

St. George J. Mivart: The First Catholic Evolutionist

Francesca Bigoni & Roscoe Stanyon

1. Museo di Storia Naturale, Università di Firenze
francesca.bigoni@unifi.it

2. Dipartimento di Biologia, Università di Firenze
roscoe.stanyon@unifi.it

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Abstract

In the history of biology little space is dedicated to St. George Mivart. He is usually only remembered for his objections to Darwin's theory of natural selection contained in his book "Genesis of species". Mivart had started his brilliant scientific career as a student, collaborator and friend of T. H. Huxley and initially had a good professional relation with Charles Darwin. Later he disappointed Darwin and Huxley by openly criticizing their theoretical approach and their materialistic view. The final break up was not caused by the discussion about evolution and natural selection, as usually claimed, but by divergence on eugenetic topics. His objections were unfairly minimized and ridiculed as bigotry due to his conversion to Catholicism. Despite the bitter controversy with Darwin, Mivart remained quite influential and from 1864 to 1898 he published more than 120 scientific papers dealing with biological and zoological subjects in the most important British scientific journals of his time. Mivart's detailed anatomical works were based on evolutionary comparisons between species and communicated important, surprisingly modern, scientific interpretations. Today Mivart's scientific and theoretical contribution to biology, primate evolution and anthropology are rarely mentioned. However, many of the concepts advanced by Mivart were later echoed in the writings of many important biologist of the 20th century. The history of biological sciences could benefit from a more thorough knowledge of Mivart's influence.

Keywords: *evolution, natural selection, eugenics, primatology, ecology, punctuated equilibrium*

CONTENTS

1	The rise of Primatology in the Victorian era	388
2	Religion and Evolution: two non-overlapping domains?	390
3	Continued Attacks on Mivart based on his Catholic Faith	391

4	Difference of “kind” not “degree”	393
5	Eugenics and the Final Break Up	394
6	Analysis of Mivart’s Scientific Production and Influence	395
7	Origins of Ecology	397
8	Evolutionary bushes not trees.	398
9	Mivart’s View of Human Evolution	398
10	Misuse of Evolutionary Theory	399
11	Caught between religion and science?	400
	References	400

1 THE RISE OF PRIMATOLOGY IN THE VICTORIAN ERA

In the history of biology little space is dedicated to St. George Mivart. He is usually only remembered for his objections to Darwin’s theory of natural selection. However, in his time he had great influence, and held important positions in scientific societies. He published widely in the highest-ranking journals of his time. His books, aimed at both scientists and educated lay people, were widely read and sold not only over the English-speaking world (UK, USA, British colonies), but also throughout Europe. It is difficult to know exactly how his Catholic faith influenced his science, but it was certainly used against him to discredit his scientific views and deny him a full acknowledgement of his legacy. It is an undeniable fact that his Catholic faith prohibited him from enrolling in the best universities in England. He could not gain admission to either Oxford or Cambridge (Gruber 1960).

Nevertheless, probably by the force of his personality, desire to learn and abilities he was able to study with the most eminent scientists of the day. But before that he first studied law and was admitted to the Bar. This legal training probably served him well in arguing science and not only. He was able to study with Richard Owen, founder of the Museum of Natural History and later Thomas H. Huxley, known as Darwin’s bulldog. Huxley introduced him to many other leading scientists of the day including Darwin and considered Mivart among his best and most promising students.

His research under Huxley was fundamental for his election to the Royal Society. The request was presented by Huxley himself and the application was signed by a roll call of famous scientists of the day including Darwin. The Royal Society document of election is informative and included a list of Mivart’s publications (1864, 1865, 1866, 1867) in which he made phylogenetic inferences of human and primate evolution supportive of the new theory of the Origin of Species.

Mivart's anatomical research detailed in these publications, the basis for his admittance to the Royal Society, were based on evolutionary comparisons between species and framed within surprisingly modern, scientific interpretations. They included the first phylogenetic tree that followed Darwin's genealogical principle of common descent. However, even this strikingly important contribution was forgotten and totally overlooked until its recent rediscovery (Bigoni Barsanti 2011).

Indeed, it is almost always asserted that Ernst Haeckel in 1866 was the first to publish a true evolutionary tree, which showed actual taxa:

The German biologist and evolutionist Ernst Haeckel (1834-1919) was the first to exploit fully the tree analogy beginning in 1866 with numerous branching trees as well as branching stick diagrams, both showing actual taxa... (Archibald 2009).

Certainly Haeckel's tree is more famous, but we now know that Mivart published the first phylogenetic tree in 1865. It depicted the position of primates and humans. Mivart's phylogenetic trees of primate and human evolution were based on what was then a vast osteological analysis with statistics. It appears more modern and is more scientific than Haeckel's tree. Mivart was extraordinarily clear about scientific principles and the characters taken in consideration in his analysis. The data were derived from 29 primates including humans. Contrary to Darwin's trees, which were abstract, Mivart placed taxonomic names, many still in use today, on his tree. In 1867 Mivart published a second phylogenetic tree, which was based on the limb bones. Both these papers were highly praised by members of the Darwinian circle and the fact that modern historians of science had forgotten about them is testimony of how effective Darwinian evolutionists were in their later exclusion of Mivart.

Many might agree that Mivart made lasting contribution to primatology. His taxonomic definition and character keys of the order primates is still in use today, even if sometimes in modified form. Linnaeus classified the bats among the Primate order, but excluded the prosimians (lemurs and lorids) or strepsirrhine primates. Mivart made a cogent argument that excluded bats and included the prosimians, the classification still followed today.

Later for unknown reasons, Mivart began to openly criticize the theory of evolution of by means of natural selection. Perhaps his apparent change of heart was due to interaction with personalities from catholic circles, but this remains to be demonstrated by future research. Mivart's opposition to Darwinism was clearly marked by his 1871 book, *Genesis of Species*. This book was published in the same year as Darwin's book on the Descent of Man. From this point on, Mivart increasing alienated both Darwin and Huxley, who previously used

Mivart's publications to support their ideas. Mivart, not only criticized natural selection, but, foremost, searched for internal mechanisms that could in large part constrain and direct evolution. As a consequence he also criticized gradualism.

Natural Selection acts, and indeed must act, but that still, in order that we may be able to account for the production of known kinds of animals and plants, it is required to be supplemented by the action of some other law or laws as yet undiscovered. (p.5)

Alfred Russell Wallace, the co-author with Charles Darwin of the first article on the theory of evolution, remarked in his autobiography *My Life: A Record of Events and Opinions* (1905), on Mivart's *Genesis of Species*:

The arguments against Natural Selection as the exclusive mode of development are some of them exceedingly strong, and very well put... I think I agree with his conclusion in the main.

Darwin then wrote to Wallace on in a letter dated 12 July 1871:

I feel very doubtful how far I shall succeed in answering Mivart. It is so difficult to answer objections to doubtful points...

The fact that Darwin added an entire new chapter of 36 pages to the sixth edition of the *Origin of Species* to answer Mivart's objections, shows how cogent were the points raised by him. These criticisms had a long lasting influence on science up until the present day and are still extensively used by creationists. Mivart, was neither creationist or an antievolutionist, even if today his work is cited by both these groups and by proponents of intelligent design. Despite his reservations about natural selection and his eventual elimination from the circle of Darwin and Huxley, he nevertheless remained for his entire life a strong supporter of evolutionary descent.

2 RELIGION AND EVOLUTION: TWO NON-OVERLAPPING DOMAINS?

Moreover, from the discussion of scientific ideas the debate began to include other aspects that were not strictly scientific. It is informative to note that Mivart never brought up religion to support his position on scientific questions. It is another question if and exactly how his religious beliefs influenced his scientific endeavors.

Mivart, however, did openly and forcefully content that science and religion were compatible. It seems incredible then, that Huxley replied to Mivart's critique of Darwinisms in *Genesis of Species* by attacking Mivart not on the basis

of biology, but on the ground of theology. In reality this is a good indication that neither Darwin nor Huxley had ready answers to many of the points against natural selection that were brought up by Mivart. In any case, Mivart supported his contention that science and religion were compatible by citing important figures in Christian and in particular Catholic tradition such as Saint Augustine and Suarez. According to Huxley, Mivart was incompetent in theology and misinterpreted both authors.

In reality, in the cultural milieu of Victorian England, it was often difficult to separate the scientific debate from theology and religion. The various aspects were much more entwined than today. On the other hand, many theologians and clergy felt threatened by scientific discoveries, especially evolution. This problem was most deeply felt and expressed in Anglican quarters. Bishop Wilberforce sustained in writing and debate that church teachings and evolutionary theory were incompatible. Huxley's debate with Wilberforce is the stuff of legend and is almost universally repeated in textbooks and histories of the Darwinian epoch. Compared to the Anglican reaction, the Catholic position in the debate was much more cautious, subdued and articulate. Mivart in a publication entitled *Contemporary Evolution* (1876a) made a clear epistemological distinction between religion and science into two non-overlapping domains:

Physical science occupies itself with the phenomenal universe as far as accessible to our senses, the collocations of causes in the visible world, together with the laws of their action, in short, with the co-existences and successions of phenomena, from mathematics and sidereal astronomy to biology and sociology (p. 136)

while

Theology occupies itself with an asserted noumenal universe, inaccessible to our senses, the collocation of causes in such an invisible world, together with the laws of their action—in short, with the relations of spiritual entities from God down to the human soul (p. 137).

Therefore, he concludes, if science and religion studied two different subjects with two different methods there could be no conflict between them.

This clear separation between science and religion became a general consensus in the next century and was artfully articulated by Stephen Jay Gould. Today it is often thought as more of a tactical strategy.

3 CONTINUED ATTACKS ON MIVART BASED ON HIS CATHOLIC FAITH

Mivart also published on philosophical and theoretical issues in numerous articles and books both in England and in the United States. During the estrange-

ment from Huxley and Darwin, Mivart wrote more widely about these issues. Apparently his relationships with influential Catholic personalities intensified. His book “*Lessons from Nature*” (1876b) contained a long dedication to Cardinal Newman. The exact relationship and influence of Newman on Mivart has yet to be investigated and may prove to be enlightening. We can also note that he was declared Doctor of Philosophy from Pope Pius IX in 1876. There were certainly many reasons for his nomination by the pope and among these were his high standing and reputation in Science and perhaps his relationship to Cardinal Newman.

More pertinent to our present discussion is that *Lessons from Nature* was characterized in the *Popular Science Monthly* as a book

full of rancorous controversy and bitter polemics (...) the discussions in this volume shows that he is more a theologian than a scientist, more a bigot than a philosopher and more fond of fighting than teaching. (Vol. 9, p. 373)

Mivart was continually branded as a religious bigot by Darwin. For example in 1871 (July 9) Darwin wrote from Down:

My dear Wallace...I conclude with sorrow that though he (Mivart) means to be honourable he is so bigoted that he cannot act fairly....

Later on 16 September he wrote to JD Hooker:

I cannot understand him; I suppose that accursed religious bigotry is at the root of it.

Huxley depicted Mivart as a blind antagonist of ‘all things Darwinian’ and a mere mouthpiece of ‘Jesuitical Rome’. This attack of religious bigotry became the main thrust of the Darwinian camp against Mivart. The message was clear: if Mivart was a bigot then there was no need to take his objections and science seriously.

This was the strategy that Darwin and Huxley adopted. After the years of open conflict with Mivart, they simply ignored him. It was a comprehensible reaction to a brilliant student and collaborator that had betrayed their friendship, trust and great expectations (Bigoni and Barsanti 2011). The Darwinians were so successful that Mivart effectively disappeared into the mists of time. Only his reputation as a nasty catholic bigot remained.

Mivart’s efforts to harmonize evolution and Catholicism were, in the long run, apparently in vain. This part of the story was effectively reported by Artigas, Glick and Martinez (2006), and we have no need to examine it further here. We can only remark that his request that catholic scientists have complete freedom to conduct research contrasts sharply with the label of bigotry.

4 DIFFERENCE OF “KIND” NOT “DEGREE”

The sharpest break between Mivart on the one hand and Darwin/Huxley on the other was the application of evolutionary theory to humans. According to Mivart, human cognitive ability and behavior could not be explained by evolution, certainly not by natural selection. According to Mivart, the unique characteristics of humans set humans apart from evolution even if the human body retained clear signs of the phylogenetic origin of humans.

Mivart was not alone in his position that natural selection could not explain the human phenomenon. Alfred Wallace, the co-discoverer of evolution by natural selection, was clearly in Mivart’s camp in this regard. In *My life record* Wallace explains that this point is: *The chief differences of opinion between Darwin and myself*. Wallace is very clear about his position:

Problem 1:

The origin of Man as an intellectual and moral being.

On this great problem the belief and teaching of Darwin was, that man’s whole nature -physical, mental, intellectual, and moral- was developed from the lower animals by means of the same laws of variation and survival; and, as a consequence of this belief, that there was no difference in kind between man’s nature and animal nature, but only one of degree. My view, on the other hand, was, and is, that there is a difference in kind intellectually and morally, between man and other animals... (1905 Vol. II pp.16-17)

Darwin, in spite of his difficulties with Mivart, in a letter to the Marquis de Saporta, 8 April 8 1872, still had to admit that Mivart was the one scientist in England who knew most about the order Primates:

I will reflect on what you have said, but I cannot at present give up my belief in the close relationship of Man to the higher Simiae.... The man who in England knows most about the structure of the Simiae, namely, Mr. Mivart, and who is bitterly opposed to my doctrines about the derivation of the mental powers, yet has publicly admitted that I have not put man too close to the higher Simiae, as far as bodily structure is concerned.

A few years later Mivart published *Man and Apes* (1874a): the conclusions again stressed the importance that differences of degree and kind bear in the comparison of humans towards other monkeys. So as far as humans were concerned Mivart, the foremost Victorian expert on primates, as seen in this book had renounced the most profound meaning and the innovating spirit of the publications that got him elected to the Royal Society and had raised so much enthusiasm in Huxley and Darwin. Mivart himself covered up their importance and implications. He became more and more ambiguous about different aspects of a theory

of evolution in respect to humans. Certainly Mivart did nothing to promote the recognition of his earlier scientific efforts. In this regards then religious influences on Mivart had a negative influence on his science, but that is not the whole story.

5 EUGENICS AND THE FINAL BREAK UP

The final break up with Darwin was not caused by the discussion about evolution and natural selection, as usually claimed, but by divergence on eugenic topics. His objections as usual were unfairly minimized and ridiculed as bigotry. Francis Darwin (son of Charles) wrote on the break up in his 1916 *Memoir of Sir George Darwin*:

In 1873 he (George) wrote "On beneficial restriction to liberty of marriage" a eugenic article for which he was attacked with gross unfairness and bitterness by the late St George Mivart. He was defended by Huxley, and Charles Darwin formally ceased all intercourse with Mivart.

So Francis Darwin acknowledges that the article dealt with Eugenics (state controlled reproduction) even if today we are told that this was a bland article on marriage and divorce. It is worthwhile therefore to briefly examine some key passages of the article, *On beneficial restrictions to liberty of marriage* by George Darwin (1874) in which he calls for the establishment of a caste of individuals who would be entrusted with the reproduction to the exclusion of others:

The object of this article is to point out how modern scientific doctrines may be expected in the future to affect the personal liberty of individuals in the matter of marriage. . . . Mr. Galton has recently given us his ideas of a scheme, whereby he hopes that this method may be ultimately made applicable to the improvement of our race. It consists in the formation of a quasi-caste of those endowed above the average in mental and physical qualities, and who would by early intermarriage (for to them success in life would be almost assured) diffuse their qualities throughout the nation. Could such a cast be formed, its effect would certainly enormous. . . . The second and less efficient method is by the prevention of breeding from the inferior members of the race. . . . This is the method which forms my ground work in the present article, and I feel little doubt that it will be the one which will be adopted. . . . the advance of medical science will, by the preservation of the weak, only aggravate the evil for future generations. . . . convulsions, hysteria, chorea, and epilepsy. . . . Gout, scrofula, rheumatism, tuberculous, cancerous, herpetic and syphilitic diseases are intimately related and all are strongly heritable. . . . asthma, dyspepsia, epilepsy, apoplexy, paralysis, madness, and many other diseases. The tendency to vice, too, seems almost of the nature of a disease, and it is without doubt hereditary.

The article referred diffusely to Dr. Francis Galton and what would become eugenics. Sir Francis Galton had coined the term eugenics not long after and was the founder and President of the Eugenics Society. He was a first cousin of Charles Darwin and Erasmus Darwin who was grandfather of both. Descendants of Darwin for various generations were active in and held important positions in Eugenics Society.

In relation to eugenics it is important to recall that one of the weaknesses of the Darwinian theory was that there was no clear idea about hereditary. Even though Mendel had already articulated the fundamental laws of genetics, his discoveries remained unappreciated for decades. Darwin was well aware of the heredity problem and made many experiments to better understand it. In the end Darwin fell back on a version of Lamarckian inheritance he called pangenesis. Darwin's theory of inheritance relied on tiny heredity particles he called gemmules. These particles were supposedly generated in body cells and accumulated in the reproductive organs.

George Darwin either does not seem to be aware of the heredity problem or blindly accepted pangenesis. He refers to heredity as a known quantity and confuses pathologies of diverse origin with behavioral problems and moral vices, an unfortunate but common confusion of the time. We do not have time and space to discuss the history of eugenics, but certainly eugenics theory was looked upon with considerable favor across Europe and America. It was not just the Nazi who implemented some type of state control on human reproduction or conducted cruel experiments on "inferior races" under the umbrella of science. In the United States alone more than 65,000 Americans (some estimates are much higher) had been sterilized, most by coercion. Eugenics was also used to support restrictions on immigration, especially from particular regions and countries (Gould 1981). Mivart's voice was certainly out of the chorus of general approval and represents a remarkable historical fact, and a prophetic vision:

He [George Darwin] speaks in an approving strain of the most oppressive laws (...). This repulsive phenomenon affords a fresh demonstration of (...) how easily the most profound moral corruption can co-exist with the most varied appliances of a complex civilisation. The peasants of the Tyrol serve equally well to demonstrate how pure and lofty a morality and how really refined a mental civilisation may coexist with very great simplicity...(1874b)

6 ANALYSIS OF MIVART'S SCIENTIFIC PRODUCTION AND INFLUENCE

Now we are going to examine Mivart's scientific production and influence on science during his life and after his death. As we noted above Mivart began publishing scientific articles in 1864 while he was a student of T. H. Huxley. Over an

arc of 34 years (up until 1898) he published 120 papers. Here we are not counting the various books Mivart published on scientific subjects or publications and books on philosophical questions. We are considering publications on biological and zoological subjects. Many of these were in the most influential British journals of his time (see table 1).

Journal	Number
Proceedings of the Zoological Society of London	34
Nature	16
Transactions of the Zoological Society of London	6
Transactions of the Linnean Society of London	3
Proceedings of the Royal Society of London	3
Journal of the Linnean Society of London	2
Journal of Anatomy and Physiology	2
Philosophical Transactions of the Royal Society of London	1

Table 1: Scientific production of St. George J. Mivart

Overall he published 692 pages dedicated to osteology and 512 pages on muscles, soft tissues, organs, behavior, physiology and development. Gruber (1960) claimed that Mivart was primarily an osteologist and after the final break-up (1874) with Darwin and Huxley was scientifically unproductive. Both are false claims (Bigoni and Barsanti 2011). Contrary to what Gruber says (1960), Mivart never gave up evolutionary analysis of phylogenetic relationships. For instance in his book *The Cat* (1881) of 557 pages he produced one of his most complete evolutionary trees, which included living and fossil forms.

Mivart's influence on the scientific culture of the time is also illustrated by the fact that he was member of and often held office in the most important scientific societies of Victorian England. He became a fellow of the Royal Society in 1869, was twice elected President of the Zoological Society of London (1869 and 1882), secretary, vice president (1874-1880) and president (1892) of the Linnaean Society, and President (1879) of the Biological Section of the British Association of Science. In addition to scientific associations, he was also a member of the Metaphysical Society whose membership included the intellectual elite of London.

One of the most pertinent measures of a scientific value must not take in consideration only if a hypothesis or theory is correct, but also the fertility of his work. Did it stimulate further research, discussion and discovery? Did Mivart pave the way for later thinkers in his interpretation of Evolution? Without doubt the answer is a resounding Yes on all counts.

Mivart's publications proved enormously fertile for provoking further research. We know that Mivart's challenges to Darwin and Huxley exposed weak-

nesses in the theory of natural selection, some of which are still debated. Importantly, there is evidence that Mivart's very articulated criticisms stimulated scientific research and innovation.

Even just considering one objection to Darwin's theory is sufficient: the contents of the second chapter of *On the Genesis of species* discussing *The incompetency of Natural Selection to account of the Incipient Stages of Useful Structure* (1871) has been an incredible stimulus to research up until today. The effectiveness of Mivart's objections to Darwin's theory in *The Genesis of Species* is better seen in the fact that Darwin in the 6th edition added an entire chapter to his book to reply to Mivart's points. This is a strong proof of the fertility of Mivart's ideas.

Indeed, Mivart's opposition to natural selection provided him with many firsts that later developed into whole avenues of discovery and scientific disciplines. For instance Mivart was the first to make development central to evolutionary change. Here we note again that Mivart embraced evolution, but not the overriding mechanism of natural selection. He hypothesized that development constrained individual variation, that variations were neither random nor infinite, and that changes in the environment bring out new phenotypes or variations as a consequence of an alteration in the conditions of development. Mivart's proposal that changes relevant to evolution occur during ontogeny is a most significant departure from previous thoughts on this topic and developed into a field of research, currently extremely active. In contrast Darwin (and Haeckel) held that the only mode of evolutionary changes was when a new stage got added at the end of ontogeny.

So it is legitimate to hold that Mivart paved the way for later thinkers in his critique of natural selection. Without doubt Mivart anticipated a series of modern concepts: macromutation, punctuated equilibria and Evo-Devo.

7 ORIGINS OF ECOLOGY

Mivart was one of the first scientists to outline the contours of the discipline, which was to become ecology. Only he coined another term for this budding science, Hexicology. Hexis in Greek means habit, state or condition. Mivart defined Hexicology in the article *The Relation of Animals and Plants to Time* (1880) as a discipline

devoted to the study of the relations which exist between the organisms and their environment as regards the nature of the locality they frequent, the temperatures and the amounts of light which suit them, and their relations to other organisms as enemies, rivals or accidental and involuntary benefactors.

Mivart might well have been regarded as a founder of ecology, a term coined by Haeckel but this contribution along with others was forgotten.

8 EVOLUTIONARY BUSHES NOT TREES.

Mivart was one of the first to discuss that different sets of data can yield different evolutionary trees. Indeed Mivart concluded that evolution was too complicated to be represented with the ‘symbol of the tree’:

If, as I believe, so many similar forms have arisen in mutual independence, then the affinities of the animal kingdom, or even of the Mammalian class, can never be represented by the symbol of a tree. Rather, I believe, we should conceive the existence of a grove of trees, closely represented, greatly differing in age and size, with their branches interlaced in a most complex entanglement. (Mivart 1873, p. 510)

Mivart’s description seems strangely close to some recent proposals of evolutionary bushes. Certainly this is an iconographic convergence and a full discussion would necessitate further research.

9 MIVART’S VIEW OF HUMAN EVOLUTION

Today Mivart’s scientific and theoretical contribution to biology, primate evolution and anthropology are rarely mentioned. Mivart’s view, in opposition to Darwin, that the difference between humans and apes were a matter of kind not degree also became the predominate perspective. It put human in a special position in respect to not only natural selection, but especially the use of evolution to explain human cognition and behavior.

For instance anthropologists long asserted that humans were the only species to have culture. The possession of culture was special and placed them outside the sphere of evolution. This view is still the consensus and permeates cultural anthropology and social science up to this day. There are many definitions of culture, but almost everyone would agree that culture is a superorganic, shared behavioral pattern, which is acquired through a process of socialization. This pattern identifies members of a cultural group and at the same time distinguishes its members from other culture groups. It was only over the last 50 years that it is now known that many species have culture. Particularly important in this regard was Jane Goodall’s discovery of the manufacture and use of tools in chimpanzees.

Another pertinent discussion launched by Mivart and other scientist of the time was that a number of behaviors found in humans were unique and could not be explained by a gradual evolutionary modulation of previous states. One of the most persistent of these was altruism. Mivart argued and Darwin had no good reply that Altruism could not be explained by natural selection. Mivart implied that there was no room in Darwin’s theory for ethical and moral behavior. Darwinian theory seemed best summarized by Alfred Tennyson’s definition as

Nature red in tooth and claw (1850). An alternative biological view of human ethical and moral behavior was that it represented only a thin veneer over our nasty animal nature. This thin veneer was applied by education in family, school and church, a top down origin of ethical behavior.

Mivart did not discuss the exact origins of these “noble” characteristics of humans, but he did claim that they were unique and specifically human. They could not be found even in our closest relative, the primates. Certainly this position first stated by Mivart, was and still is the consensus view, in spite of the fact that ethologists over the last 10-15 years have provided evidence that altruism does exist in other species. Chimpanzees and bonobos, our closest relatives provide help in the absence of rewards repeatedly towards conspecifics and humans. The long lasting influence of Mivart on the discussion of the origins of such behaviors is seen by the fact that only in the last few years ethologists are just beginning to develop evolutionary theories to account for the origins of “good” behavior. The “bottom up” view provides evidence that the roots of human altruism may go deep into evolutionary time.

10 MISUSE OF EVOLUTIONARY THEORY

Finally, Mivart exposed how “shallow thinkers” could misuse evolutionary theory. In particular, social darwinism and the misuse of evolution for ideological and political agendas. His objections to eugenics (state controlled reproduction) and George Darwin now seem incredibly prophetic.

Finally his criticisms made it clear that there was little understanding of heredity, which was a particular weak point of eugenics. This led Darwin to propose his erroneous theory of Pangenesis, but later also helped make it clear that Mendelian genetics could resolve many weaknesses in Darwin’s theory.

Many of the concepts advanced by Mivart were later echoed in the writings of many important biologist of the 20th century. Mivart anticipated a series of modern concepts: macromutation, punctuated equilibria, Evo-Devo. It can be argued that Mivart emphasis on the lack of transitional forms eventually led to modern concepts of punctuated equilibrium as expressed by Gould and Eldredge. Similarly Mivart’s insistence on the internal constraints to natural selection may be viewed as a precursor to later ideas of canalization (Worthington), genetic landscapes (Wright), evo-devo and niche construction.

So we can see that the arguments first set forth by Mivart had considerable and long lasting resonance in the scientific community. On this basis the science of Mivart can be judged highly. His arguments are still relevant to the debate of today. The history of biological sciences could benefit from a more thorough knowledge of Mivart’s influence. It is our suspicion that many researchers used

the insights provided by Mivart, but did not acknowledge him for fear of being discredited.

11 CAUGHT BETWEEN RELIGION AND SCIENCE?

Mivart was a very brilliant, complex individual that went through conflicts and changes on many levels. He strove apparently in vain to harmonize evolutionary thinking with religion. His religious views also brought him into conflict with the Catholic Church and he died in 1900 after being excluded from sacraments (Mivart 1900). Nonetheless, it is probable that his scientific approach and positions were strongly influenced by his religious beliefs, but the relation between these two aspects in his life were coldly labeled as bigotry and never deeply investigated. It is probable that Mivart's religious views stimulated his opposition to certain aspects of Darwin's theory and this opposition was heuristic in promoting innovation. On the other hand, despite some opposition by contemporaries, Mivart view that the differences between humans and apes were a matter of kind and not of degree, became the predominant perspective. It permeated anthropology. For example, anthropologists long asserted that humans are the only species to have culture.

Certainly Mivart was a key person in Victorian circle in both scientific research and in general cultural and religion. His writings were at least initially received with much acclaim in England, Europe and the United States. Today he is quickly liquidated as an annoying, religious bigot. More benign labels include heretic, or mentally ill muddler. All these labels are far from reality. It is certain however that his Catholic faith was used to discredit him.

A more complete reexamination of Mivart's works would clarify the role he played in stimulating innovation and forging the modern sciences of biology. It would also help to clarify how his religious worldview influenced his scientific voyage of discovery.

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