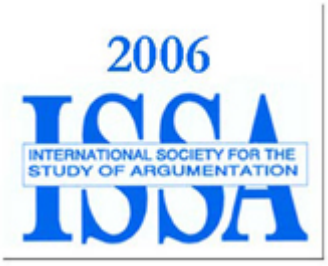
# ISSA Proceedings 2006 – The Polemical Interaction Between Darwin And Mivart: A Lesson On Refuting Objections




Charles Darwin and George Mivart once engaged in a famous polemic concerning the origin of species. I will analyze this polemic in the light of the conceptual framework and argumentative strategies of Darwin's *On the Origin of Species* (1872)**[i]** and Mivart's *On the Genesis of Species* (1871). In order to understand the nature of their polemic, I will compare the problems they intended to deal with, their answers as well as their motivations, presuppositions, arguments, and argumentative strategies. In particular, I will focus on Mivart's objections and Darwin's responses as part of their argumentative strategies.I will treat refutation in its widest sense (without reducing it to merely proving falsehood) as a collection of procedures to challenge an opponent's position or proposition.

1. *Problems*

1.1 *Darwin's problem*

What is the subject of *Origin of Species*? If one looks at the table of contents, the *Origin* covers all the branches of Natural History in order to answer the central question: how are species produced in Nature? The *Origin* is a narrative which, by pulling together a great variety of threads, weaves a web whose purpose is clearly expressed in the Introduction: in dealing with the "origin of species", it is not enough to conclude that the various species were not created independently. It is necessary to show how species originate from one another. This question appears in several forms (Darwin 1875, chapter III, p. 48-9): How are species produced in Nature? How do co-adaptations take place? How do varieties become good species? How are genera, groups, and sub-groups formed?

1.2 *Mivart's problem*

The purpose of *On the Genesis of Species* is to find a path which reconciles apparently opposing scientific, philosophical, and religious views. Mivart's main

concern is how to reconcile evolution and theology. In order to answer this question, he first has to remove what he sees as "a few misconceptions and mutual misunderstandings which oppose harmonious action" (Mivart 1871, p.15), and to attack a theory of evolution which clashes with his own religious views. The Darwinian theory of Natural Selection is his main target, but he also attacks Herbert Spencer and Alfred R. Wallace's views on ethical or moral questions (Darwin's *Descent of Man* and *Expressions and Emotions in Man and Animals* had not yet been published).

2. *Answers*

2.1 *Darwin's answer*

From the very beginning of his long narrative, Darwin's guiding answer is:
"… I am convinced that Natural Selection has been the most important, but not the exclusive, means of modification." (Darwin, 1875, Introduction, p. 2).

The central role played by the Principle of Natural Selection in Darwin's theory can be seen in its "definitions":
"I have called this principle, by which each slight variation, if useful, is preserved, by the term Natural Selection, in order to mark its relation to man's power of selection. But the expression often used by Mr. Herbert Spencer of the Survival of the Fittest is more accurate, and is sometimes equally convenient" (C.Darwin, 1875, p.49.).

"This preservation of favorable individual differences and variations, and the destruction of those which are injurious, I have called Natural Selection, or the Survival of the Fittest" (Darwin, 1875, p.63).

"… Natural Selection, as we shall hereafter see, is a power incessantly ready for action, and is immeasurably superior to man's feeble efforts, as the works of Nature are to those of Art" (Darwin, 1875, p.49).

"Nature, if I may be allowed to personify the natural preservation or the survival of the fittest, cares nothing for appearances, except in so far as they are useful to any being. She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects for his own good: Nature only for that of the being which she tends" (Darwin, 1875, p.65).

2.2 *Mivart's answer*

Mivart's looks for a *tertium quid* to provide a comprehensive and conciliatory

view of the genesis of species which will “completely harmonize with the teachings of science, philosophy, and religion” (Mivart 1871, p.15). In relation to science, Mivart’s contribution aims at proving scientifically that the Darwinian theory is not the only view of evolution (indeed that it is not scientific at all), and in proposing an alternative view of evolution. In relation to religion and philosophy, in chapter IX, “Evolution and Ethics”, Mivart examines the fact of morality to prove the dual origin of man, and thus the existence of God. Human beings, according to Mivart, have a dual origin: the dust of the earth and God’s breath of life (Mivart 1871, p. 269). “Grace” and “Nature” combine to create something unique (Mivart, 1871, p. 305). In his concluding chapter, “Theology and Evolution”, he initially dismisses those who identify religious orthodoxy with the narrow-minded opinions with which they were brought up, as well as those who are hostile to religion.

The action of God in the physical world takes place through what Mivart calls “derivative creation” as the “natural” action of God, which occurs by means of “secondary laws” and presupposes God’s direct and supernatural action (Mivart 1871, p. 269). “Evolution” (which cannot be completely explained) is defined as the manifestation to the intellect, by means of impressions of the senses, of some ideal entity (power, principle, nature, or activity) which was previously in a merely “potential” state, but capable of becoming present, or manifest, under the requisite conditions. Species are “peculiar congeries of characters or attributes, innate powers and qualities, and a certain nature realized in individuals (…) which before were latent” (Mivart 1871, p. 288).

## 3. *Motivations*

### 3.1 *Darwin’s motivations*

From the time of his *Notebooks* (1836 and 1837), or even earlier during his voyage on the Beagle, Darwin was moved by what he called the “mystery of mysteries”, i.e. the origin of species, and the questions he raises reveal his search for explanations based on “natural” causes which do not depend on “supernatural” ones. From early on, he dreamt of the idea of making a contribution to science, and of being recognized for this by his fellow scientists.

### 3.2 *Mivart’s motivations*

Mivart says that the aim of his work is “to endeavor to add one stone to this temple of concord, to try to remove a few of the misconceptions and mutual misunderstandings which oppose harmonious action” (Mivart 1871, p. 15). His

reflections suggest an almost desperate physical, epistemological, and ontological search for harmony, in spite of the dualisms on which many of his beliefs are based, and which he tries to overcome. Although Mivart tries to refute Darwin's theory scientifically, he does not attempt to hide his religious motivations.

4. *Presuppostions*

4.1 *Darwin's presuppostions*

Darwin's approach to the problem of the origin of species presupposes gradualism and naturalism as epistemological and ontological tenets, and evolution as a "natural" process of formation of new organic forms which are to be explained by "natural" means, together with a non-essentialist view of species (he compares species with individuals). On the basis of his approach there is a view of Nature as a system, and, in accordance with this view, one of his strongest methodological tenets is the interdisciplinary support that evidence from different fields can provide.

4.2 *Mivart's presuppositions*

Mivart advocates a rational theism, and believes that the general theory of evolution is "perfectly consistent with the strictest and most orthodox Christian theology" (Mivart 1871, p. 16). Physical science, philosophy, and theology belong to different domains. Physical science and "evolution" have nothing to do with absolute or derivate creation, inasmuch as the latter is simply the working of divine action through natural laws. Mivart holds an essentialist view of "evolution" and "species". In addition to his religious beliefs, Mivart had a scientific background as an accomplished anatomist.

5. *General arguments*

5.1 *Darwin's general argument*

Darwin asks the reader to understand his work as "one long argument". Its structure follows five main argumentative steps:

I. Historical Sketch – which situates Darwin's theory within the framework of evolutionary thought;
II. Introduction – Darwin presents his aims, facts to be explained, the need to show how evolution takes place, in order to differentiate evolutionism from creationism, and the new demands for investigation to be created by his theory;
III. The logical-conceptual framework of the theory (chapters I-V) – Variation, Nature, the Struggle for Existence, Natural Selection, and their

interrelationships;
IV. The explanatory power of Natural Selection;
IV.I The treatment of the difficulties that the theory has to overcome (chapters VI-IX) – the difficulties raised by Mivart, miscellaneous objections, instinct, and hybridism;
IV.II The transformation of unfavorable into favorable evidence (chapter X) – the exploitation of the imperfection of geological records;
IV.II. Cases which are clearly favorable to the explanatory superiority of the Darwinian theory over the Creationist view (chapters XI –XIV) – the geological succession of organic beings, their geographical distribution, morphology, embryology, rudimentary organs, and classification;
V. Recapitulation and Conclusion – the "one long argument" that constitutes the book is concisely presented as a single whole.

5.2 *Mivart's argument*
There are three main steps in Mivart's attempt to show that the Darwinian theory of evolution is not the only one (indeed that it is not a scientific theory at all), and to open the path for a theory designed to reconcile evolution and theology:

I. Introduction: Mivart tries to establish the legitimacy of a *tertium quid* by criticizing Darwin's general argument, and sets out the reasons for the wide acceptance of Darwin's theory;
II. The scientific reasons for not accepting the Darwinian theory, and for the plausibility of an alternative evolutionary view (chapters I-XI) – Mivart criticizes Darwin's basic concepts, such as "species" and "natural selection", and attributes the wide acceptance of Darwin's theory to half-educated people. He attempts to show the inability of Natural Selection to explain certain natural phenomena and morality, by drawing up a list of general objections, and carefully examining some particular cases.
III. The main points of Mivart's attempt to reconcile evolution and theology are discussed (chapters IX and XII). Mivart's main arguments are: God exists and our belief in God's existence is not based on physical phenomena (Mivart, 1871, p. 272), but justified by our primary intuitions, such as the uncontroversial intuitions of free will and causation, and morality and responsibility. As regards evolution, Mivart says that if causes other than Natural Selection can be proved to have been involved – for instance, variation – then Natural Selection is not the sole cause of evolution, but depends on these other causes, and only supplements

them (Mivart 1871, p. 32). (It is worth noting that Darwin clearly states that variation must be provided by Nature in order for Natural Selection to act upon it. To this extent, Mivart's critique misses its target).

## 6. *Argumentative strategies*

### 6.1 *Darwin's argumentative strategies*

Throughout his explanatory task, Darwin is clearly aware of the fact that explanation always depends on a given theoretical view or assumption and, in particular, on the comparison of different views, and that facts can be seen from these different viewpoints. In particular, in explaining the origin of species one cannot rely on immediate and conclusive empirical evidence.

Certain Darwinian strategies are central to the general structure of his "one long argument", such as the whole-part movement designed to put together Darwin's argument; his appeal to explanatory power as a whole; the comparison of his view with those of his opponents in order to emphasize its superior explanatory power; the balance of reasons for and against any issue; the interplay of the real and the possible by focusing on what is actually given, on the existence or inexistence of contrary evidence, and on what is logically and/or factually possible; and the treatment of difficulties / objections / exceptions. He considers the latter strategy so important that, when defending the explanatory power of his theory, Darwin begins by presenting and refuting difficulties and objections. By anticipating and discussing them, Darwin is able to make even the weakest points of his theory plausible.

The explanation of difficulties / objections /exceptions consists in: confronting them directly; accounting for their nature and source as the result of our ignorance of the relevant factors; clarifying their objective content, "resolving" the "apparent" difficulties, or "solving" the "real" ones, and weakening their impact; showing the reasonableness / unreasonableness of objections in the light of the appropriate approach to the subject; filling gaps through pertinent assumptions; confronting the presuppositions and/or procedures of the objector by showing that they are objections which have to be confronted by all theories, and by progressively rendering the objection more and more relative, until it is neutralized, or converted into mere "appearance", or by changing it into evidence favorable to the explanatory power of the Darwinian theory; the treatment of the exceptions not only sets limits on the validity of the explanations to be given, but discussing them extends the scope of Darwin's explanatory efforts in such a way

that the surprising may be converted into the expected.
In addition, Darwin appeals to our ignorance, to the authority of the scientific community and its values and ideals, to the psychological conditions of scientific investigation, to mental habits, to the progressive minds of those from whom Darwin expects support for his theory, and to its revolutionary nature, by demanding the re-structuring of existing disciplinary fields and the creation of new ones.

6.2 *Mivart's argumentative strategies*
Besides criticizing the Darwinian view, Mivart's basic strategy for defending his ideas is to rely on very general (and repeated) religious and philosophical considerations. His more specific strategies consist in: separating the domains of physical science, philosophy, and theology in such a way that the "facts" of the first domain cannot prove or disprove the beliefs related to the other two; establishing careful semantic distinctions, such as between the meanings of "creation", "evolution" and "specific forms"; on the basis of these distinctions, avoiding incompatibility between these separate realms; and discussing the positions of scientists, philosophers and theologians, whose prestige appears to convey a certain scientific legitimacy to his speculations. In order to attack Darwin's theory "scientifically", his basic strategy consists in attempting to show the inconsistencies of Natural Selection as an approach to evolution by discussing a series of counter-examples and, in the light of these, arguing that explanation by means of Natural Selection does not exclude other kinds of explanation.
Additional strategies used by Mivart include: the exploitation of emotional resources – he takes advantage of the emotional tone with which some of Darwin's supporters attacked theology to emphasize their intolerance and narrow-mindedness; and a mixture of candor and irony, of recognition and reprobation – he recognizes the positive scope of Darwin's efforts, and then indicates certain "absolutely insuperable" difficulties (Mivart 1871, pp.16-17). Mivart says that the great problem of the origin "of different kinds of animals and plants seems at last to be fairly on the road to receive – perhaps at no very distant future – as satisfactory a solution as it can well have" (Mivart 1871, p. 13). Thus, all efforts made before Mivart – including Darwin's long work – have only amounted to an effort to put things "fairly on the road" to receiving a satisfactory solution in the future! Having ruled out the Darwinian approach, Mivart then politely says that we are indebted to the "invaluable labors and active brains" of Darwin and Wallace, which have helped us to come closer to the solution for the

problem. Even short comments within brackets are used to this end, such as the remark that “on account of the noble self-abnegation of Mr. Wallace” (Mivart 1871, p. 22), the theory of Natural Selection is in general exclusively associated with Darwin’s name.

7. *Objections and responses*
7.1 *Mivart’s objections*
7.1.1 Mivart criticizes Darwin for never admitting that the absence of reconciliation between his theory and theism is unfounded. If Darwin has not studied Christian philosophy well enough, Mivart argues, he should not accept the antagonism between “creation” and “evolution” as an unchallengeable fact. Darwin has nothing to offer in terms of the dilemma of an Omnipotent God who would either render “Natural Selection” a superfluous law of Nature, or would be responsible for preordering so many deviations (Mivart 1871, p. 272). Having made all due restrictions, Mivart can then admit to the usefulness of Darwin’s theory for explaining certain facts, but adds that “the utility of a theory by no means implies its truth” (Mivart 1871, p. 22).

7. 1.2 Mivart criticizes the ready acceptance or rejection of Darwin’s theory. The ease with which Darwin’s theory coincides with facts can only be appreciated by physiologists, zoologists, and botanists (Mivart 1871, p. 23). One reason for this ready (and non-scientific) acceptance is the “remarkable simplicity” of Darwin’s theory in explaining all complex phenomena “by the simple phrase ‘survival of the fittest’” (Mivart 1871, p. 23). This “simplicity” makes Darwinism a subject for general conversation, in the same way as hydropathy and phrenology, “in the eyes of the unlearned or half-educated public”.

7.1.3 Some difficulties are raised against basic tenets of Darwin’s theory. Immediately after saying that the solution to the problem of the origin of species “is fairly on the road”, Mivart adds that the birth of species cannot be compared to that of an individual being. Darwin’s theory, which is based on such a view, is placed “out of the road” from the start. Mivart’s argument against this comparison is determined by the concept of species he assumes, i.e. “species” as “common natures”. One might in turn ask why Mivart’s concept of species as a congeries of “powers” and, moreover, of “innate powers”, should be accepted. Mivart interprets Darwin’s argument as follows:
(1) Every kind of animal and plant tends to increase in numbers in a geometrical progression.

(2) Every kind of animal and plant transmits a general likeness, with individual differences, to its offspring.
(3) Every individual may present minute variations of any kind and in any direction.
(4) Past time has been practically infinite.
(5) Every individual has to endure a severe struggle for existence, owing to the tendency to geometrical increase of all kinds of animals and plants, while the total animal and vegetable population (man and his actions excepted) remains almost stationary.

(Conclusion) Thus, every variation of a kind tending to save the life of the individual possessing it, or to enable it more surely to propagate its kind, will in the long-run be preserved, and will transmit this favorable characteristic to at least some of its offspring, which peculiarity will does become intensified till it reaches its maximum degree of utility. On the other hand, individuals presenting unfavorable peculiarities will be ruthlessly destroyed. The action of this law of 'Natural Selection' may thus be well represented by the convenient expression, 'survival of the fittest'.(Mivart 1871, pp. 17-18).

Premises 1 and 2 were broadly accepted at the time, and they were not at issue. In relation to premise 3, Mivart seems to confuse "kind" and "direction" of variations (he will later make use of the possibility of dealing with variations "in any direction" to argue against the power of Natural Selection in the formation of new species). The "kind" of variation, according to Darwin, depends on laws of variation that are for the most part unknown to us. Once they arise, they may be useful, injurious or neutral. Once variability begins, Darwin believes that there is a tendency to continue in "that direction", so that the accumulation of useful variations through Natural Selection in the right direction will lead to the production of new species. Instead of emphasizing variation in "any direction", Darwin emphasizes variation "in the right direction".
In relation to premise 4, one must be reminded that Darwin does not focus on the infinity of time, but on the limits of our imagination to perceive geological time.
In relation to premise 5, this might be a useful premise to ensure control over individuals and populations in order to preserve harmony, which is what Mivart is seeking. However, what Darwin says is that if there were no checks to the balance of nature, the natural tendency of populations to increase their numbers to the maximum level would not be controlled, and he does not exclude man from

this balance.
Lastly, the phrase “till it reaches the maximum degree of utility” in the conclusion may be in accordance with Mivart’s own ideas, but it is at least a distortion of Darwin’s conceptions.

7.1.4 On p. 34, Mivart lists objections on general issues:
1. “That ‘Natural Selection’ is unable to account for the incipient stages of useful structures”
2. “That it does not harmonize with the coexistence of closely-similar structures of diverse origin.”
3. “That there are grounds for thinking that specific differences may be developed suddenly instead of gradually.” (Mivart admits that both are possible, but thinks the first is more likely)
4. “That the opinion that species have definite though very different limits to their variability is still tenable”.
5. “That certain fossil transitional forms are absent, when they might have been expected to be present”.
6. “That some facts of geographical distribution complement other difficulties.” (Mivart attributes a lesser grade of difficulty to the phenomena of geographical distribution)
7. “That the objection based on the physiological difference between “species” and “races” is still unrefuted”.
8. “That there are many remarkable phenomena in organic forms upon which “Natural Selection” throws no light whatever, but the explanations of which, if they could be attained, might throw light upon specific origination”.
Several of these difficulties are discussed by Darwin in chapter VII of his 6th. edition when responding to Mivart’s specific objections, although many of them had already been discussed in the *Origin*.

Objections 2, 4 and 8 are based on irreconcilable viewpoints. Darwin deals with difficulties 2 and 8 in Chapter XIV of the *Origin*, and Difficulty 4 is examined in chapter I (According to Darwin, the more uniform the conditions of life, the less variation occurs, and he returns to his objector the *onus probandi* for the existence of limits to variability once it has begun). Difficulties 1 and 3 are closely related to each other, and have to do with Darwin’s basic presuppositions of gradualism. Difficulty 1 is dealt with in Chapter VI, Difficulty 5 in chapter X, Difficulty 6 in chapters XI and XII, and Difficulty 7 is extensively examined in

Chapter IX.

7.1.5 Specific difficulties are carefully examined by Mivart from chapters II to VIII.**[ii]** Among these are: the formation of the giraffe's neck; cases of mimicry; the eyes of flat-fish; the formation of the whalebone; the physiology of the young kangaroo; the utility of sea-urchins' pedicellaria; the co-adaptation of orchids and visiting insects; the case of sterile insects; the formation of the mammary gland; the formation of organs of senses; homologies. Mivart dedicates a very detailed analysis of each of these cases. All of them involve the issue of gradualism, which was the first of the general difficulties raised by Mivart: "That 'Natural Selection' is unable to account for the incipient stages of useful structures".

7.2 Darwin's responses. Darwin claims that all of Mivart's objections are considered in his 6th edition of the *Origin of Species* (Darwin 1875, pp.176-177). Mivart's book had had a significant impact on the public. Darwin had been preparing the 6th edition of the *Origin* since June, 1871. From July to September Darwin answered Mivart's objections, his "cleverest and least fair enemy" (Peckham 1959, p.22). The answers took up the largest part of a chapter included by Darwin in the 6th. edition, which was a new chapter VII.

Mivart's book was reviewed by Chaunchey Wright (*North American Review*, July, 1871), who had sent Darwin a letter on June 21, 1871 (Darwin, 1888, III vol. p. 143) with the revised proofs of his article, and a comment on using Mivart's book as the basis on which to illustrate and philosophically defend the Theory of Natural Selection. Darwin thought about asking Wright to publish his review as a shilling pamphlet, together with additions not previously included. Darwin would treat the subject much more concretely, so that he and Wright would not duplicate each other's comments. Darwin consulted Wallace about Wright's article, and said:
"… after studying Mivart, I was never before in my life so convinced of the general (i.e not detailed) truth of the views in the *Origin*. I grieve to see the omission of the words by Mivart, detected by Wright. I complained to Mivart that in two cases he quotes only the commencement of sentences by me, and thus modifies my meaning; (…) There are other cases of what I consider unfair treatment. I conclude with sorrow that though he means to be honorable, he is so bigoted that he cannot act fairly" (Darwin, 1888, III vol. p. 144-145).

7.2.1 Wright's pamphlet was published on October 23, 1871. In this way, Darwin

involved the philosophical and scientific community in his cause against Mivart. By publicly accepting a minor objection from Mivart to certain laws of correlation stated in Chapter V, Darwin showed a reasonable attitude towards Mivart. (Darwin, 1875, p.115), and thus increased the impact of his chapter VII. He begins his answers to Mivart by discrediting him before the reader – he claims Mivart does not intend to set out the various facts and considerations opposed to his conclusions, nor does he leave any space for the reader's reason or memory (Darwin, 1875, p.177).
Let us now consider some of Darwin's responses to Mivart's specific objections.

7.2.2 The case of the whale-bone belongs to a pattern of explanation of difficulties already mastered in chapter VI. In this chapter, Darwin deals with the General Objection 1, and offers a detailed argument for the formation of "organs of extreme perfection and complication" which spring from minute variations, and gives the case of human eyes as an example. In this kind of argument, the interplay of the real and the possible, the explanatory power as a whole, the balance of reasons, the comparison between the explanatory power of Darwin's theory and that of his opponents, and the careful descriptions of the organs of the different groups to be compared – all play an integrated part. The treatment of this objection also serves as an answer to Objection 2 concerning the co-existence of closely-similar structures.
In the case of the whale-bone Darwin starts with very careful descriptions of the baleen, or whalebone. He carefully examines the possible gradations that go from the beak of a member of the duck family to that of a shoveller, by way of the beak of the Egyptian goose and of the common duck. Returning to the whales, considering that the Hyperoodon Bidens has a roughened palate with small, unequal, hard points of horn, there is, claims Darwin, nothing unusual in supposing that some early cetacean form had similar but more regularly placed points of horn on the palate, and that these were converted through variation and Natural Selection into well-developed lamellae. Subsequent gradations, which may be observed in existing cetaceans, would lead to the enormous plates of baleen in the Greenland whale.

7. 2.3 In answering the objection about the formation of the giraffe's neck, Darwin points out that the acquisition of certain organic structures depends on the fact that some species are much more variable than others, and that a set of conditions must exist: the co-adaptation of several other parts of the organism;

the variability of the necessary parts in the right direction and to the right degree; external and continuingly conditions favorable to the action of Natural Selection; the concurrence of the laws of growth; and living habits. In addition, the treatment of the case of the giraffe's neck serves to emphasize that certain explanatory aims must be general and vague.

7.2.4 The case of the mammary gland seems to raise a major difficulty: could the young be saved from destruction by sucking a drop of a barely nutritious fluid from the accidentally hypertrophied cutaneous gland of its mother? And even if this was so, what chance was there of the perpetuation of such a variation?
Initially Darwin replies by attacking the basis for this objection: the case is not put fairly. Most evolutionists admit that mammals are descended from a marsupial form; if so, the mammary glands would have at first developed within the marsupial sack. "Now with the early progenitors of mammals (…), is it not at least possible that the young might have been similarly nourished?" (Darwin 1875, p.189 ). In this case, the individuals who secreted the most nutritious liquid (similar to milk) would in the long run have reared a larger number of well-nourished offspring. Thus, the cutaneous glands, homologues of the mammary glands, would be rendered more effective, and more highly developed than the remainder of the sack due to whatever cause. In consequence, they would have initially formed a breast without a nipple as in the Ornithorhynchus. But the development of the mammary glands would have been of no use, unless the young at the same time were able to partake of the secretion. But there is no greater difficulty in understanding how young mammals have instinctively learnt to suck the breast, than in understanding how unhatched chickens have learnt to break the egg-shell, or how a few hours after leaving the shell they have learnt to pick up grains of food.

7.2.5 Related to the above difficulty is the case of the young kangaroo: the young kangaroo only clings to the nipple of its mother, who has the power of injecting milk into the mouth of her offspring. Mivart remarks that some special provision exists to avoid the young being choked by the intrusion of the milk into the windpipe. Darwin responds: there is a special provision. The larynx is so elongated that it rises up into the posterior end of the nasal passage, and is thus enabled to give free entrance to the air for the lungs, while the milk passes harmlessly on each side of this elongated larynx, and so safely attains the gullet behind it. But if so, how would Natural Selection remove this perfectly innocent

and harmless structure in the adult kangaroo (and in most other mammals, provided they are descended from a marsupial form)? Darwin answers that the voice, which is certainly of high importance to many animals, could hardly have been used with full force, as Professor Flower suggests, while the larynx entered the nasal passage.

7.2.6 After meeting Mivart's chief objections against Natural Selection, Darwin attacks the inconsistencies of their fragile bases. They do not have the character of demonstration that Mivart requires for the explanatory power of Natural Selection. Mivart invokes an unknown "internal force or tendency" instead of the well-known tendency to ordinary variability, which through the aid of selection by man has clearly given rise to many well-adapted domestic races, and which through the aid of Natural Selection would give rise by graduated steps to natural races or species.
Also, Darwin claims that there are reasons for disbelieving in great and abrupt modifications on the bases of what we know about the rarity of occasional specific and abrupt changes in domestication. On the one hand, as species are more variable under domestication than under Nature, the frequent occurrence of such great and abrupt variations in Nature is not probable. To believe in the sudden appearance of a new species, one would also have to believe that several miraculously-changed individuals could appear simultaneously within the same geographical area!
On the other hand, many large groups of geographical distribution, geological succession of forms, classification, and embryology are intelligible only on the principle that different species have evolved by very small steps. The only evidence that seems to support a belief in abrupt development, i.e. the sudden appearance of new and distinct forms of life in our geological formations, depends entirely on the unproven belief in the precision of geological records.

*Conclusion*
Comparing Darwin and Mivart, one sees that they put different emphases on the issue of the origin of species, and this fact has consequences for the specificity of their problems, answers, and arguments. Darwin's problem is much more specific, focusing on "natural" phenomena, while Mivart's attention concentrates on a very general point of view by trying to reconcile evolution and theology. Darwin's answer is definite, and concerned with a "natural" cause to explain a host of natural phenomena. Mivart's answer is based on general religious and

philosophical beliefs, and much more indefinite in terms of their concrete explanatory scope. In relation to the explanation of natural phenomena, he concentrates his efforts on raising difficulties to Darwin's theory, rather than proposing an explanation of his own. The combination of these different levels of questions turns Mivart's argument less structured than Darwin's.

Their presuppositions are radically opposed to each other and built on different meanings of central ideas, such as those of "evolution" and "species". Darwin has a naturalistic orientation, and Mivart has a theistic one. Whereas Mivart tries to conciliate Science and Religion, Darwin wants to keep them apart. According to Darwin, to accept all the analogies required by Mivart, and which Wright proved to be false, is "to enter into the realms of miracle and to leave those of Science" (Darwin 1875, p. 204).

Both thinkers share a strong motivation: making a personal contribution to science. They both appeal to emotional overtones, and to argumentative maneuvers to rule out the opponent. Each of them feels personally attacked by the other. Mivart makes use of some intellectual strategies mastered by Darwin, like the interplay of the actual and the possible, the appeal to the scientific community, which is so fundamental to Darwin's argumentation. Both also appeal to the complexity of the problem, and to our ignorance about several matters involved in it. Nevertheless, Darwin develops a larger repertoire of sophisticated cognitive strategies. Mivart explicitly raises objections to Darwin in order to build his own explanation. Darwin's treatment of difficulties / objections / exceptions is a leading strategy to show the explanatory superiority of his theory.

As a result, we might expect that distortions by the opponent's ideas by each one of them would play an important role in the polemics. And they do. On the one hand, Mivart unquestionably assumes an anti-Darwinian concept of "species", and subtly makes little distortions in his reconstruction of Darwin's argument. Darwin clearly referred to Mivart's omissions and distortions in his citations of Darwin. Many difficulties of Darwin's theory raised by Mivart presuppose the adoption of his viewpoint, as his general Objection 2. On the other hand, Darwin finely takes advantage of circumstances favorable to create an anti-Mivart atmosphere before responding to his objections. In responding to them, Darwin first shows the explanatory capacity of his theory, and secondly attacks the bases of Mivart's objections. Objections and answers are moved by irreconcilable viewpoints.

One can learn several lessons from this polemics. I will point out three. First, that it is deeply founded on radically different presuppositions, and that it is clearly

about “views” rather than about facts, and has consequences for what should be the “facts”, how to interpret them, and how to make science. Second, that they are not trying to persuade one another, but a larger audience, the scientific community. Third, we can also learn something about “rationality”. Mivart espouses a dual view of the human, in which rationality is on the side not shared with other “natural” beings. In turn, Darwinian procedures belong to the rational effort we can achieve as “natural” beings. At the bottom of his efforts, there was a hidden “if” clause: “if there is a rational (according to ‘natural’ faculties and ‘means’) answer to the question about the origin of species, then (it should be like his)”.

NOTES

**[i]** The first edition of the Origin of Species was published in 1859.

**[ii]** As the attention of this paper is focused on The Origin of Species, the questions about pangenesis (chapter X) will not be referred to.

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