examples:

In the module on evolution, videos and pre-class readings, along with focus questions, will train students' attention on the foundational principles of the idea of descent with modification. In class, we'll discuss evidence for evolution taken from accounts by Darwin and Wallace. Students will use biogeographical data to reconstruct the Wallace line and explain how the data support the

theory of evolution. In journals, they will describe how the work of Darwin and Wallace provides examples of both inductive and deductive reasoning as defined by Francis Bacon (studied earlier in the course).

During the molecular biology module, after learning about gene expression and recombinant DNA technology, students will create their own genetically modified organisms in the lab (bacteria expressing recombinant green fluorescent protein or GFP derivatives). They will then write a report of their findings in the style of contemporary scientific literature. The bench work and written account help students understand concepts and analyze evidence (evidence they generate themselves) for the central dogma of molecular biology, as well as provide a basis for appreciating modern applications of genetic engineering to be discussed later in the course.

The zoological collection will provide another entry point for students to assemble data to describe and explain natural phenomena. Early in the semester, they gather a portfolio of images of various animals (and curate that collection according to classical and medieval techniques and language). In the evolution module, they will classify those "beasts" according to anatomical homologies (e.g., noting the presence or absence of shared derived traits—vertebrae, limbs, amnion, hair, etc.). Later, after learning about DNA sequencing technology and the idea of molecular clocks, they'll use gene sequence comparisons (cytochrome c) to reclassify those same animals. They then compare the results of these different categorization schemes, as well as those guided by classical and medieval works.

Integrative Studies

Explain how the intellectual frameworks And methodologies of the two Knowledge Domains will be explicitly addressed in the course and practiced by the students.

Through the readings, classwork, assignments, and exams in the course, students will explore:
- The following humanities fields: medieval studies, natural history, philology, genre studies;
- The following methods/approaches of the humanities: close reading, historical contexts, etymology, concepts of authority (classical, Biblical) and sources, audience, iconography;
- The following science fields: evolutionary theory, taxonomy, and phylogeny; molecular biology; genomics; genetic engineering;
- The following scientific methods/approaches: observation, hypothesis, and experiment; inductive and deductive reasoning; reductionism; engineering and design.

Below is an outline of key emphases for the course (sample readings are given in the attached syllabus):

Classical Natural History and Early _Scientia_
Day 1. What is Science? What is Natural History? What is Classification?
Day 2. Classical Natural History: Early Methods
Day 3. Aristotle's Natural History, Moralizing tales and literary animals
Day 4. Roman Natural History: Pliny the Elder, Poetic natural history: Ovid's Metamorphoses

Medieval Appropriations and Authority
Day 5. Translating _Auctorite_, Etymology: Isidore
Days 6 & 7. Bestiaries: What are they?
Day 8. Literary classification? Chaucer's Parliament of Fowls

Introducing Taxonomy
Day 9. Linnaeus
Day 10. Swift's satiric classification: "The Beast's Confession"

Scientific Methods in Transition in Words and Pictures
Days 11 & 12. Nascent Scientific Methods: Bacon and Cavendish, Observations upon experimental philosophy
Day 13. Observing in the field and in the hand: Edward Lear limericks and natural history; Beatrix Potter illustrations and tales

[Day 14: Mid-Term Exam]

Evolutions
Day 15: Darwin's Poetic Life
Day 16: Evolution: Descent with Modification
Day 17: Origins: Forming Species
Day 18: Family Trees
Day 19: Inheritance

Reducing Life: Molecules
Day 20: The Double Helix
Day 21: A Staircase: DNA as Metaphor
Day 22: Expression: The Central "Dogma"
Day 23: Tinkering with a Common Language
Day 24: Letters and Relationships

Connections: Past, Present, and Future
Day 25: Genomes
Day 26: Poetic Mapping
Day 27: Big Data
Day 28: Resurrecting Dinosaurs?
Day 29: Designing and Engineering Life

We'll use readings as a basis for class-wide and small-group discussions and debates during virtually every class period. In addition, students will journal and engage in experiential activities, samples of which are listed below:

- Take a nature walk: observation, field notes, disseminating information.

- Evaluate Aristotle's claims about animals—one claim that is true based on your experience, one that is untrue, and one of which you aren't sure.
- Describe an animal in words and pictures according to personal observation and _auctorite_
- Etymology: describe yourself, your appearance, and/or behaviors in relation to your name. Cite sources (authorities) for the etymology of your name.
- Assemble a classroom bestiary—describing and imagining physical, behavioral, and moral characteristics of each specimen
- Compare classification methods by writing labels and descriptions for creatures that reflect the bestiary taxonomy and Linnaean taxonomy
- Reconstruct the Wallace line from biogeographical data
- Find examples of the unity and diversity seen among extant organisms and explain both forms of evidence in terms of evolution in presentations to the 19th century Linnaean Society and to the governing body of the Church of England.
- Construct phylogenetic trees using anatomical homologies to classify a set of hypothetical/idealized insects, and creatures in your zoological collection.
- Transform bacteria with and observe expression of recombinant Green Fluorescent Protein
- Search for cytochrome c sequences in a sequence database and create a phylogenetic tree by comparing the sequences; classify the creatures of the zoological collection using cytochrome c sequences.

Demonstrate that each Of the two domains will receive approximately equal attention, providing evidence from course topics, assignments, or other course components, and that students will integrate material from both domains.

The syllabus divides the course into two equal sections, with equal class time devoted to each discipline. That the course is taught by faculty representing the two domains also ensures equal attention. The instructors teach the entire course together to reinforce its integrative structure.

The assigned texts balance classical, medieval, and early modern materials with later texts focusing on the scientific literature, including and after Darwin. Darwin is read critically in the humanities and in the sciences, which is why his work is in the middle of the course, marking a transition between natural philosophy and biology as seen in the light of evolution. "Scientific" material is interwoven into the first half of the course and "literary" material into the second half in order to attune the student to resonances between the two disciplines throughout the term.

The experiential work engages the methodologies of the humanities—through close reading, critical analysis of texts, history of ideas—together with the methodologies of the sciences.

Finally, the assignments reinforce the balance between the two domains. Equal weight is given to the first and second halves of the course in determination of grades, and, as described earlier, journal assignments, the research paper, the zoological collection, and exams draw on material and synthesis from the two areas.

By design, the course balances and integrates the methods and theories, the language and traditions, of the humanities with those of science. Approaching the study and representation of beasts historically, we find developing, varied, and contrasting conceptualizations emerge. Specifically, integrating the two disciplines in this way encourages students to make connections and discern the shifts found in: the nature of _scientia_ and science; varied approaches to gathering information about the world; sources of explanations and the role of _auctorite_ and authority of prior work; different practices for dissemination of knowledge; and how language changes. Students will gain an appreciation for complex, diverse viewpoints while expanding their appreciation for biodiversity and the natural world and building an understanding of "the how, why, and whence" of contemporary efforts to modify, synthesize, and "resurrect" organisms.

For instance, students will become aware that while both disciplines require a close reading of primary and secondary texts for the acquisition of knowledge, the nature of the knowledge sought is different. Where a humanist might read a bestiary for what it reveals about culture, for how religion informs understanding and representation, and/or for its beauty, a scientist might challenge the validity of the conclusions reached in the same text based on conflicting observations, propose alternative explanations, and design and conduct experiments to test the new hypotheses. The scientist might consider (and reject) the utility of the text in the present, even as a humanist discerns what can be learned about the shaping of meaning, the history of ideas, and what the past has to tell us about the present.

Students will also see that as biology increasingly incorporated "scientific" methodologies—quantification, replication, hypothesis and experiment—in the movement from classical genetics to Watson and Crick's double helix to genomics, new ideas, ways of thinking, and representations emerged. And yet, when we look at some of the latest scientific endeavors such as genetic engineering, de-extinction, and synthetic biology, even the very language used reinforces continuities while accreting new meaning. The etymological origin of "synthetic" and "helix" glance at the classical writers while the concepts they name provide fertile ground for creative thought; the "resurrecting" of species reminds us that an understanding of nature once was informed by religious belief.

Briefly explain the staffing plan. Given that each Inter-Domain course is approved for two Knowledge Domains, it will be taught by an instructor (or instructional team) with appropriate expertise in both domains.

To reinforce the integrative nature of the course, and given the disparate nature of the two domains, the course will be taught jointly by instructors from each discipline, humanities and biology. They should have a knowledge base and practical experience in the topics, an interest in multidisciplinary and integrative work and co-teaching in a small discussion-based classroom, and an ideal of shared inquiry with one another and their students.

Sandy Feinstein, Associate Professor of English and Honors Program Coordinator, has published on natural philosophy and literature. She has published an article with a biologist on taxonomy and its implications in Chaucer's _Pardoner's Tale_. Her most recent article focuses on an early modern play, _The History of Friar Bacon and Friar Bungay_, in light of sixteenth-century concerns about natural philosophy. Before coming to Penn State (1999), she taught a course called From Alchemy to Chemistry with an organic chemist, and published an article about that course. She participated in an NEH Institute with Kenneth Kitchell and Irven Resnick, editors of _On Animals_ by Albertus Magnus and also participated in two Folger Seminars-- one with Paula Findlen, historian of science at Stanford, the other with Pamela Smith, historian of science at Columbia. As an undergraduate at Pomona College she proposed an honors program characterized by an integration of the disciplines.

Bryan Shawn Wang, Instructor of Biology, has published and patented research in synthetic biology and directed evolution. He has designed and taught, among other courses, a blended version of BIOL 110: Basic Concepts and Biodiversity and 200- and 400-level laboratories in biochemistry and molecular biology. He also has a long-standing interest in literature and has published short fiction

in a variety of literary magazines. As an undergraduate at Penn State, where he was a University Scholar and Braddock Scholar in the Eberly College of Science, he majored in Molecular and Cell Biology and minored in English.

Describe the assessments that will be used to determine students' ability to apply integrative thinking.

Some directive journal assignments are intended to facilitate understanding of the distinct methodologies and language usages of the readings and in the two disciplines and therefore help students synthesize knowledge across the two domains and the various modes of inquiry, historical periods, and perspectives as well as see the relationship among these perspectives. The rubric for grading these assignments will include a category for integrative thinking.

In a more developed way, the research paper that examines the changing meaning of a key word using pre-Darwinian and post-Darwinian sources requires students to reflect on, research, and analyze distinct approaches to a shared subject. The research paper will be graded for the development of ideas—including their integration, the accuracy of content, and the adherence to stylistic expectations as defined by a rubric.

In the zoological collection project, students assemble images of creatures that reflect either ideas of classical natural history and the bestiaries or of more recent scientific discoveries—and then curate those representations by naming and organizing them according to different schemes used throughout history. This assignment provides another means for students to demonstrate their understanding of the different ways nature has been analyzed, explained, and represented, and how new methods reflect culture, refined technologies, and evolving ideas about the natural world and life itself. Again, the ability to make such connections between different areas of the course is a component of the projects' evaluation.

A midterm exam will review key concepts and integration of ideas in the pre-Darwinian section of the course; the final exam will emphasize post-Darwinian work, but review those ideas in the context of the entire course and will thereby comprehensively evaluate student understanding and integration.

Campuses That Have Offered ( ) Over The Past 4 Years

semester	AB	AL	BK	BR	BW	CR	DS	ER	FE	GA	GV	HB	HN	HY	LV	MA	NK	PC	SH	SL	UP	WB	WC	WS	XC	XP	XS	YK

UPLOADED DOCUMENTS FOLLOW:

FROM BEAST BOOKS TO RESURRECTING DINOSAURS

Durable Curricular / Academic Elements

Course Abbreviation and Number: CMLIT 183HN / BIOL 183HN

Credits: 3

Prerequisites/Co-requisites/Concurrent Requirements/Recommended Preparation: None

Course Attributes/Designations:

Honors (H)

GenEd Humanities (GH) and Natural Sciences (GN)

Inter-Domain (N)

General Education Learning Objectives:

KEY LITERACIES – the ability to identify, interpret, create, communicate and compute using materials in a variety of media and contexts. Literacy acquired in multiple areas, such as textual, quantitative, information/technology, health, intercultural, historical, aesthetic, linguistic (world languages), and scientific, enables individuals to achieve their goals, to develop their knowledge and potential, to lead healthy and productive lives, and to participate fully in their community and wider society.

INTEGRATIVE THINKING – the ability to synthesize knowledge across multiple domains, modes of inquiry, historical periods, and perspectives, as well as the ability to identify linkages between existing knowledge and new information. Individuals who engage in integrative thinking are able to transfer knowledge within and beyond their current contexts.

Course Description:

In this honors course, we'll explore changing perspectives on life and approaches to studying life. More specifically, we'll examine, through an historical lens, humankind's quest to describe and explain and, ultimately, to expand the diversity of the living world. We begin with early attempts to classify living things—for example, Aristotle and Pliny. We then see how medieval bestiaries appropriated classical ideas about nature while adding to them in the context of Christian *historia*. In the Enlightenment, Linnaeus's taxonomic work provided a new way of naming and systematizing organisms. On the other hand, the nascent scientific methods of Sir Francis Bacon anticipate the shift from the descriptive to the

theoretical and mechanistic that accompanied Darwin's first sketch of a phylogenetic tree and the theory of evolution. We consider new theories, methods, and language in our examination of Watson and Crick and the double helix, molecular biology, and genomics. The course concludes with a glimpse at future possibilities enabled by what was studied previously in the course: genetic engineering, synthetic biology, and de-extinction.

The course's original structure offers the experiential engagement of the sciences through laboratory experiments and fieldwork along with the workshop and directed discussions characteristic of the humanities seminar. The content and type of "readings" also reflect both areas and include primary and secondary sources in a variety of media. Class periods (1 hour and 40 minute periods, twice a week) comprise a mix of discussion, debate, and collaborative exercises, including experiential work. A visit to a natural history museum and/or zoo provides important physical contexts where students learn about type specimens, live specimens, and how scientists today use collections. As they enact the varied methods of studying nature, students maintain a field log/notebook and write laboratory reports. In a research paper, they explore in depth how language and methods change. They will assemble and curate their own zoological collection, juxtaposing various approaches to describing and classifying animals. The integration of the humanities and the sciences into a single course, along with the incorporation of significant experiential work, helps students gain a broad and deep understanding of and appreciation for each of these intellectual disciplines and for life itself.

Course Learning Objectives:

Through this course, students will:

- gain an understanding of how the nature of knowledge and science and approaches to gathering, recording, and disseminating ideas about the living world have changed over time;

- engage with a variety of material and employ various methods of inquiry in the humanities and the sciences to address questions about natural phenomena;

- demonstrate knowledge of major cultural currents, issues, and developments through time, including exposure to unfamiliar material that challenges their curiosity and stretches their intellectual range;

- demonstrate informed understanding of scientific claims and construct evidence-based explanations of natural phenomena;

- synthesize and transfer knowledge and ideas in and between the humanities and sciences;

- gain competence in critical thinking and communication about topics, texts, and ideas in the humanities and sciences; and

- increase their awareness of, appreciation for, and curiosity about living things.

A Tentative Syllabus with Sample Readings

Classical Natural History and Early *Scientia*

Day 1: Introductory. Definitions: What is Science? What is Natural History? What is Classification?

Day 2: Classical Natural History: An Early View
- Aristotle, *History of Animals*, Bks. I and IX.
- Aesop, "The Tortoise and the Hare"

Day 3: Contextualizing Aristotle's Natural History
- Brian Ogilvie, "Natural History, Ethics, and PhysicoTheology" in *Empiricism and Erudition in Early Modern Europe*, ed. Gianna Pomata and Nancy G. Siraisi (Cambridge: MIT, 2005): 75-85.

Day 4: Roman Natural History: Pliny the Elder & Ovid
- Pliny the Elder, "The Nature of the Terrestrial Animals," *The Natural History*, Bk VII, Chapters 1-4.
- Ovid, "Primal Chaos" to "Other Species are Generated," *Metamorphoses*

Medieval Appropriations and Authority

Day 5: Translating Auctorite
- Albertus Magnus, "The Disposition and Life of Animals," *On Animals* Bk.VII, chapter 1 and Bk VIII, Tract v., Chapters 1-2 (Lions through elephants).
- "Albert's Importance to Medieval Science," Irven Resnick and Kenneth Kitchell.

Day 6: Etymology
- "Fourfooted animals," *The Etymologies of Isidore of Seville*, Chapter XII, trans. and ed. Stephen Barney (Cambridge: Cambridge University Press).

Days 7 & 8: Bestiaries: What are they?
- Physiologus, Commentary and Animal Chapters (lion and elephant).
- *Aberdeen Bestiary*, Introduction and selections, Folios 1R-2V, 7R, 10R & V, and 15R (Creation, the lion, elephant, and monceros)

Introducing Taxonomy

Day 9: Introducing Taxonomy
- Susan Crane, "A Taxonomy of Creatures in the Second-Family Bestiary," *New Medieval Literatures*, 10 (2008): 1-48 [selections].
- Chaucer, *Parliament of Fowls*

Day 10: Linneaus
- Video: Carl Linnaeus by Natural History Museum. https://www.youtube.com/watch?v=Gb_IO-SzLgk
- Swift, "The Beast's Confession"

Scientific Methods in Transition in Words and Pictures

Days 11 & 12: Nascent Scientific Methods
- Francis Bacon, *Novum Organum*, 17-28, and preceding aphorisms.
- *New Atlantis*.
- Cavendish, *Observations upon experimental philosophy*, "Of a Butter-flie"

Day 13: Illustrations: Observing details in the field and in the hand
- Maria Sibylla Merian, *Metamorphosis insectorum surinamensium* (Transformations of the Insects of Suriname), Amsterdam, 1705.
- Edward Lear, "Sketches of Animals in the Zoological Gardens," excerpts from Robert McCracken Peck, *The Natural History of Edward Lear*, pp. 42-46, and collaborations with Elizabeth Gould, 72-75. & limericks
- Beatrix Potter, mycology and *Peter Rabbit*

[Day 14: Mid-Term Exam]

Evolutions

Day 15: Darwin's Poetic Life
- selections from Ruth Padel, *Darwin: A Life in Poems* (2009)
- excerpts from Charles Darwin, *The Origin of Species, 6th edition* (1872)

Day 16: Evolution: Descent with Modification
- video: "Darwin, Wallace, and Natural Selection" (HHMI BioInteractive)

Day 17: Origins: Forming Species
- excerpt from Alfred Russel Wallace, "The Origin of Species and Genera," *Nineteenth Century* (1880)

Day 18: Family Trees
- website: "Patterns" *Understanding Evolution* (2017) (University of California Museum of Paleontology) <http://evolution.berkeley.edu/evolibrary/article/0_0_0/evo_03>

Day 19: Inheritance
- excerpts from Evelyn Fox Keller, *The Century of the Gene* (2000)

Reducing Life: Molecules

Day 20: The Double Helix
- video: "The Double Helix" by HHMI BioInteractive
- excerpt from James D. Watson and Francis H. Crick, "A Structure for Deoxyribose Nucleic Acid," *Nature* (1953)

Day 21: A Staircase: DNA as Metaphor
- poem: May Swenson, "The DNA Molecule," *Poetry* (1968)

Day 22: Expression: The Central "Dogma"
- videos: "What Exactly Is a Gene" and "What Is DNA and How Does It Work?" (Stated Clearly)
- excerpt from Francis Crick, "On Protein Synthesis," *The Symposia of the Society for Experimental Biology* (1958)

Day 23: Tinkering with a Common Language
- Carl Zimmer, "Creating Life As We Don't Know It," *Nautilus* (2013)

Day 24: Letters and Relationships
- interactive media: "Creating Phylogenetic Trees from DNA Sequences" (HHMI BioInteractive)

Connections: Past, Present, and Future

Day 25: Genomes
- video: "Sequencing the First Human Genome" (History Channel)
- video: "How to read the genome and build a human being" (TED: Riccardo Sabatini)

Day 26: Poetic Mapping
- poem: Michael Symmons Roberts, "Mapping the Genome," *Poetry* (2003)

Day 27: Big Data
- excerpt from Hiroaki Kitano, "Systems biology: a brief overview," *Science* (2002)

Day 28: Resurrecting Dinosaurs?
- George Martin, Bringing back the dragons, excerpt from *Game of Thrones* (1996)
- Carl Zimmer, "Bringing them back to life," *National Geographic* (2013)

Day 29: Designing and Engineering Life
- excerpt from Jonathan B. Tucker and Raymond A. Zilinskas, "The promise and perils of synthetic biology," *The New Atlantis* (2006)
- excerpt from J. K. Rowling, *Fantastic Beasts and Where to Find Them* (2001)

Day 30: Field Trip

[Comprehensive Final Exam]