Chapter 15

The Origin of Species, III: Objections and Responses

15.1 Reading and Homework

- Reading: Darwin, Selections, pp. 135-74
- Homework:

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

  1. How is it that Darwin's theory is giving an account of the two great laws: unity of type and conditions of existence
  2. Variations in organisms lead to gradual changes in the species. That said, the geological record seems inconsistent with this claim. What is Darwin's response?
  3. How does Darwin explain the similarities in morphology and embryology of radically different species?

15.2 Darwinism and the existence of well defined species

15.2.1 The *actual lack* of transitional forms

Darwin's answers to the objection:

- The "main cause" of the absence of intermediate types is the very process of natural selection, as described before: new varieties take the place of their parent forms (136; 148, q.v.)

- the absence of fossils is explained by the imperfection of the geological record (too many contingencies necessary for fossilization)

- the absence of intermediate species in intermediate area:

  * Possibility of separation in the past

  * More importantly, we should remember that the environment is not defined just by gradually changing physical conditions, but by presence of other species (137-8). Because other species with which species X interacts are well defined, the species X is well defined.

  * The intermediate zone being small, and the intermediate species being in lesser number, it has lesser chance to survive (illustration with the sheep in the mountain/hills/plain)

Discussion question: how compelling are these arguments??

15.2.2 The *possibility* of links between species

Objection: the problem of very different habits and organs evolving from one another (136, q.v.; 140)

Different habits The objection is about evolution of:

1. an aquatic animal from a land animal

2. or a flying bat from a four-legged animal

Question: how would transitional form have survived?

- Darwin proceeds by examples: comparing bats with flying squirrels and lemurs, suggests that an adaptation for gliding may evolve into one for flying (140-1)

- Through his discussions of various types of birds and their habits, suggests that (141 ff.)

a. habits and structures probably often change simultaneously (142)

b. sometimes habits change without change in structure: (143)

1.) woodpeckers who eat fruit, chase bugs on the wing, or live where there are no trees (143)

2.) web-footed birds that do not swim and birds that are not web-footed that do swim (q.v.)

3.) in fact, there are species like the N. American pole-cat that change their feeding habits with the season (140)

- Darwin finally compares theory of evolution through natural selection to theory of special creation with regard to their ability to explain such facts (143, q.v.)

1. they are surprising to one who believes in creation

2. to explain them in terms of what pleases the Creator is merely to "re-state the facts in dignified terms" (q.v.)

3. to one who believes in evolution, on the other hand, these facts cause no surprise (q.v.)

The question was about the possibility of the intermediate forms. Darwin's answer, beside some examples for not too difficult cases, argues that: "organs and habits do not always match. How does this answer to the question? How is it a defense of the theory of evolution at all?

Well, reading carefully, it seems that what Darwin here does is more arguing against creationism than arguing for his theory. More precisely, he argues that there are some facts for which creationism cannot account for.

So, the argument seems to be: while it is, even if difficult, not impossible to explain the empirical fact of the differences between species within the theory evolution, it is really impossible to explain the empirical fact of the mismatch between environment and habits within creationism. Again, the argument is placed at the level of ***plausibility****.*

Complex Organs - Darwin then tackles the issue of the complex organs – paradigmatically, the eye. He admits that it is difficult to accept that complex organs and instincts have evolved through the accumulation of slight variations, each favorable for the possessor (144; cf. 158)

1. for example, it seems too difficult to explain the formation of the eye through natural selection (144)

a. adjusts focus for distance

b. iris admits different amounts of light, etc.

2. however, this difficulty is overcome once we admit the following (158):

a. gradations in the state of perfection may have existed, each good in its kind

b. that all parts of organization and instincts offer differences

c. that there is a struggle for existence leading to preservation of profitable deviations (158)

3. to return to the example of the eye (144-5): Darwin proposes that simpler, less perfect eyes would have been useful at each stage, beginning with light-sensitive cells

- Darwin then returns the argument against the design argument: suggests that the design argument, in which the eye is compared to a man-made optical instrument such as a telescope, and God's mind is compared to ours, is presumptuous. (145, q.v.)

Here again: Darwin argues for its theory in showing that competitive theories have less explanatory power.

> *He who will go thus far, if he find on finishing this treatise that large bodies of facts, otherwise inexplicable, can be explained by the theory of descent, ought not to hesitate to go further, and to admit that that a structure even as perfect as the eye of an eagle might be formed by natural selection, although in this case he does not know any of the transitional grades. (p. 145)*

Darwin admits that
- there are observable facts that seem contradictory with his theory;
- there is a lack of evidence for a proper answer to these objections.
That said,
- He argues that the theory is not in contradiction with these facts: in both cases, the theory remains plausible. The theory explains the lack of evidence itself.
- Moreover, he believes that the general explanatory power of the theory will suffice to convince anybody of the possibility of the theory, despite its difficulties.

- Finally, he stresses the fact that competitive theories cannot explain certain facts that the theory of evolution does explain.

SO, in short:

1. My theory is not falsified by empirical facts

2. My theory has great explanatory power

3. Competitive theories are falsified by empirical facts

From this, you cannot deduce that the theory is true, but certainly that it is the best we have.

15.2.3 The imperfection of the geological records

We already know that, due to the rare circumstances favorable to fossilization, the fossil record is imperfect.

- Darwin cautions us that when looking for transitional forms (148)

  1. we should be looking not for forms that are transitional between living forms

  2. but for forms that are transitional between living types and their ancestors

  3. examples:

  a. pigeons

  1.) look for transitional forms between rock and pouter, rock and fantail (148)

  2.) not for transitional forms between pouter and fantail

  b. horses and tapirs: look for links to common ancestors (148-9)

- Insistence on the time scale: On the lapse of time (149)

  A. some might object that there has not been enough time for evolution to have produced all the life forms we observe

  B. he refers the reader to Lyell's Principles of Geology for estimates of the age of the Earth

  C. and in the pages the editor skipped, he gives geological evidence concerning erosion and sedimentation for the great age of the world

- Back to the imperfection of the fossil record:

  It seems that whether intermediate forms once existed and then went extinct is a question for the fossil record (136, 140). Darwin argues again that the fossil record does not provide sufficient evidence of intermediate or transitional forms because of the imperfect state of our collections (150)

  1. have not studied the entire earth carefully
  2. soft things leave no fossils
  3. even shells and bones will decay if not buried in sediment
  4. fossils can be later exposed and worn away
  5. land animals only rarely leave fossils
  6. "more important" cause: consecutive rock formations are separated by wide intervals of time

- In sum – following Lyell's metaphor – compares geological record to an imperfectly kept history (151)

  1. written in a changing language
  2. have only the last volume, relating to two or three countries
  3. of this book, only a few short chapters have been preserved, and on each page only a few lines remain

(Objection: instincts – Ch. VII, skipped here)
(Objection: sterile offsprings between species – chapter VIII, skipped)

15.2.4 Darwinisism and classification

The main thesis is that the theory of evolution gives an account of the **classification** of beings.

Nominalism vs. Essentialism Darwin distinguishes between two attitudes regarding the classification:

1. Nominalists: the classification is an artificial tool designed by humans – it does not correspond to anything real in nature
2. Essentialists see the Natural System as the Plan of the creator – not mere resemblance, but essential traits.

Darwin sets himself on the side of the nominalists. To be more precise, he believes that natural selection and the theory of descent give the mean to be a coherent nominalist about the classification: affinities as well as differences are explained, but not in terms of essential traits chosen by God.

The main point is that the classification correspond to a *genealogical* arrangement: that way, both affinities and differences are explained.

"the Natural system is genealogical in its arrangement, like a pedigree; but the degrees of modification which the different groups have undergone, have to be expressed by ranking them under different so-called genera, sub-families, families, sections orders and classes." (154)

Morphology – the great law of "Unity of types" Beside the great differences, striking structural similarities between species:

- members (arms and legs) in widely different animals: same bone structure

- mouth of insects: same mouth structure: upper lip, mandibles and two pairs of maxillae

- mouth of crustaceans, etc.

Again, Darwin shows that the competitive theories (creationism, design) do not have the explanatory power that the theory of evolution has.

- utility of these structural similarities?

- trivial explanation by the creationist: so it is (thanks)

By contrast, the theory of natural selection simply explains the common patterns by the descendence form a common ancestor.

(Embryology skipped)

15.3 Conclusion

15.3.1 Summing up the difficulties and answers

- Starts with summing up the difficulties and responses to it

- Says that it is worth noticing that "the more important objections relate to questions on which we are confessedly ignorant"(geological records, etc.). The objections point out to conjectures on which hinges the theory. **Such conjectures might be hard to swallow, but they concern domains on which we ARE ignorant, were we evolutionist or creationist.** Thus the creationist does not provide counter examples, but only points out that Darwininism involves conjectures in unknown domains. The domains being unknown, the conjectures are possible.

In short: Darwin admits his ignorance, not the implausibility or inaccuracy of his hypotheses regarding the phenomena.

15.3.2 Arguments and facts in favor of the theory

The argument recapitulated

In the conclusion, Darwin recapitulates the argument of chapters I - IV (162)

A. existence of variability

1. under domestication

2. in nature: no reason to believe that the amount of variation in nature is limited (163, below)

B. Makes analogy between artificial selection and the effects of the struggle for existence(162)

1. human beings can select variations in animals and accumulate them over time

2. no reason that the same principle should not act in nature

a. struggle for existence in nature produces a similar sort of selection

b. repeats this analogy on 163 to argue for the large scope of natural selection, against the idea that natural selection is limited:

- He notices that such a claim cannot be proved: to think that natural selection is restricted to varieties within species is a rather arbitrary hypothesis

- *If men, with their external influence and reduced time-scale, can make a huge effect on the varieties within species, then there is "no reason to doubt" an unlimited power for natural selection, which acts continuously, internally, and at the geological time-scale*

C. N.B. that the more similar the organisms, the closer the competition (162)

D. sexual selection also produces similar effects (163)

In favour of the theory

Darwin then turns "to the special facts and arguments in favour of the theory" (163)

A. the form of his argument here consists of listing facts that are easier for his theory than the theory of special creation to explain

B. First group of facts concerns the **ambiguity of the species concept**

1. on the assumption that species are only "strongly marked and permanent varieties," we can explain:

a. difficulty of distinguishing varieties from species (163, q.v.)

b. in places where we find many species of a genus, these species have many varieties (164, q.v.)

c. species of larger genera are more like varieties, differing from one another less than species of smaller genera (q.v.)

2. note the form that this argument takes

a. does not say that these facts refute special creation

b. rather, that they appear to be "strange" relations on the creationist view but are "intelligible" from the evolutionary point of view where species began as varieties (q.v.)

C. his argument concerning the fact that o**rganisms can be classified by groups**, sub-groups, etc. is similar in form

1. Darwin can explain this by his principle of the divergence of character (also back on 152)

2. but this fact is "utterly inexplicable" on the theory of creation

a. again, this fact does not refute creation

b. creation theory says absolutely nothing about it

D. the argument concerning the fact that **"natura non facit saltum"** is also of this form

1. that is, that nature makes no jumps is explained by natural selection working the accumulation of slight v variation (164)

2. natural selection thus explains why nature is "prodigal in variety, niggard in innovation"

3. think of something like a penguin's flipper: instead of designing it from scratch, nature uses a variation on the wing

4. but the theory of creation cannot explain why nature makes no jumps

E. Darwin next turns to facts concerning **animals in which habits do not agree with structure** (164-5)

1. woodpeckers that do not live in trees, web-footed geese that never get near the water, etc.

2. this argument takes a somewhat different form from the previous ones: (165, q.v.)

a. here he says not only that his theory could make such facts intelligible

b. but that it might even anticipate them

F. the theory of natural selection can also explain the **lack of perfection in nature**

1. we are no longer "surprised" that introducing alien forms into an environment will adversely affect other species, which, on the other view, were supposed to be created and specially adapted to that environment (165)

2. we don't "marvel" that everything in nature is not "absolutely perfect"

3. nor do we "marvel" at facts that are totally opposed to our notion of fitness

a. bee's sting causes its own death

b. drones destroyed after mating

c. parasites, etc.

G. The laws of variation seem to work the same way with both **varieties and species**

1. he concedes that these laws are not well-understood

2. yet he observes that use and disuse have the same effect on varieties and species, as for instance in the case of blind moles and blind cave animals

3. also, reversions to long-lost characters occur with both

a. example: stripes on the shoulder and legs of several species of the horse genus

b. easily explained if we believe that all these species descended from a striped ancestor

c. inexplicable on theory of creation

H. also, the idea that each species was independently created cannot explain the fact that **characters that distinguish species of the same genus are more variable** than generic characters that they all share (165)

1. e.g., if different species of the same genus of flower are distinguished by color, color will be variable in each species, but not if all the species are the same color (165-6)

2. we can understand such facts if species are just well-marked varieties (166)

I. instincts

1. can be explained by natural selection in the same way as physical structure

2. note that although he admits some role for habits in modifying instincts, he points out that in the case of neuter insects, acquired habits are obviously not inherited

3. on the view that species of the same genus have a common ancestor, we can explain why they have similar instincts

J. that **crosses between species** obey same laws as crosses between varieties would be a "strange fact" if species had been independently created (120)

K. facts concerning the **fossil record** support his theory

1. extinction (167)

2. intermediate forms in intermediate rock layers

3. that extinct forms fit into classification scheme with living (167)

4. long endurance of characteristic forms of various continents

a. marsupials in Australia

b. edentata in S. America

L. facts of **geographical distribution** also support his theory

1. parallels between distribution through space and through time

2. on the same continent, closely related species may inhabit very different environments

3. while two areas with similar physical conditions may have very different inhabitants (167-8)

4. oceanic islands (168)

a. few species

b. not inhabited by terrestrial animals that cannot cross oceans

c. but inhabited by new species of animals like bats that can cross oceans

d. organisms most similar to those on nearest mainland

e. such facts are "utterly inexplicable" or "receive no explanation" on the theory of independent acts of creation

M. Facts about **classification** (168)

1. as he's already mentioned, the fact that extinct and living species all fit into the same classification scheme is intelligible on his theory

2. theory of natural selection can also explain why some characteristics are more important for classificatory purposes than others (also on p. 155)

a. e.g., adaptive or analogical characters less important and rudimentary characters more important for classificatory purposes

b. embryological characteristics often most important of all – e.g., similarities in embryos of mammals, birds, reptiles, and fishes

3. "Natural System" of classification (by species, genera, families, etc.) is a genealogical arrangement

a. previous naturalists thought it revealed the plan of the creator – but not clear what is meant by this or how it adds to our knowledge (153, q.v.)

b. there is also something more to it than mere resemblance – and that is, relations of descent

c. indeed, he argues that the amount of difference or resemblance in a group can vary greatly – referring back to the chart in ch. IV to explain this (153)

N. natural selection explains what we now call **homologies**, such as skeletal similarities (168, 155)

1. members of each class have same general body plan (155)

2. e.g. neck of giraffe and of elephant: same number of vertebrae (168)

3. hand of man, wing of bat, fin of porpoise, leg of horse similar in structure in spite of differences in purpose (169, 156)

4. indeed, we even give the same names to the different bones in different species (156)

5. these homologies cannot be explained in terms of final causes or the "ordinary view of the independenet creation of each being" (156, q.v.)

6. but on the theory of natural selection, these homologies can be explained in terms of successive slight modifications from common ancestors

O. embryological similarities

1. no longer "marvel" that embryos of mammals, birds, reptiles, and fishes are more similar to each other than to adult forms (169; cf. 181)

2. that is, the homologous parts resemble each other in the embryo more than in the adult form (157)

P. rudimentary organs

1. such as the teeth that never cut through the gums of the calf

2. useless wings of certain beetles

3. these things are again "inexplicable" on the notion that each organ was specially created for some purpose

The main argument is thus: Darwinism has far more explanatory power than any of the two other theories (creationism or design) of the origin of species.

15.3.3 Resistance to Darwin's theory

Causes of the general belief in the immutability of species

A. removes several reasons for this belief:

1. one cannot prove that there is no variation in nature or that it is limited in quantity

2. nor can one clearly distinguish species from varieties

a. not all inter-species crosses are sterile

b. not all inter-variety crosses are fertile

3. we no longer believe the age of the earth to be so short (170)

4. no proof that the geological record is so perfect that it would provide all the evidence we need

B. However, he thinks, the main reason for belief in stability of species is the difficulty of admitting changes of which we do not see the steps (170)

1. same difficulty as that encountered by Lyell's uniformitarian geology (entire valley slowly formed by the force of a stream of water)

2. this raises the issue of hypotheses that postulate unobservable processes

C. does not hope to convince experienced naturalists who have viewed many facts from the opposite point of view

1. people opposed to it will place more weight on the outstanding difficulties than on the facts that it can explain

2. Darwin looks to the future, to young scientists, instead

A compromise position

A. some have adopted a compromise position according to which some reputed species in each genus are not real species, while others are "real" species that were independently created

B. Darwin argues that they are in effect saying that some species were produced by variation but others not

1. however, they do not pretend that they can tell which species are "real" and which are notproduced by variation?

2. that is, they allow that in some cases variation is a "true cause," but not others, without telling us how to distinguish them (170, q.v.)

– we will return to this problem of "true causes" in the next set of readings

C. other problems with this compromise position:

1. was one or many of each kind created? (170-1)
2. were they created as eggs and seeds or full grown? (171)
3. in the case of mammals, did they have navels?

How far Darwin is willing to extend his theory

A. How far the theory of common descent may be extended, he said, is difficult to answer, because the more different the forms under consideration, the weaker the arguments for common descent

B. however, he cannot doubt that all members of the same class have a common ancestor

1. He believes that animals descended from at most four or five ancestors (thinking of Cuvier's classification?)

2. perhaps fewer plants

C. analogy would lead him to think that all living things, plants and animals, have a common ancestor

1. "But analogy can be a deceitful guide"

2. nevertheless, he sees similar chemical composition, cellular structure, laws of growth, etc.

15.4 Philosophical and methodological issues

Effects of its adoption of the study of natural history

A. believes that when his or "analogous views" (Wallace's?) are adopted, they will cause "a considerable revolution in natural history" (171)

B. Naturalists will no longer argue incessantly whether something is a **"true" species**

1. all that matters is whether it is different enough to be described and warrant a different name – not that this is easy

2. only difference between species and varieties will be whether intermediate forms still exist or are believed still to exist (172)

3. species will come to be thought of the way we now think of genera: as merely **artificial combinations made for our convenience**

4. we will be free of the vain search for the "essence" of the word "species"

C. naturalists' terms like relationship, adaptive characteristic, etc. will no longer have only a metaphorical meaning

D. when we no longer look at living organisms as beyond our understanding, **natural history will be much more interesting**

1. analogy with "savages" looking at a ship.

2. will regard productions of nature as having a long history, just as machines result from the improvements of many workmen

E. note the argument implicit in this: the promise of what life will be like after the revolution

1. in what follows, he keeps pointing out all the new things we can study

2. as well as the sterile controversies that we can avoid

F. How the **scientists**' lives will change for the better:

1. new fields of inquiry, such as the study of the laws and causes of variation, will open up

2. other fields, such as the study of domestic organisms, will become more important

3. classifications will become genealogies and rules of classification will be made easier

4. embryology will show us prototype of each class

5. can trace former migrations of world's inhabitants (173)

6. geology

a. although it will lose some of its former glory once we admit imperfection of fossil record

b. will now be able to use changes in fossils to measure lapse of time

7. Psychology will have new foundations

8. will throw light on origin of man

in conclusion, offers a bit of his theological views

A. Darwinism and Theism

Species are ennobled by viewing them as having evolved by laws of nature than having been specially created (q.v.)

1. these laws were impressed on matter by the "Creator"

2. "Creator" is a deist expression

a. Darwin seems to adopt the deist notion of a Creator who set the whole thing in motion according to law

b. he does not appear to accept the personal god of the theists, who intervenes in the course of nature through miracles

3. hence, he rejects the "cataclysms" of those like Cuvier (q.v.)

a. not needed to explain organic change

b. hence we can look with confidence to the future – no need to worry about cataclysms!

B. Darwinism and the good nature

Note, finally, how death and famine now play a positive role in the evolution of species (174)

1. where formerly they were a serious objection to the design argument

2. that is, he can now explain how these things fit into God's plan, on the assumption that God's plan is for species to evolve through natural selection

3. "*there is grandeur in this view of life*"