

# Natural Sciences 2: Evolution, Genetics, and Animal Behavior

Natural Sciences 2: Evolution, Genetics, and Animal Behavior, traces the efforts in Western thought to understand the nature of life, or failing that, the nature of living things. The questions it addresses at the most basic level are:

- Why are living things so varied?
- How are they organized (or are they organized)?
- How do they behave?
- How do we know that?

Aristotle offered answers to many of these questions, but increasing amounts of data from experiments and the fossil record called his ideas into question. Several other attempts were made until Lamarck and Darwin focused the discussion by presenting alternative views about how the variety of living things might arise by one form evolving into another. Eventually, variety and changes would come to be understood in terms of the inheritance of traits—genes. Even behavior can be inherited, and the course finishes with a look at the behavior of animals, including the two-legged kind.

Of all of the courses in the Natural Sciences sequence, this one strikes closest to home; because we too are living things, the answers to the above questions affect our ideas on the nature of humans and ourselves. The course will require real effort at genuine conversation and open dialogue, an effort that will pay off well with increased understanding for all of us around the table.

## Table of Contents

The contents of this syllabus are as follows:

- Texts
- Pitfalls
- Course objectives
- Course requirements
- Syllabus

## Texts

### *Required Books*

The following works are required:

Aristotle, appropriate works (especially *On the Parts of Animals* and *On the Soul*)  
Darwin, *Origin of Species*  
Goodall, *Through a Window* (recommended) or  
Goodall, *Chimpanzees of Gombe*  
Hardy, “Hardy-Weinberg Law”  
Lamarck, *Zoological Philosophy*  
Lorenz, *On Aggression* (recommended) or other works on ethology by Lorenz or Tinbergen  
Mendel, “Experiments in Plant Hybridization”

### ***Recommended Books***

The following works should also be included, space permitting:

Glick and Kohn, eds., *Charles Darwin on Evolution*  
Goldschmidt, *Darwin’s Dreampond: Drama in Lake Victoria*  
Gould, *Panda’s Thumb* (recommended) or other works on evolution  
Lewontin, *Triple Helix*

Any of the following works may also be used:

Darwin, *On the Expression of Emotion in Animals*  
Short papers on genetics and/or evolution and knowledge

### ***Course Readings***

A list of the books and articles used in this course follows in the order in which they are read. Additional assignments will be announced in class.

Lamarck, *Zoological Philosophy*  
Darwin, *Origin of Species*  
Mendel, *Experiments in Plant Hybridization*  
Mayr, *What Evolution Is*  
Lorenz, *On Aggression*  
Reprints:  
Aristotle, *Parts of Animals, Generation of Animals, On the Soul*  
Cuvier, *Revolutionary Upheavals on the Surface of the Globe*  
Paley, *Natural Theology*  
Hardy, *Hardy-Weinberg Law*  
Chetverikov, *On Certain Aspects of the Evolutionary Process*  
Fisher, *Genetical Theory of Natural Selection—Analysis of Senescence*  
Medawar, *Unsolved Problem in Biology*  
Goodall, *Chimps of Gombe*

### **Pitfalls**

Being born in the twentieth century, we have a distinct disadvantage in this class. In class discussions we will need to operate on the assumption that the twentieth century does not have a monopoly on wisdom. If elements of an author’s work appear rustic or silly to us, it is probably because we have failed to understand what is significant to the author. If you disagree with an author, the worst thing to do is to trivialize the author’s work. Rather, in class we bring the authors and ourselves into genuine conversation by searching for the integrity of their contributions, even if what they say seems strange or just plain wrong at first. We seek to converse and engage in

dialogue with the author.

The same skill of energetic open-mindedness that we apply to the readings we should also apply to one another. We can work together and develop this skill carefully by following the thread of each conversation and by sympathetically understanding each person's position in the conversation—particularly when we disagree with that position. You should be able to repeat each person's argument with precision and force. In addition to thinking through the evolution of our culture's ideas about the living world, a fundamental objective of the course is the development of our dialogal abilities, the abilities that enable us to inquire together as a group.

## Course Objectives

### Student Competencies

The heart of the Shimer educational method is the encouragement and practice of those skills that will make possible lifelong learning. To this end, certain commitments and competencies are expected to be developed in Natural Sciences 2. These include:

- Commitment to one's own learning. This is measured by your attending classes on time, letting others know what you do and don't understand, and identifying for yourself issues of safety in the class discussion.
- Reading the source materials for the class carefully and completely
- Asking genuine questions within the discussion
- A growing ability to recapitulate someone else's point of view. This is measured by that other person agreeing that you have done justice to his or her position.
- The ability to understand and express your emotional reactions to the readings and to the process of learning
- The ability to write effectively

In addition to the above, certain competencies are specific to Natural Science 2, and the student's achievement will be confirmed using the assigned papers and an exam. These include the ability to:

- Summarize the foundational ideas of genetics and evolution.
- Analyze and explain the genetics of a dihybrid cross.
- Explain what the word "species" refers to, how a species could be identified, and what it means when a scientist claims that one species changes into another.
- Review and summarize the data supporting evolutionary arguments and critique both the data and the arguments.
- Describe the basic elements of animal behavior, especially aggression, dominance, and violence, and apply these to humans.

Finally, these represent the key and basic objectives identified by the teacher. No list of objectives is rich enough to exhaust these readings, and I hope that you will identify your own objectives that go beyond these.

## Course Requirements

At the beginning of each class session, one pre-selected member of the class will distribute a 1–2

page paper or “focus statement” concerning the reading for that session. Responsibility for the focus statement of each session will be assigned during the first class.

Each person will also write at least one short paper (five to six pages). The first will be on the meaning and validity of species and classification systems. If you would like to write on a different topic, ask me. Alternative topics must be pre-approved. You will also receive a worksheet of genetics problems to work out, and a final exam. The final exam will be due by the last day of class.

Except under unusual circumstances, late papers will not be accepted. On-time papers may be rewritten, so if you feel that a paper is not “good enough,” hand it in anyway and rewrite it. No work will be accepted after the start of writing week. Your course grade will be based upon the following components: class participation (quality, as well as quantity), 40 percent; paper focus statements, 20 percent; exam and worksheet, 20 percent. *Remember, it is up to you to demonstrate by your participation that you have read and understand the material.*

If you have any difficulty with the class or the readings or if you have any suggestions, please talk with me. Don’t wait.

## Syllabus

### September

9/2	LAB	Start plants/Describe phyla
9/6	Aristotle	<i>Parts of Animals</i> , Bk. 1, ch. 1
9/7		<i>Generation of Animals</i> , Bk. 1
9/9		<i>On the Soul</i> , Bk. 2, ch. 1–5; Bk. 3, ch. 3, 8–13
9/13	Cuvier	<i>Revolutionary Upheavals . . .</i> , pp. 1–16, 23–34
9/14	Paley	<i>Natural Theology</i> , ch. 1–3, 26–27
9/16	Lamarck	<i>Zoological Philosophy</i> , pp. 1–25
TBD		Cross the first generation of plants
9/20		<i>Zoological Philosophy</i> , pp. 26–54
9/21		<i>Zoological Philosophy</i> , pp. 77–95
9/23		<i>Zoological Philosophy</i> , pp. 130–141
9/27	LAB	Fastener lab
9/28	Darwin	<i>Origin of Species</i> , Introduction and ch. 1
9/30		<i>Origin of Species</i> , ch. 2
TBD		Plant F1 generation

## October

- 10/4 *Origin of Species*, ch. 3
- 10/5 *Origin of Species*, ch. 4
- 10/7 *Origin of Species*, ch. 5, 6
- 10/14 *Origin of Species*, ch. 11, 12
- 10/15 1ST PAPER DUE
- TBD Cross second generation of plants
- 10/18 *Origin of Species*, ch. 13
- 10/19 Mendel *Experiments in Plant Hybridization*, foreword, pp. 1–20
- 10/21 *Experiments . . .*, pp. 20–41
- 10/25 Hardy *Hardy-Weinberg Law*
- 10/26 Chetverikov *On Certain Aspects of the Evolutionary Process*, pp. 3–21
- 10/28 *On Certain Aspects . . .*, pp. 21–41

## November

- 11/1 Medawar *Unsolved Problem in Biology*
- Fisher *Genetical Theory of Natural Selection*
- TBD Plant F<sub>2</sub> generation
- 11/2 LAB Genetics workshop
- 11/3 GENETICS SHEET DUE
- 11/4 Mayr *What Evolution Is*, pp. 126–157
- 11/8 *What Evolution Is*, ch. 8–9
- 11/9 *What Evolution Is*, ch. 10
- 11/11 Darwin *Descent of Man*, ch. 2
- 11/15 *Descent of Man*, ch. 3
- 11/16 Lorenz *On Aggression*, ch. 1–3
- TBD Cross third generation of plants

11/18		<i>On Aggression</i> , ch. 4–6
11/22		<i>On Aggression</i> , ch. 7–9
11/23		<i>On Aggression</i> , ch. 10–11
11/29		<i>On Aggression</i> , ch. 12–14
11/30	Goodall	<i>Chimps of Gombe</i> , ch. 2
TBD		Plant F3 generation

## **December**

12/1	LAB	Animal behavior lab
12/2		<i>Chimps of Gombe</i> , ch. 6
12/6		<i>Chimps of Gombe</i> , ch. 15
12/7		<i>Chimps of Gombe</i> , ch. 17