Alles Introductory Biology: Illustrated Lecture Presentations

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Part Four: Biology and Society

“We are called to be the architects of the future,
not its victims.”

Buckminster Fuller

“May you live in interesting times.”

anonymous curse

Science & Ethics

• How does scientific knowledge affect social, ethical questions?

What is the nature of human nature?

Are we intrinsically good or are we inherently bad?

If our genetic heritage determines how we are, at least in part,
should we accept our nature or oppose it?

What of human violence?

Is violent aggression "wrong"?

What of human fecundity?

Is a mother's love for her child "right"?

Natural fecundity always leads to over production of offspring
beyond what the environment can support.

• Is it possible that the world we are adapted for no longer exists, and that we are now genetically maladapted to the modern world we live in?

Freedom of Action & Control

Moral responsibility can arise only when there is freedom of action and the ability to control the outcome of relevant events. Thus, there are two aspects in assessing moral obligation. The first is that we must be free to act upon our ethical considerations. The second is that our actions must be able to change the course of events. We must be able to control the outcome of events to have moral responsibility, for no moral entity can logically be held responsible for anything that is beyond their control. Thus, *control*, itself, is the logical first principle for determining moral responsibility.

The most significant change in our world in the last four hundred years is that science and technology have immensely extended our control over natural events. This extension of control has extended our moral obligations in directions undreamed of by our ancestors. **It is, therefore, the fundamental task of our age to analyze and come to understand how this extension of control over the natural world has changed our moral obligations.**

How has science changed our world?

• World Population projections show that by the year 2050 the human population will reach 9 billion.

• Currently, today, it is 6.7 plus billion.

Web Reference: http://www.census.gov/main/www/popclock.html

"Over production coupled to variation that can be inherited leads to differential reproductive success which leads to adaptation to local environments."

• What does "differential reproductive success" mean if not that some will fail and others will win in the raw, amoral competition of life.

"The universe we observe has precisely the properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but blind, pitiless indifference."

Richard Dawkins from his book *River out of Eden* (1995, 133)

Adaptation

Evolution by natural selection does not lead to optimal adaptations. It produces only historically constrained answers to past questions. What worked in the past was cobbled together from what was genetically available and has no guarantee of working in the future. Evolutionary adaptations are always a gamble that future conditions will be similar to the past.

• In reality—the only adaptation natural selection "selects" is reproductive success.

"Let us understand, once and for all, that the ethical progress of society depends, not on imitating the cosmic process [evolution by natural selection], still less in running away from it, but in combating it."

Thomas Henry Huxley from his essay *Evolution and Ethics*
(in Paradis and Williams, 1989)

• In the end, it may be true that the process of natural selection is, itself, the greatest cause of evil.

Human Population Increase

Based on genetic evidence, at some point in the Late Pleistocene the ancestral population of humans dropped to a low of ~ 20,000 individuals.

From this Late Pleistocene population modern humans spread throughout the world and then invented agriculture so that by the year 1 A.D. the human population had reached 1/4 billion. It then took—

from 1 A.D. to 1600	— to reach 1/2 billion	(1600 years doubling time)
from 1600 to 1830	— to reach 1 billion	(230 years doubling time)
from 1830 to 1930	— to reach 2 billion	(100 years doubling time)
from 1930 to 1960	— to reach 3 billion	(30 years to add a billion)
from 1960 to 1974	— to reach 4 billion	(14 years to add a billion)
from 1974 to 1987	— to reach 5 billion	(13 years to add a billion)
from 1987 to 1999	— to reach 6 billion	(12 years to add a billion)

(after Cohen, 1995)

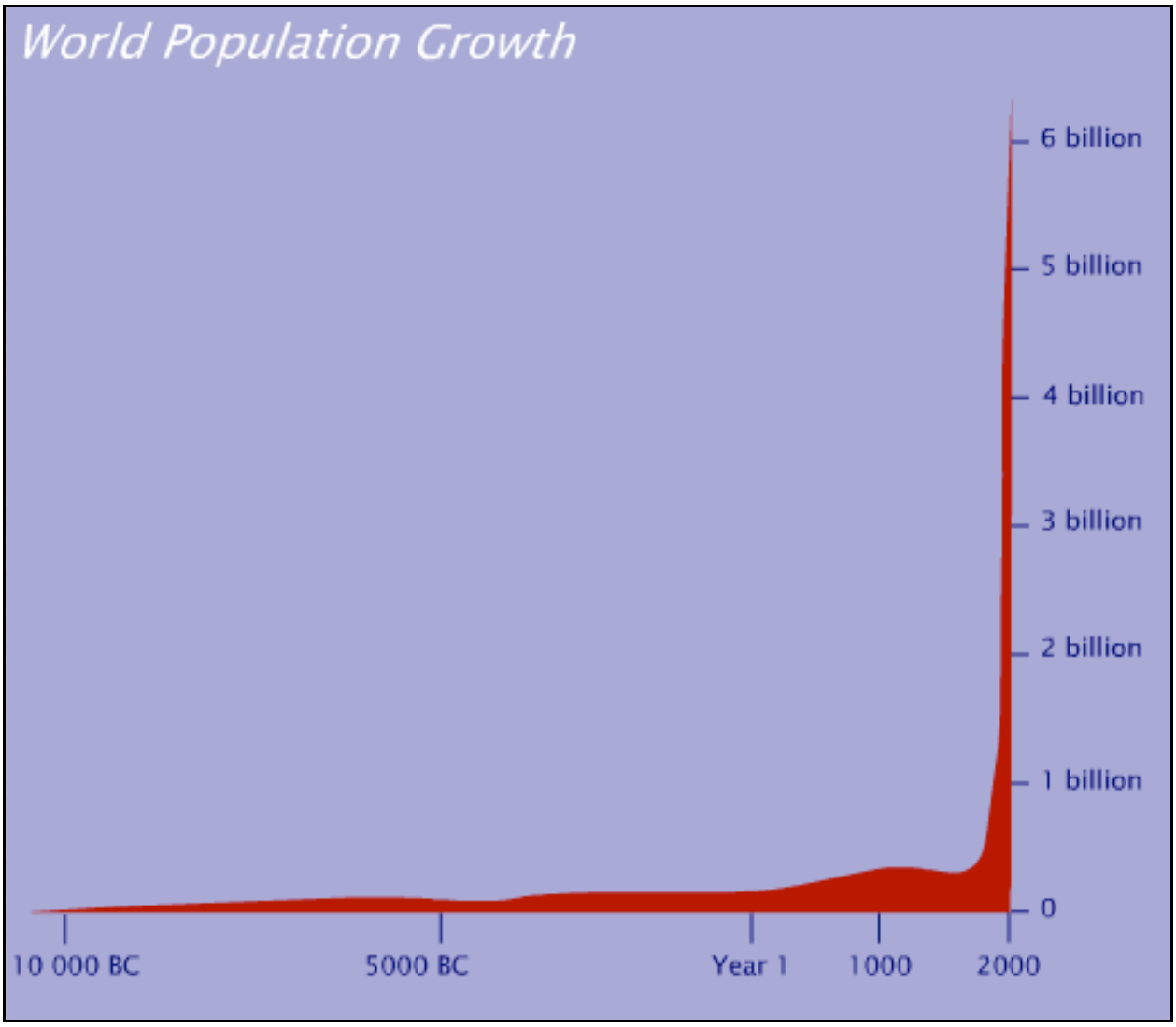
• World population projections show that by the year 2050 the human population will reach 9 billion (Lutz et al., 2001).

• This will be from 20,000 to 9,000,000,000 or more than a 450,000 times increase in population in a period of time that, when compared to the history of life on Earth, is a geologic instant.

Web References

http://www.census.gov/ipc/www/popclockworld.html

http://www.census.gov/ipc/www/idb/worldpopinfo.html


World Population Growth
6 billion
5 billion
4 billion
3 billion
2 billion
1 billion
0
10 000 BC
5000 BC
Year 1
1000
2000

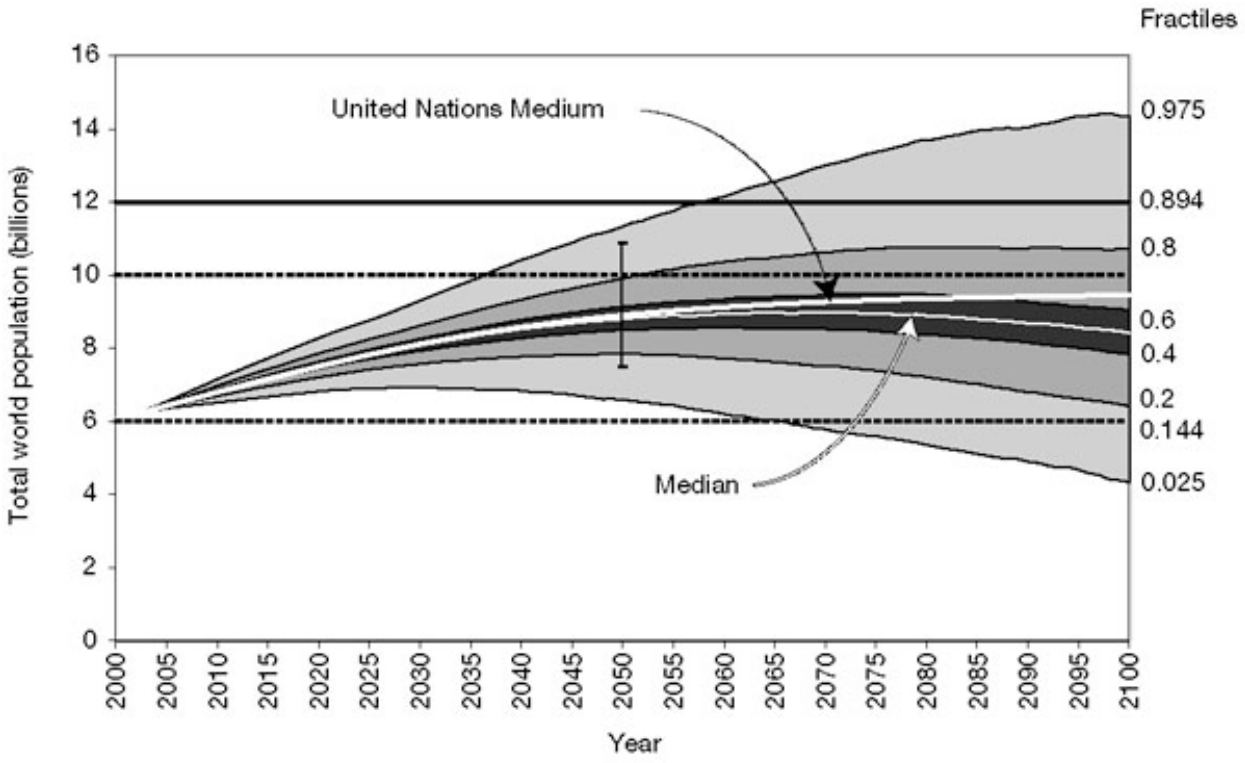
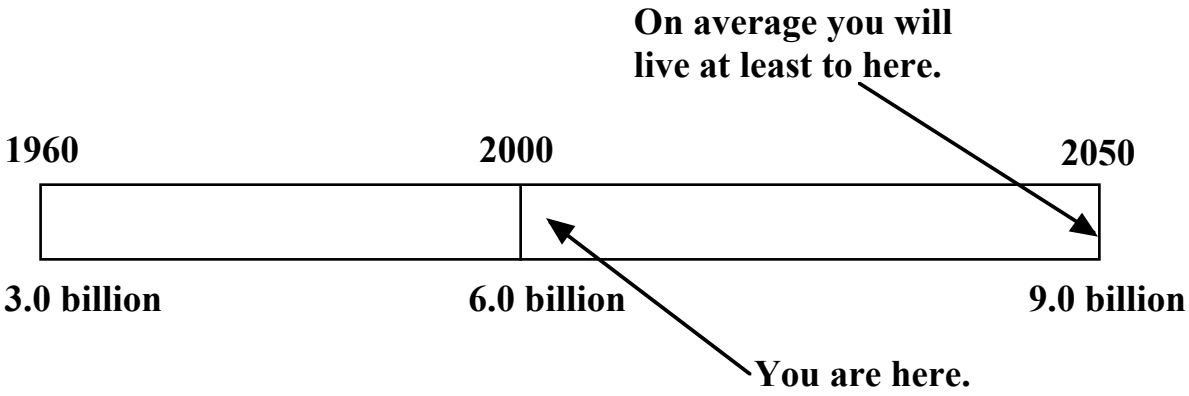


Chart of predicted human population growth showing the degree of confidence interval per size projection (Lutz, et al., 2001).

“May you live in interesting times.”



The Point

• The whole point is that we are doing exactly what natural selection has programmed natural levels of fecundity to achieve — increase our population until the environment stops us.

• The reason our population has exploded results from a form of competitive release. First improved hunting methods, then agriculture, and finally science and technology have released us from the population constrains of disease and famine and we have exploded across the Earth.

The World at Night

(Composite image by C. Mayhew & R. Simmon NASA/GSFC)

Web Reference
http://antwrp.gsfc.nasa.gov/apod/image/0011/earthlights2_dmsp_big.jpg

North America at Night

The Scientific Consensus

Starting in 1992, and continuing to the present some 1,670 scientists including 104 Nobel laureates have signed *The World's Scientists Warning to Humanity* on population. In 1993, fifty-six of the world's scientific academies (including the U.S. National Academy) came together in a "Science Summit" on world population. The conference had as its primary goal the formulation of a statement to be presented at the International Conference on Population and Development in 1994. The consensus opinion of both these efforts is expressed in the following statements.

• "Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about."

• "Pressures resulting from unrestrained population growth put demands on the natural world that can overwhelm any efforts to achieve a sustainable future."

• "No more than one or a few decades remain before the chance to avert the threats we now confront will be lost and the prospects for humanity immeasurably diminished."

(For the full text of these documents see Ehrlich & Ehrlich (1996) Appendix B, pages 233-250.)

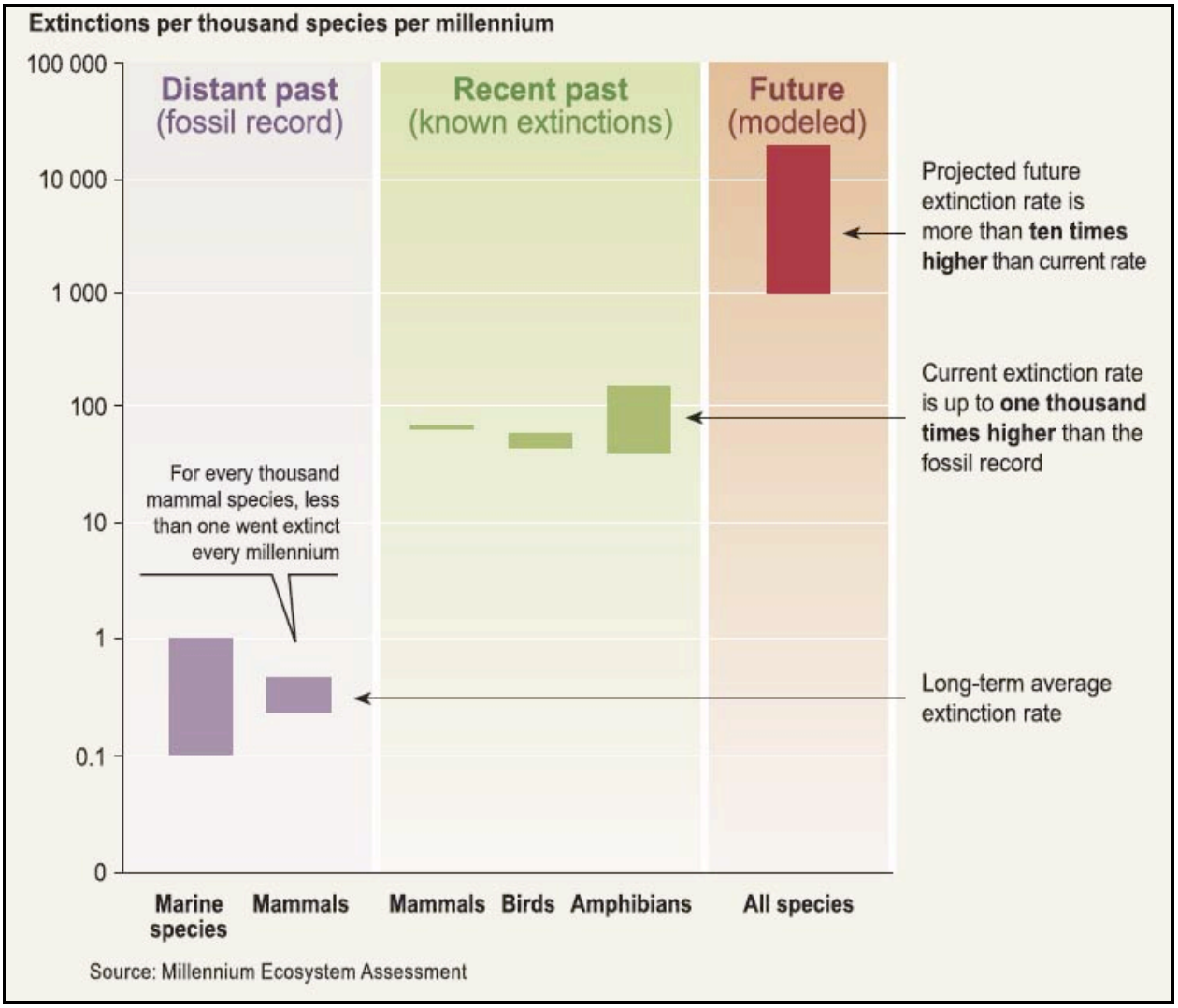
Biodiversity Today: The Sixth Extinction

"Humanity has initiated the sixth great extinction spasm [in the history of life], rushing to eternity a large fraction of our fellow species in a single generation."

• Today, then, is the sixth extinction.

(The term, as shown by this quote, was first used by E. O. Wilson in his book *The Diversity of Life* 1992.)

Estimates of Extinction Rates



Estimates of the natural background extinction rate cluster around 10 species per year for all species. The current extinction rate is now estimated to be a 1000 times that natural rate of extinction. The projected future extinction rate is more than 10 times higher than now.

(United Nations Millennium Ecosystem Assessment 2005)

• The bottom line is that we could lose between 1/3 and 1/2 of all species within the next hundred years (Pimm, 2001).

As Peter Raven puts it:

"At the time *Homo sapiens* developed agriculture in a number of widely scattered centers, some 10,000 years ago, there were fewer than five million of us throughout the world. Now we number six billion plus.

We consume, waste or divert over 40% of the total primary net photosynthetic productivity on land; we use about 60% of the total supplies of freshwater and affect directly some two thirds of the planet's surface. Over the past 50 years, while our total population has grown by 3.5 billion people, we have lost a quarter of our topsoil and a fifth of our agricultural lands, changed the characteristics of the atmosphere in important ways and cut down a major part of the forests.

It is no wonder that we are driving to extinction, and will drive over the next century, such a high proportion of the other organisms that live with us on Earth, thus limiting our own material and spiritual prospects substantially."—Raven, 1998, 100

The Upshot

What then are the realities of our relationship to the natural world? I submit it is something akin to the relationship Jared Diamond describes between groups of early agriculturists—kill everybody except those you grew up with and only stop killing when somebody stronger than you makes you (Diamond, 1997).

Humanity simply does not let nature stand in the way of what it wants. The results of this are predictable—we are wiping out the other life-forms on Earth at an ever increasing rate. The scale of this slaughter is comparable to, if not greater than, the scale of species extinction that occurred during the five recognized mass extinction events in the history of life.

It is, therefore, a valid question to ask: Are there any ethical relationships between humanity and other species? And if there are, when will we accept our moral obligations toward other life forms — before or after we drive most of them to extinction?

E. O. Wilson from The Diversity of Life (1992)

"Four splendid lines of Virgil came to mind, the only ones I ever memorized, where the Sibyl warns Aeneas of the Underworld:

> The way downward is easy from Avernus.
> Black Dis's door stands open night and day.
> But to retrace your steps to heaven's air,
> There is the trouble, there is the toil . . ."

"We do not understand ourselves yet and descend farther from heaven's air if we forget how much the natural world means to us.

Signals abound that the loss of life's diversity endangers not just the body but the spirit. If that much is true, the changes occurring now will visit harm on all generations to come."

Why do science?

"The extreme novelty of humans as the dominant force on this planet is as surprising as is our current rate of destruction of our own habitat and that of the Earth's other life forms. This disregard is all the more striking since, in geological terms, our species has only recently departed from its 'place in nature'. The full implications of our derivation by the random processes of biological evolution in a mere 5 million to 7 million years from an animal much like a chimpanzee have yet to be incorporated in any manner into the fundamental beliefs or institutions of our own, or in fact, any society.

In its very success, our species has raised grave problems that demand new kinds of solutions. Will we, by better understanding the processes that made us what we are, grow in capacity to solve the frightening problems of the future arising from our very selves?"

Elwyn L. Simons from his article *Human Origins* (1989)

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