# Chapter 13

# *The Origin of Species*, I: Variations and Struggle

## 13.1 Readings and Homework assignment

**Readings** Chapter I, II, III – Selections Darwin pp.95-111

**Homework** Give a short answer to the following questions on the basis of your readings:

1. Darwin gives an overview of his theory in the introduction. List the theses that constitute Darwin's theory of evolution according to the introduction

2. What does Darwin say about the notion of species? Explain how it fits his theory.

3. Is there struggle for existence for only some or for all species? Why will there be always struggle for existence?

4. How does struggle for existence lead to certain variations to be preserved?

## 13.2 Introduction: Darwinism

### 13.2.1 Reading the introduction of the *Origin*

Darwinism, right from the introduction can be characterized as a set of principles which are not only scientific, but also methodological.

#### Theory of evolution

Darwinism gives us a hint of the majors theses he is going to defend:

1. Species have not been created independently but have descended from other species

HOW?

A. VARIATION:

2. *Possibility* of a large *amount* of variations

This will be shown in the context of domestication, with the hope to draw an *analogy* for the context of wild life.

3. *Power* of accumulation of slight variations

B. STRUGGLE

4. Geometrical growth of population for all species – Malthus

5. Struggle for Existence – assumption: limited resources which increase at a smaller rate

C. SELECTION

6. Consequence 1: Any favorable difference biases the chances of survival – *Natural selection* of some variations

D. INHERITANCE

7. Consequence 2: Perpetuation of the selection through natural principle of inheritance

E. DIVERGENCE

8. Extinction of certain species

#### Methodological standards

- The importance of empirical evidence (95, 97): "catalogues of facts"
- Balance the opposite opinions
- The nature of causes or explanation

- Aim: to show "how the innumerable species inhabiting this world have been modified, as as to acquire that perfection of structure and coadaptation which most justly excites our admiration"

  - against external conditions: environment (woodpecker and mistletoe)

  - against also habit (Lamarck) and volition

- The main point seems to be CO-ADAPTATION: interdependence of, or interaction between several species between them and with the environment.

### 13.2.2 Darwinism

So we have: Variation, Struggle, Selection, Inheritance, Divergence

Here is how James Lennox completes the picture of what the process of evolution is for Darwin, in his article on "Darwinism" in the Stanford Encyclopedia of Philosophy:

- Variation: "Species are comprised of individuals that vary ever so slightly from each other with respect to their many traits".

- Increase: "Species have a tendency to increase in size over generations at an exponential rate".

- Limitation of resources and Struggle: "This tendency, given limited resources, disease, predation, and so on, creates a constant condition of struggle for survival among the members of a species."

- Advantageous variations: "Some individuals will have variations that give them a slight advantage in this struggle, variations that allow more efficient or better access to resources, greater resistance to disease, greater success at avoiding predation, and so on."

- Survival and Reproduction: "These individuals will tend to survive better and leave more offspring."

- Inheritance: "Offspring tend to inherit the variations of their parents."

- Natural Selection: "Therefore favorable variations will tend to be passed on more frequently than others, a tendency Darwin labeled "Natural Selection"."

- : Variation intra-species: "Over time, especially in a slowly changing environment, this process will cause the character of species to change."

- Speciation and Divergence: Given a long enough period of time, the descendant populations of an ancestor species will differ enough to be classified as different species, a process capable of indefinite iteration. There are, in addition, forces that encourage *divergence* among descendant populations, and the elimination of intermediate varieties.

## 13.3 The great power of a large amount of slight and random variations

### 13.3.1 Argument for the large range and permanence of variability

Darwin announced in the introduction that he will defend two theses in chapter I:

1. large amount of variations in hereditary characters – large range of possibilities and endless variability

2. power of selecting among theses variations

There is a possible tension between the two requirements. "large amount" can involve:

a. high frequency of variations

b. wide range of possibilities of variations

c. endless variability (long term point of view)

Let's see...

- Variations in domestic context:

  - The interest of looking at domesticated species is that individuals vary more: variations are more easily observed to be important – due to less uniform environment – Great variations are possible

- No evidence of cessation of variations – Cumulative effect implies great power of a large amount of slight variation.

  If too much variations: then selection would not be possible ! Answer: inheritance

- Note on Scientific Method: look for evidence!!

### 13.3.2 Argument for the inheritance of characters

A rule that warrant the inheritance of modified character is important: it would constitute at least part of the process leading to the origin of species.

- Concedes:

  - laws unknown

- But conjectures:

  - from the case of the inheritance of strange and rare variations to the general case

- PB is : the process is not necessary (sometimes does, sometimes not)

  This is to say: *Whatever the laws of heredity are, they are not deterministic.*

  - Thus Darwin introduces a PROBABILISTIC RULE: this is am important and problematic point in Darwin's theory. Darwin's theory is a *statistical* theory.

  - He further says that such a probabilistic rule cannot give the "primary cause", but only account for the "first appearance".

- the issue of Statistical theories:

  - Other examples of statistical theories?

  - How new was it in Darwin's age?

  - What difficulties does it imply for methodology in science?

  1. Predictions only over ensemble, not for single cases

  2. Explanation in terms of a primary cause vs. account of appearances?

  The issue of the interpretation of probabilities is very controversial. The debate is far from closed.

## 13.4 Problems with the notion of Species

- Nominalism vs. essentialism of species.

- Arguments against essentialism

  Arg 1: Domestic races differ from one another as much as wild species differ from one another – counter evidence to a possible coherent application of the concept to empirical phenomena.

  Arg 2: divergence of opinions among experts – no consensus about species/races

  Arg 3: the distinction is empirical: it does not hinge on distinctive characters of generic value (this notion seems pretty empty to Darwin) – no consensus about essences

- The concept of species is thus ambiguous. It cannot be applied to empirical data satisfactorily. The consequence according to Darwin is that **it cannot correspond to an ontological entity**: the term species might be useful, but nothing corresponds to it in the world.

- Alternative: Conjecture of the hypothesis of a common ancestor. That said, Darwin does not say he proved it!! (all dogs do not have only one ancestor, but...)

- Argument from the pigeons:

  a. Description of varieties

  b. Any expert would take these varieties, outside the breeding context, as different species.

  c. But all these varieties or species come from the same ancestor

- Why the last claim? because from the first two claims, one could argue that the proper thing to do is to distinguish more species. This is not however what Darwin wants to do! He does not want to say:

  1. some varieties seem to be species

  2. species have different ancestors

  3. these varieties have different ancestors

- But rather:
  1. some varieties seem to be species
  2. varieties have the same ancestor
  3. species have the same ancestor
- The idea is thus **to deflate the notion of species to the notion of variety**, not to inflate the notion of variety to the notion of species.
- He has obviously to argue for (c), since it does not follow from what precedes.

  - compatibility of the rock-pigeon with different environments where the breeds are

  - intermediates

  - endless variability in the breeds

  - long history of breeding
- Makes an analogy between the errors of the breeders, and the errors of the naturalists.

  - The breeders are mistaken in taking the races to be species.

  - The naturalists know that varieties come from the same species,

  - but they make the same mistake as the breeder's, only at the level species: by the same argument of profound differences, they concludes that different species come each from a different species.

  - In thinking how the breeders' argument about races is flawed, they should consider that their argument about species is flawed.

  *At different levels, breeders and naturalists do not consider the huge effect of "slight differences accumulated during many successive generations"*
- Note that the ambiguity of the notion of species is an argument for the *possibility* of the mutability of species: If a long history of variability and selection has produced differences between breeds that are comparable to differences between species, then there is *no reason to reject* the idea that the same process has produced the same effect for species. Note that the rhetorics is still hypothetical: *it is not impossible that...*

## 13.5 The Analogy between Domestic and Natural Selection

This section is a reproduction of part of Warren Schmaus' course notes:

**A. the first chapter, on variation under domestication, contains an account of artificial selection, in order to suggest by analogy the notion of selection in nature**

**B. Darwin pointed out that**

1. domesticated plants and animals are adapted not to their own good, but to ours (103-4)

2. we cannot supposed that they were originally made that way – in many cases, we even know their history (104)

**C. "The key is man's power of accumulative selection."**

1. that is, nature has supplied successive variations (104)

2. we select them in a direction that is useful to us

3. over all causes of variability, accumulative action of selection "is by far the predominant power" (105)

**D. two ways in which artificial selection comes about (104):**

1. **methodical** selection, in which one purposely sets out to create some new breed (e.g., think of flower breeders)

2. **unconscious** selection

a. more important type of selection for Darwin's purposes

b. in which one simply breeds the best of the lot with no intention of creating a new breed

c. yet new breeds are nevertheless created:

1.) dogs

2.) cattle

3.) English vs. Arabian race horses (105)

d. in sections left out of the anthology, he also talks about how our food plants and domestic flowers differ from the wild types as a result of selection

**E. the distinction between methodical and unconscious selection paves the way for the reader to accept natural selection**

1. that is, we are led to accept that selection need not be a conscious process

2. natural selection, of course, is not conscious

3. note that he says the term "natural selection" was chosen to bring out the analogy between natural and domestic selection (108)

4. in fact, biologists today no longer distinguish artificial and natural selection

a. both have played a role in evolution

b. to distinguish domestic from wild plants and animals, after all, is to assume that there is something special about the effects that human beings have on living things.

End of Prof. Schmaus Course notes

Discussion question:

- what are the relata in the analogy?
- what is the analogy good for? – "Power of accumulative selection"
- what are the problems in the analogy? – conscious vs. unconscious.
- how does Darwin respond to them?

## 13.6 Struggle for existence

- The existence of Variations is not enough to account for species' arising

  Pastiche of the description of the world by natural religion?

  In any case: evidence of adaptations, and everybody has now in mind the explanation in terms of God's design

- **Definition of natural selection:**

  - favorable characters tends to perpetuate

  - favorable in which sense?? regarding what? this will be answered later on

  The very notion of natural selection supposes that there is an underlying process: "for, of the many individuals of any species which are periodically born, but a small number can survive"

- Struggle for existence has a **metaphorical sense**

  - within species

  - between similar species

  - with conditions of life

  But in the most direct way: struggle is within species

- Struggle and geometrical increase of the population: application of **Malthus**
- The Struggle for existence is a direct and necessary consequence of:

  **1. geometrical increase of population**

  **2. restricted resources for survival (room, food...)**
- The law of increase is **exceptionless**: therefore the struggle is itself exceptionless: all species, everywhere and at all times, struggle.
- **Evidence for the law of increase:**

  - theoretical: calculations (even elephants...)

  - empirical: many instances of increase under favorable conditions
- **Objection**: it is not true that the population of all species grows at the same ratio, if the growth of population is correlated to the number of eggs or seeds.

  Darwin's answer: There is no direct correlation between the number of eggs and the growth of population. Another factor is to take into account: the average loss in the eggs and seeds.

  Again: even the elephants could saturate the Earth...

About Struggle for existence:

1. It illustrates Darwin's **actualism** and **uniformitarianism**: struggle for existence is a cause that has always existed, and whose effects are still observable today.
2. It poses the question of whether Natural Selection is a positive or an eliminative force: whether Darwin's theory gives an account of evolution in terms of

   a. an "intermediate cause", that is a positive, God-ordered, law of nature, or

   b. a mere negative process of elimination

The fact that the struggle for existence underlies necessarily natural selection tend to speak in favor of b. We should keep an eye on this in the next chapter: is Darwin's natural selection reducible to the "survival of the fittest"?