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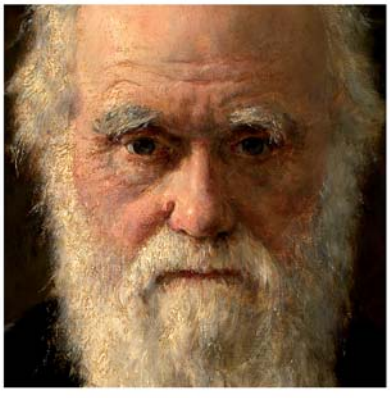
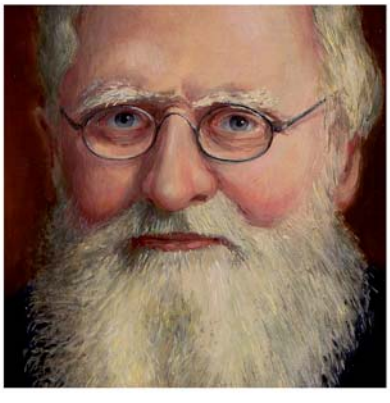
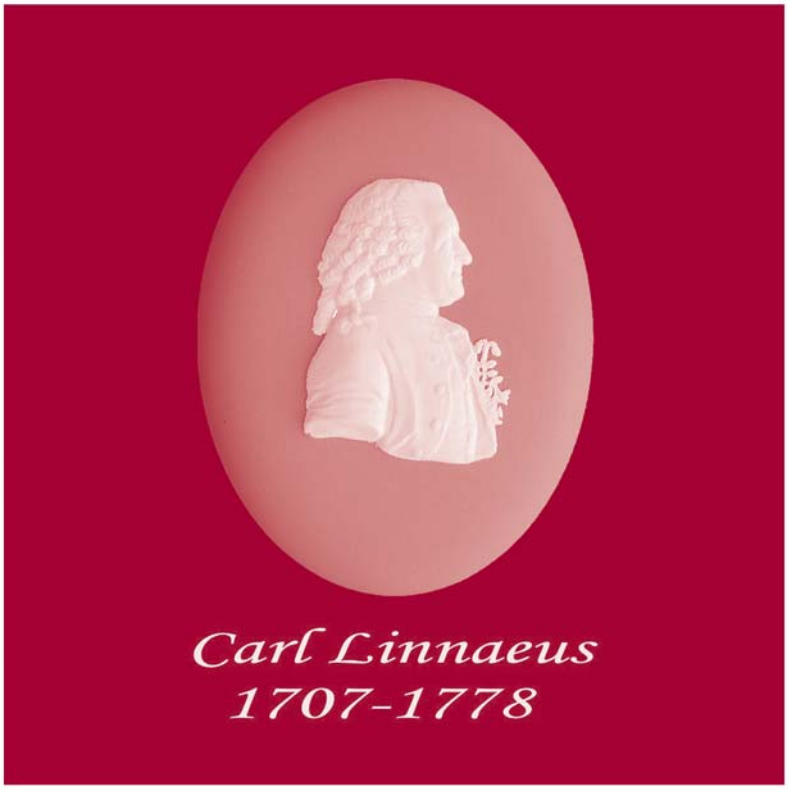
PATRON: HER MAJESTY THE QUEEN

Survival of the Fittest

Celebrating the 150th anniversary of the Darwin-Wallace theory of evolution







THE LINNEAN SPECIAL ISSUE NO. 9

A forum for natural history

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Survival of the Fittest

A Special Issue of *The Linnean*
celebrating the 150th anniversary of the
Darwin-Wallace theory of evolution

edited by

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Introduction and the "Joint Essay"

This Special Issue of *The Linnean* is to commemorate the 150th anniversary of the most important event in the history of the Linnean Society: the reading of the Joint Essay of Darwin and Wallace in July 1858. It comprises seven papers in all, which are mainly concerned with the post-1858 careers of Darwin and Wallace.

Returning to the Joint Essay, it is important to note that in May 1855 Bennett and Hooker submitted a resolution that in future papers communicated for the *Proceedings* should be printed in full, given a printed cover and registered as a Periodical. The outcome was the appearance in March 1856 of a new octavo publication entitled the *Journal of Proceedings of the Linnean Society* whose great advantage was rapid publication. This astute move by Hooker was soon to bear dividends since, three years later, the new octavo *Proceedings* not only allowed the rapid publication of the Joint Essay of Darwin and Wallace, with its contained novel theory, but also ensured its rapid promulgation. The joint communication was printed in our *Journal of Proceedings*, vol. 3: pp45-62 on the 20th August 1858, within two months of being submitted.

At the actual reading of the Joint Essay there were only 32 members present and although the interest was intense, as Bentham pointed out later, Bell would not have allowed anyone to initiate a discussion of the startling hypothesis so unexpectedly presented. Nevertheless, at the beginning of the propitious papers both Lyell and Hooker spoke, impressing on those present the necessity of profound attention and for giving their most careful consideration to what they were about to hear and its bearing on the future of natural history. Both those lucky few present at the meeting, as well as the remaining 371 Fellows, had only two months to wait until the Proceedings of that July meeting were published in full. It was at this point in time that the Darwin/Wallace hypothesis that "Natural Selection" was dependant on the "Struggle for Existence" became universally known, when the Society's *Proceedings* were picked up by many Journals including, for instance, the *Gardeners Chronicle* and the *Athenaeum*. Thus the *Gardeners Chronicle* extracted the entire Darwin paper "On the variation of organic beings in a state of nature; on the natural means of selection and on the comparison of domestic races and true species."

Page 735 of the *Gardeners Chronicle* No. 40, October 2nd, 1858 reads:

Notice of Books

Journal of Proceedings of the Linnean Society

The first part of the third volume of this important work attests to the determination of the Council to maintain the reputation of the Society as a great centre of scientific natural history. The zoological papers are varied and highly interesting; the botanical consists of further contributions to the orchidology of India as especially as relates to the genera Denobrium and Erica. Among others is a most suggestive paper by Mr. Darwin on variation among organic beings which we extract entire "De Candelle in an elegant passage has declared that all nature is at war, one organism with another or with external nature. Seeing the contented face of nature this may at first well be doubted, but reflection will inevitably prove it to be true. The war, however, is not

constant, but recurrent in a slight degree at short periods, and more severely at occasional more distant periods; and hence its effects are easily overlooked."

For the remainder of the extract – from Darwin's paper on variation, see below.

On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection. By Charles Darwin, Esq., F.B.S., F.L.S., & F.G.S., and Alfred Wallace, Esq. Communicated by Sir Charles Lyell, F.R.S., F.L.S., and J.D. Hooker, Esq., M.D., V.P.R.S., F.L.S., &c.

[Read July 1st, 1858.]
London, June 30th, 1858,

MY DEAR SIR, — The accompanying papers, which we have the honour of communicating to the Linnean Society, and which all relate to the same subject, viz. the Laws which affect the Production of Varieties, Races, and Species, contain the results of the investigations of two indefatigable naturalists, Mr. Charles Darwin and Mr. Alfred Wallace.

These gentlemen having, independently and unknown to one another, conceived the same very ingenious theory to account for the appearance and perpetuation of varieties and of specific forms on our planet, may both fairly claim the merit of being original thinkers in this important line of inquiry; but neither of them having published his views, though Mr. Darwin has for many years past been repeatedly urged by us to do so, and both authors having now unreservedly placed their papers in our hands, we think it would best promote the interests of science that a selection from them should be laid before the Linnean Society. Taken in the order of their dates, they consist of; —

I. Extracts from a MS. work on Species*, by Mr. Darwin, which was sketched in 1839, and copied in 1844, when the copy was read by Dr. Hooker, and its contents afterwards communicated to Sir Charles Lyell. The first Part is devoted to "The Variation of Organic Beings under Domestication and in their Natural State;" and the second chapter of that Part, from which we propose to read to the Society the extracts referred to, is headed, "On the Variation of Organic Beings in a state of Nature; on the Natural Means of Selection; on the Comparison of Domestic Races and true Species."

   * This MS work was never intended for publication, and therefore was not written with care – C.D. 1858.

II. An abstract of a private letter addressed to Professor Asa Gray, of Boston, U.S., in October 1857, by Mr. Darwin, in which he repeats his views, and which shows that these remained un-altered from 1839 to 1857.

III. An Essay by Mr. Wallace, entitled " On the Tendency of Varieties to depart indefinitely from the Original Type". This was written at Ternate in February 1858, for the perusal of his friend and correspondent Mr. Darwin, and sent to him with the expressed wish that it should be forwarded to Sir Charles Lyell, if Mr. Darwin thought it sufficiently novel and interesting. So highly did Mr. Darwin appreciate the value of the views therein set forth, that he proposed, in a letter to Sir Charles Lyell, to obtain Mr. Wallace's consent to allow the Essay to be published as soon as

possible. Of this step we highly approved, provided Mr. Darwin did not withhold from the public, as he was strongly inclined to do (in favour of Mr. Wallace), the memoir which he had himself written on the same subject, and which, as before stated, one of us had perused in 1844, and the contents of which we had both of us been privy to for many years. On representing this to Mr. Darwin, he gave us permission to make what use we thought proper of his memoir, &c.; and in adopting our present course, of presenting it to the Linnean Society, we have explained to him that we are not solely considering the relative claims to priority of himself and his friend, but the interests of science generally; for we feel it to be desirable that views founded on a wide deduction from facts, and matured by years of reflection, should constitute at once a goal from which others may start, and that, while the scientific world is waiting for the appearance of Mr. Darwin's complete work, some of the leading results of his labours, as well as those of his able correspondent, should together be laid before the public.

We have the honour to be yours very obediently,

CHARLES LYELL
JOS. D. HOOKER.

J. J. Bennett, Esq.,
Secretary of the Linnean Society.

Extract from an unpublished Work on Species, by C. DARWIN, Esq., *consisting of a portion of a Chapter entitled, "On the Variation of Organic Beings in a state of Nature; on the Natural Means of Selection; on the Comparison of Domestic Races and true Species"*

De Candolle, in an eloquent passage, has declared that all nature is at war, one organism with another, or with external nature. Seeing the contented face of nature, this may at first well be doubted; but reflection will inevitably prove it to be true. The war, however, is not constant, but recurrent in a slight degree at short periods, and more severely at occasional more distant periods; and hence its effects are easily overlooked. It is the doctrine of Malthus applied in most cases with tenfold force. As in every climate there are seasons, for each of its inhabitants, of greater and less abundance, so all annually breed; and the moral restraint which in some small degree checks the increase of mankind is entirely lost. Even slow-breeding mankind has doubled in twenty-five years; and if he could increase his food with greater ease, he would double in less time. But for animals without artificial means, the amount of food for each species must, *on an average,* be constant, whereas the increase of all organisms tends to be geometrical, and in a vast majority of cases at an enormous ratio. Suppose in a certain spot there are eight pairs of birds, and that *only* four pairs of them annually (including double hatches) rear only four young, and that these, go on rearing their young at the same rate, then at the end of seven years (a short life, excluding violent deaths, for any bird) there will be 2048 birds, instead of the original sixteen. As this increase is quite impossible, we must conclude either that birds do not rear nearly half their young, or that the average life of a bird is, from accident, not nearly seven years. Both checks probably concur. The same kind of calculation applied to all plants and animals affords

results more or less striking, but in very few instances more striking than in man.

Many practical illustrations of this rapid tendency to increase are on record, among which, during peculiar seasons, are the extraordinary numbers of certain animals; for instance, during the years 1826 to 1828, in La Plata, when from drought some millions of cattle perished, the whole country actually *swarmed* with mice. Now I think it cannot be doubted that during the breeding-season all the mice (with the exception of a few males or females in excess) ordinarily pair, and therefore that this astounding increase during three years must be attributed to a greater number than usual surviving the first year, and then breeding, and so on till the third year, when their numbers were brought down to their usual limits on the return of wet weather. Where man has introduced plants and animals into a new and favourable country, there are many accounts in how surprisingly few years the whole country has become stocked with them. This increase would necessarily stop as soon as the country was fully stocked; and yet we have every reason to believe, from what is known of wild animals, that *all* would pair in the spring. In the majority of cases it is most difficult to imagine where the checks fall — though generally, no doubt, on the seeds, eggs, and young; but when we remember how impossible, even in mankind (so much better known than any other animal), it is to infer from repeated casual observations what the average duration of life is, or to discover the different percentage of deaths to births in different countries, we ought to feel no surprise at our being unable to discover where the check falls in any animal or plant. It should always be remembered, that in most cases the checks are recurrent yearly in a small, regular degree, and in an extreme degree during unusually cold, hot, dry, or wet years, according to the constitution of the being in question. Lighten any check in the least degree, and the geometrical powers of increase in every organism will almost instantly increase the average number of the favoured species. Nature may be compared to a surface on which rest ten thousand sharp wedges touching each other and driven inwards by incessant blows. Fully to realize these views much reflection is requisite. Malthus on man should be studied; and all such cases as those of the mice in La Plata, of the cattle and horses when first turned out in South America, of the birds by our calculation, &c., should be well considered. Reflect on the enormous multiplying power *inherent and annually in action* in all animals; reflect on the countless seeds scattered by a hundred ingenious contrivances, year after year, over the whole face of the land; and yet we have every reason to suppose that the average percentage of each of the inhabitants of a country usually remains constant. Finally, let it be borne in mind that this average number of individuals (the external conditions remaining the same) in each country is kept up by recurrent struggles against other species or against external nature (as on the borders of the Arctic regions, where the cold checks life), and that ordinarily each individual of every species holds its place, either by its own struggle and capacity of acquiring nourishment in some period of its life, from the egg upwards; or by the struggle of its parents (in short-lived organisms, when the main check occurs at longer intervals) with other individuals of the *same* or *different* species.

But let the external conditions of a country alter. If in a small degree, the relative proportions of the inhabitants will in most cases simply be slightly changed; but let the number of inhabitants be small, as on an island, and free access to it from other countries be circumscribed, and let the change of conditions continue progressing (forming new

stations), in such a case the original inhabitants must cease to be as perfectly adapted to the changed conditions as they were originally. It has been shown in a former part of this work, that such changes of external conditions would, from their acting on the reproductive system, probably cause the organization of those beings which were most affected to become, as under domestication, plastic. Now, can it be doubted, from the struggle each individual has to obtain subsistence, that any minute variation in structure, habits, or instincts, adapting that individual better to the new conditions, would tell upon its vigour and health? In the struggle it would have a better *chance* of surviving; and those of its offspring which inherited the variation, be it ever so slight, would also have a better *chance.* Yearly more are bred than can survive; the smallest grain in the balance, in the long run, must tell on which death shall fall, and which shall survive. Let this work of selection on the one hand, and death on the other, go on for a thousand generations, who will pretend to affirm that it would produce no effect, when we remember what, in a few years, Bakewell effected in cattle, and Western in sheep, by this identical principle of selection?

To give an imaginary example from changes in progress on an island: — let the organization of a canine animal which preyed chiefly on rabbits, but sometimes on hares, become slightly plastic; let these same changes cause the number of rabbits very slowly to decrease, and the number of hares to increase; the effect of this would be that the fox or dog would be driven to try to catch more hares: his organization, however, being slightly plastic, those individuals with the lightest forms, longest limbs, and best eyesight, let the difference be ever so small, would be slightly favoured, and would tend to live longer, and to survive during that time of the year when food was scarcest; they would also rear more young, which would tend to inherit these slight peculiarities. The less fleet ones would be rigidly destroyed. I can see no more reason to doubt that these causes in a thousand generations would produce a marked effect, and adapt the form of the fox or dog to the catching of hares instead of rabbits, than that greyhounds can be improved by selection and careful breeding. So would it be with plants under similar circumstances. If the number of individuals of a species with plumed seeds could be increased by greater powers of dissemination within its own area (that is, if the check to increase fell chiefly on the seeds), those seeds which were provided with ever so little more down, would in the long run be most disseminated; hence a greater number of seeds thus formed would germinate, and would tend to produce plants inheriting the slightly better-adapted down.

Besides this natural means of selection, by which those individuals are preserved, whether in their egg, or larval, or mature state, which are best adapted to the place they fill in nature, there is a second agency at work in most unisexual animals, tending to produce the same effect, namely, the struggle of the males for the females. These struggles are generally decided by the law of battle, but in the case of birds, apparently, by the charms of their song, by their beauty or their power of courtship, as in the dancing rock-thrush of Guiana. The most vigorous and healthy males, implying perfect adaptation, must generally gain the victory in their contests. This kind of selection, however, is less rigorous than the other; it does not require the death of the less successful, but gives to them fewer descendants. The struggle falls, moreover, at a time of year when food is generally abundant, and perhaps the effect chiefly produced would be the

modification of the secondary sexual characters, which, are not related to the power of obtaining food, or to defence from enemies, but to fighting with or rivalling other males. The result of this struggle amongst the males may be compared in some respects to that produced by those agriculturists who pay less attention to the careful selection of all their young animals, and more to the occasional use of a choice mate.

II. *Abstract of a Letter from* C. DARWIN, Esq., *to* Prof. ASA GRAY, *Boston, U.S., dated Down, September 5th,* 1857.

1. It is wonderful what the principle of selection by man, that is the picking out of individuals with any desired quality, and breeding from them, and again picking out, can do. Even breeders have been astounded at their own results. They can act on differences inappreciable to an uneducated eye. Selection has been *methodically* followed in *Europe* for only the last half century; but it was occasionally, and even in some degree methodically, followed in the most ancient times. There must have been also a kind of unconscious selection from a remote period, namely in the preservation of the individual animals (without any thought of their offspring) most useful to each race of man in his particular circumstances. The "roguing," as nurserymen call the destroying of varieties which depart from their type, is a kind of selection. I am convinced that intentional and occasional selection has been the main agent in the production of our domestic races; but however this may be, its great power of modification has been indisputably shown in later times. Selection acts only by the accumulation of slight or greater variations, caused by external conditions, or by the mere fact that in generation the child is not absolutely similar to its parent. Man, by this power of accumulating variations, adapts living beings to his wants — may be said to make the wool of one sheep good for carpets, of another for cloth, &c.
2. Now suppose there were a being who did not judge by mere external appearances, but who could study the whole internal organization, who was never capricious, and should go on selecting for one object during millions of generations; who will say what he might not effect? In nature we have some *slight* variation occasionally in all parts; and I think it can be shown that changed conditions of existence is the main cause of the child not exactly resembling its parents; and in nature geology shows us what changes have taken place, and are taking place. We have almost unlimited time; no one but a practical geologist can fully appreciate this. Think of the Glacial period, during the whole of which the same species at least of shells have existed; there must have been during this period millions on millions of generations.
3. I think it can be shown that there is such an unerring power at work in *Natural Selection* (the title of my book), which selects exclusively for the good of each organic being. The elder De Candolle, W. Herbert, and Lyell have written excellently on the struggle for life; but even they have not written strongly enough. Reflect that every being (even the elephant) breeds at such a rate, that in a few years, or at most a few centuries, the surface of the earth would not hold the progeny of one pair. I have found it hard constantly to bear in mind that the increase of every single species is checked during some part of its life, or during some shortly recurrent generation. Only a few of those annually born can live to propagate their kind. What a trifling difference must often determine which shall survive, and which perish!

4. Now take the case of a country undergoing some change. This will tend to cause some of its inhabitants to vary slightly — not but that I believe most beings vary at all times enough for selection to act on them. Some of its inhabitants will be exterminated; and the remainder will be exposed to the mutual action of a different set of inhabitants, which I believe to be far more important to the life of each being than mere climate. Considering the infinitely various methods which living beings follow to obtain food by struggling with other organisms, to escape danger at various times of life, to have their eggs or seeds disseminated, &c. &c., I cannot doubt that during millions of generations individuals of a species will be occasionally born with some slight variation, profitable to some part of their economy. Such individuals will have a better chance of surviving, and of propagating their new and slightly different structure; and the modification may be slowly increased by the accumulative action of natural selection to any profitable extent. The variety thus formed will either coexist with, or, more commonly, will exterminate its parent form. An organic being, like the woodpecker or mistletoe, may thus come to be adapted to a score of contingencies — natural selection accumulating those slight variations in all parts of its structure, which are in any way useful to it during any part of its life.
5. Multiform difficulties will occur to every one, with respect to this theory. Many can, I think, be satisfactorily answered. *Natura non facit saltum* answers some of the most obvious. The slowness of the change, and only a very few individuals undergoing change at any one time, answers others. The extreme imperfection of our geological records answers others.
6. Another principle, which may be called the principle of divergence, plays, I believe, an important part in the origin of species. The same spot will support more life if occupied by very diverse forms. We see this in the many generic forms in a square yard of turf, and in the plants or insects on any little uniform islet, belonging almost invariably to as many genera and families as species. We can understand the meaning of this fact amongst the higher animals, whose habits we understand. We know that it has been experimentally shown that a plot of land will yield a greater weight if sown with several species and genera of grasses, than if sown with only two or three species. Now, every organic being, by propagating so rapidly, may be said to be striving its utmost to increase in numbers. So it will be with the offspring of any species after it has become diversified into varieties, or sub-species, or true species. And it follows, I think, from the foregoing facts, that the varying offspring of each species will try (only few will succeed) to seize on as many and as diverse places in the economy of nature as possible. Each new variety or species, when formed, will generally take the place of, and thus exterminate its less well-fitted parent. This I believe to be the origin of the classification and affinities of organic beings at all times; for organic beings always *seem* to branch and sub-branch like the limbs of a tree from a common trunk, the flourishing and diverging twigs destroying the less vigorous — the dead and lost branches rudely representing extinct genera and families.

C. DARWIN.

This sketch is *most* imperfect; but in so short a space I cannot make it better. Your imagination must fill up very wide blanks. C. Darwin.

III. *On the Tendency of Varieties to depart indefinitely from the Original Type.*

BY ALFRED RUSSEL WALLACE.

One of the strongest arguments which have been adduced to prove the original and permanent distinctness of species is, that *varieties* produced in a state of domesticity are more or less unstable, and often have a tendency, if left to themselves, to return to the normal form of the parent species; and this instability is considered to be a distinctive peculiarity of all varieties, even of those occurring among wild animals in a state of nature, and to constitute a provision for preserving unchanged the originally created distinct species.

In the absence or scarcity of facts and observations as to *varieties* occurring among wild animals, this argument has had great weight with naturalists, and has led to a very general and somewhat prejudiced belief in the stability of species. Equally general, however, is the belief in what are called "permanent or true varieties," — races of animals which continually propagate their like, but which differ so slightly (although constantly) from some other race, that the one is considered to be a *variety* of the other. Which is the *variety* and which the original *species,* there is generally no means of determining, except in those rare cases in which the one race has been known to produce an offspring unlike itself and resembling the other. This, however, would seem quite incompatible with the "permanent invariability of species," but the difficulty is overcome by assuming that such varieties have strict limits, and can never again vary further from the original type, although they may return to it, which, from the analogy of the domesticated animals, is considered to be highly probable, if not certainly proved.

It will be observed that this argument rests entirely on the assumption, that *varieties* occurring in a state of nature are in all respects analogous to or even identical with those of domestic animals, and are governed by the same laws as regards their permanence or further variation. But it is the object of the present paper to show that this assumption is altogether false, that there is a general principle in nature which will cause many *varieties* to survive the parent species, and to give rise to successive variations departing further and further from the original type, and which also produces, in domesticated animals, the tendency of varieties to return to the parent form.

The life of wild animals is a struggle for existence. The full exertion of all their faculties and all their energies is required to preserve their own existence and provide for that of their infant offspring. The possibility of procuring food during the least favourable seasons, and of escaping the attacks of their most dangerous enemies, are the primary conditions which determine the existence both of individuals and of entire species. These conditions will also determine the population of a species; and by a careful consideration of all the circumstances we may be enabled to comprehend, and in some degree to explain, what at first sight appears so inexplicable — the excessive abundance of some species, while others closely allied to them are very rare.

The general proportion that must obtain between certain groups of animals is readily seen. Large animals cannot be so abundant as small ones; the carnivora must be less numerous than the herbivora; eagles and lions can never be so plentiful as pigeons and antelopes; the wild asses of the Tartarian deserts cannot equal in numbers the horses of the more luxuriant prairies and pampas of America. The greater or less fecundity of an animal is often considered to be one of the chief causes of its abundance

or scarcity; but a consideration of the facts will show us that it really has little or nothing to do with the matter. Even the least prolific of animals would increase rapidly if unchecked, whereas it is evident that the animal population of the globe must be stationary, or perhaps, through the influence of man, decreasing. Fluctuations there may be; but permanent increase, except in restricted localities, is almost impossible. For example, our own observation must convince us that birds do not go on increasing every year in a geometrical ratio, as they would do, were there not some powerful check to their natural increase. Very few birds produce less than two young ones each year, while many have six, eight, or ten; four will certainly be below the average; and if we suppose that each pair produce young only four times in their life, that will also be below the average, supposing them not to die either by violence or want of food. Yet at this rate how tremendous would be the increase in a few years from a single pair! A simple calculation will show that in fifteen years each pair of birds would have increased to nearly ten millions! whereas we have no reason to believe that the number of the birds of any country increases at all in fifteen or in one hundred and fifty years. With such powers of increase the population must have reached its limits, and have become stationary, in a very few years after the origin of each species. It is evident, therefore, that each year an immense number of birds must perish — as many in fact as are born; and as on the lowest calculation the progeny are each year twice as numerous as their parents, it follows that, whatever be the average number of individuals existing in any given country, *twice that number must perish annually,* — a striking result, but one which seems at least highly probable, and is perhaps under rather than over the truth. It would therefore appear that, as far as the continuance of the species and the keeping up the average number of individuals are concerned, large broods are superfluous. On the average all above *one* become food for hawks and kites, wild cats and weasels, or perish of cold and hunger as winter comes on. This is strikingly proved by the case of particular species; for we find that their abundance in individuals bears no relation whatever to their fertility in producing offspring. Perhaps, the most remarkable instance of an immense bird population is that of the passenger pigeon of the United States, which lays only one, or at most two eggs, and is said to rear generally but one young one. Why is this bird so extraordinarily abundant, while others producing two or three times as many young are much less plentiful? The explanation is not difficult. The food most congenial to this species, and on which it thrives best, is abundantly distributed over a very extensive region, offering such differences of soil and climate, that in one part or another of the area the supply never fails. The bird is capable of a very rapid and long-continued flight, so that it can pass without fatigue over the whole of the district it inhabits, and as soon as the supply of food begins to fail in one place is able to discover a fresh feeding-ground. This example strikingly shows us that the procuring a constant supply of wholesome food is almost the sole condition requisite for ensuring the rapid increase of a given species, since neither the limited fecundity, nor the unrestrained attacks of birds of prey and of man are here sufficient to check it. In no other birds are these peculiar circumstances so strikingly combined. Either their food is more liable to failure, or they have not sufficient power of wing to search for it over an extensive area, or during some season of the year it becomes very scarce, and less wholesome substitutes have to be found; and thus, though more fertile in offspring, they can never increase beyond the supply of food in the least favourable seasons.

Many birds can only exist by migrating, when their food becomes scarce, to regions possessing a milder, or at least a different climate, though, as these migrating birds are seldom excessively abundant, it is evident that the countries they visit are still deficient in a constant and abundant supply of wholesome food. Those whose organization does not permit them to migrate when their food becomes periodically scarce, can never attain a large population. This is probably the reason why woodpeckers are scarce with us, while in the tropics they are among the most abundant of solitary birds. Thus the house sparrow is more abundant than the redbreast, because its food is more constant and plentiful, — seeds of grasses being preserved during the winter, and our farm-yards and stubble-fields furnishing an almost inexhaustible supply. Why, as a general rule, are aquatic, and especially sea birds, very numerous in individuals? Not because they are more prolific than others, generally the contrary; but because their food never fails, the sea-shores and river-banks daily swarming with a fresh supply of small mollusca and crustacea. Exactly the same laws will apply to mammals. Wild cats are prolific and have few enemies; why then are they never as abundant as rabbits? The only intelligible answer is, that their supply of food is more precarious. It appears evident, therefore, that so long as a country remains physically unchanged, the numbers of its animal population cannot materially increase. If one species does so, some others requiring the same kind of food must diminish in proportion. The numbers that die annually must be immense; and as the individual existence of each animal depends upon itself, those that die must be the weakest — the very young, the aged, and the diseased, — while those that prolong their existence can only be the most perfect in health and vigour—those who are best able to obtain food regularly, and avoid their numerous enemies. It is, as we commenced by remarking, " a struggle for existence," in which the weakest and least perfectly organized must always succumb.

Now it is clear that what takes place among the individuals of a species must also occur among the several allied species of a group, — viz. that those which are best adapted to obtain a regular supply of food, and to defend themselves against the attacks of their enemies and the vicissitudes of the seasons, must necessarily obtain and preserve a superiority in population; while those species which from some defect of power or organization are the least capable of counteracting the vicissitudes of food supply, &c., must diminish in numbers, and, in extreme cases, become altogether extinct. Between these extremes the species will present various degrees of capacity for ensuring the means of preserving life; and it is thus we account for the abundance or rarity of species. Our ignorance will generally prevent us from accurately tracing the effects to their causes; but could we become perfectly acquainted with the organization and habits of the various species of animals, and could we measure the capacity of each for performing the different acts necessary to its safety and existence under all the varying circumstances by which it is surrounded, we might be able even to calculate the proportionate abundance of individuals which is the necessary result.

If now we have succeeded in establishing these two points — 1st, *that the animal population of a country is generally stationary, being kept down by a periodical deficiency of food, and other checks*; and, 2nd, *that the comparative abundance or scarcity of the individuals of the several species is entirely due to their organization and resulting habits, which, rendering it more difficult to procure a regular supply of food and to provide for their personal safety in some cases*

than in others, can only be balanced by a difference in the population which have to exist in a given area — we shall be in a condition to proceed to the consideration of *varieties,* to which the preceding remarks have a direct and very important application.

Most or perhaps all the variations from the typical form of a species must have some definite effect, however slight, on the habits or capacities of the individuals. Even a change of colour might, by rendering them more or less distinguishable, affect their safety; a greater or less development of hair might modify their habits. More important changes, such as an increase in the power or dimensions of the limbs or any of the external organs, would more or less affect their mode of procuring food or the range of country which they inhabit. It is also evident that most changes would affect, either favourably or adversely, the powers of prolonging existence. An antelope with shorter or weaker legs must necessarily suffer more from the attacks of the feline carnivora; the passenger pigeon with less powerful wings would sooner or later be affected in its powers of procuring a regular supply of food; and in both cases the result must necessarily be a diminution of the population of the modified species. If, on the other hand, any species should produce a variety having slightly increased powers of preserving existence, that variety must inevitably in time acquire a superiority in numbers. These results must follow as surely as old age, intemperance, or scarcity of food produce an increased mortality. In both cases there may be many individual exceptions; but on the average the rule will invariably be found to hold good. All varieties will therefore fall into two classes — those which under the same conditions would never reach the population of the parent species, and those which would in time obtain and keep a numerical superiority. Now, let some alteration of physical conditions occur in the district — a long period of drought, a destruction of vegetation by locusts, the irruption of some new carnivorous animal seeking "pastures new" — any change in fact tending to render existence more difficult to the species in question, and taking its utmost powers to avoid complete extermination; it is evident that, of all the individuals composing the species, those forming the least numerous and most feebly organized variety would suffer first, and, were the pressure severe, must soon become extinct. The same causes continuing in action, the parent species would next suffer, would gradually diminish in numbers, and with a recurrence of similar unfavourable conditions might also become extinct. The superior variety would then alone remain, and on a return to favourable circumstances would rapidly increase in numbers and occupy the place of the extinct species and variety.

The *variety* would now have replaced the *species,* of which it would be a more perfectly developed and more highly organized form. It would be in all respects better adapted to secure its safety, and to prolong its individual existence and that of the race. Such a variety *could not* return to the original form; for that form is an inferior one, and could never compete with it, for existence. Granted, therefore, a "tendency" to reproduce the original type of the species, still the variety must ever remain preponderant in numbers, and under adverse physical conditions *again alone survive.* But this new, improved, and populous race might itself, in course of time, give rise to new varieties, exhibiting several diverging modifications of form, any of which, tending to increase the facilities for preserving existence, must, by the same general law, in their turn become predominant. Here, then, we have *progression and continued divergence* deduced from the general laws which regulate the existence of animals in a state of

nature, and from the undisputed fact that varieties do frequently occur. It is not, however, contended that this result would be invariable; a change of physical conditions in the district might at times materially modify it, rendering the race which had been the most capable of supporting existence under the former conditions now the least so, and even causing the extinction of the newer and, for a time, superior race, while the old or parent species and its first inferior varieties continued to flourish. Variations in unimportant parts might also occur, having no perceptible effect on the life-preserving powers; and the varieties so furnished might run a course parallel with the parent species, either giving rise to further variations or returning to the former type. All we argue for is, that certain varieties have a tendency to maintain their existence longer than the original species, and this tendency must make itself felt; for though the doctrine of chances or averages can never be trusted to on a limited scale, yet, if applied to high numbers, the results come nearer to what theory demands, and, as we approach to an infinity of examples, become strictly accurate. Now the scale on which nature works is so vast — the numbers of individuals and periods of time with which she deals approach so near to infinity, that any cause, however slight, and however liable to be veiled and counteracted by accidental circumstances, must in the end produce its full legitimate results.

Let us now turn to domesticated animals, and inquire how varieties produced among them are affected by the principles here enunciated. The essential difference in the condition of wild and domestic animals is this, — that among the former, their well-being and very existence depend upon the full exercise and healthy condition of all their senses and physical powers, whereas, among the latter, these are only partially exercised, and in some cases are absolutely unused. A wild animal has to search, and often to labour, for every mouthful of food — to exercise sight, hearing, and smell in seeking it, and in avoiding dangers, in procuring shelter from the inclemency of the seasons, and in providing for the subsistence and safety of its offspring. There is no muscle of its body that is not called into daily and hourly activity; there is no sense or faculty that is not strengthened by continual exercise. The domestic animal, on the other hand, has food provided for it, is sheltered, and often confined, to guard it against the vicissitudes of the seasons, is carefully secured from the attacks of its natural enemies, and seldom even rears its young without human assistance. Half of its senses and faculties are quite useless; and the other half are but occasionally called into feeble exercise, while even its muscular system is only irregularly called into action.

Now when a variety of such an animal occurs, having increased power or capacity in any organ or sense, such increase is totally useless, is never called into action, and may even exist without the animal ever becoming aware of it. In the wild animal, on the contrary, all its faculties and powers being brought into full action for the necessities of existence, any increase becomes immediately available, is strengthened by exercise, and must even slightly modify the food, the habits, and the whole economy of the race. It creates as it were a new animal, one of superior powers, and which will necessarily increase in numbers and outlive those inferior to it.

Again, in the domesticated animal all variations have an equal chance of continuance; and those which would decidedly render a wild animal unable to compete with its fellows and continue its existence are no disadvantage whatever in a state of domesticity. Our quickly fattening pigs, short-legged sheep, pouter pigeons, and poodle

dogs could never have come into existence in a state of nature, because the very first step towards such inferior forms would have led to the rapid extinction of the race; still less could they now exist in competition with their wild allies. The great speed but slight endurance of the race horse, the unwieldy strength of the ploughman's team, would both be useless in a state of nature. If turned wild on the pampas, such animals would probably soon become extinct, or under favourable circumstances might each lose those extreme qualities which would never be called into action, and in a few generations would revert to a common type, which must be that in which the various powers and faculties are so proportioned to each other as to be best adapted to procure food and secure safety, — that in which by the full exercise of every part of his organization the animal can alone continue to live. Domestic varieties, when turned wild, *must* return to something near the type of the original wild stock, *or become altogether extinct.*

We see, then, that no inferences as to varieties in a state of nature can be deduced from the observation of those occurring among domestic animals. The two are so much opposed to each other in every circumstance of their existence, that what applies to the one is almost sure not to apply to the other. Domestic animals are abnormal, irregular, artificial; they are subject to varieties which never occur and never can occur in a state of nature: their very existence depends altogether on human care; so far are many of them removed from that just proportion of faculties, that true balance of organization, by means of which alone an animal left to its own resources can preserve its existence and continue its race.

The hypothesis of Lamarck — that progressive changes in species have been produced by the attempts of animals to increase the development of their own organs, and thus modify their structure and habits — has been repeatedly and easily refuted by all writers on the subject of varieties and species, and it seems to have been considered that when this was done the whole question has been finally settled; but the view here developed renders such an hypothesis quite unnecessary, by showing that similar results must be produced by the action of principles constantly at work in nature. The powerful retractile talons of the falcon- and the cat-tribes have not been produced or increased by the volition of those animals; but among the different varieties which occurred in the earlier and less highly organized forms of these groups, *those always survived longest which had the greatest facilities for seizing their prey.* Neither did the giraffe acquire its long neck by desiring to reach the foliage of the more lofty shrubs, and constantly stretching its neck for the purpose, but because any varieties which occurred among its antitypes with a longer neck than usual *at once secured a fresh range of pasture over the same ground as their shorter-necked companions, and on the first scarcity of food were thereby enabled to outlive them.* Even the peculiar colours of many animals, especially insects, so closely resembling the soil or the leaves or the trunks on which they habitually reside, are explained on the same principle; for though in the course of ages varieties of many tints may have occurred, *yet those races having colours best adapted to concealment from their enemies would inevitably survive the longest.* We have also here an acting cause to account for that balance so often observed in nature, — a deficiency in one set of organs always being compensated by an increased development of some others — powerful wings accompanying weak feet, or great velocity making up for the absence of defensive weapons; for it has been shown that all varieties in which an unbalanced deficiency occurred could not long

'Wallace's house', in Ternate, where he wrote his 1858 essay.
(Photograph taken by Prof. Sir Ghillean Prance in 1986.)

continue their existence. The action of this principle is exactly like that of the centrifugal governor of the steam engine, which checks and corrects any irregularities almost before they become evident; and in like manner no unbalanced deficiency in the animal kingdom can ever reach any conspicuous magnitude, because it would make itself felt at the very first step, by rendering existence difficult and extinction almost sure soon to follow. An origin such as is here advocated will also agree with the peculiar character of the modifications of form and structure which obtain in organized beings — the many lines of divergence from a central type, the increasing efficiency and power of a particular organ through a succession of allied species, and the remarkable persistence of unimportant parts such as colour, texture of plumage and hair, form of horns or crests, through a series of species differing considerably in more essential characters. It also furnishes us with a reason for that "more specialized structure" which Professor Owen states to be a characteristic of recent compared with extinct forms, and which would evidently be the result of the progressive modification of any organ applied to a special purpose in the animal economy.

We believe we have now shown that there is a tendency in nature to the continued progression of certain classes of *varieties* further and further from the original type — a progression to which there appears no reason to assign any definite limits — and that the same principle which produces this result in a state of nature will also explain why domestic varieties have a tendency to revert to the original type. This progression, by minute steps, in various directions, but always checked and balanced by the necessary conditions, subject to which alone existence can be preserved, may, it is believed, be followed out so as to agree with all the phenomena presented by organized beings, their extinction and succession in past ages, and all the extraordinary modifications of form, instinct, and habits which they exhibit.

Ternate, February, 1858.

Alfred Russel Wallace – a Welsh Entomologist!

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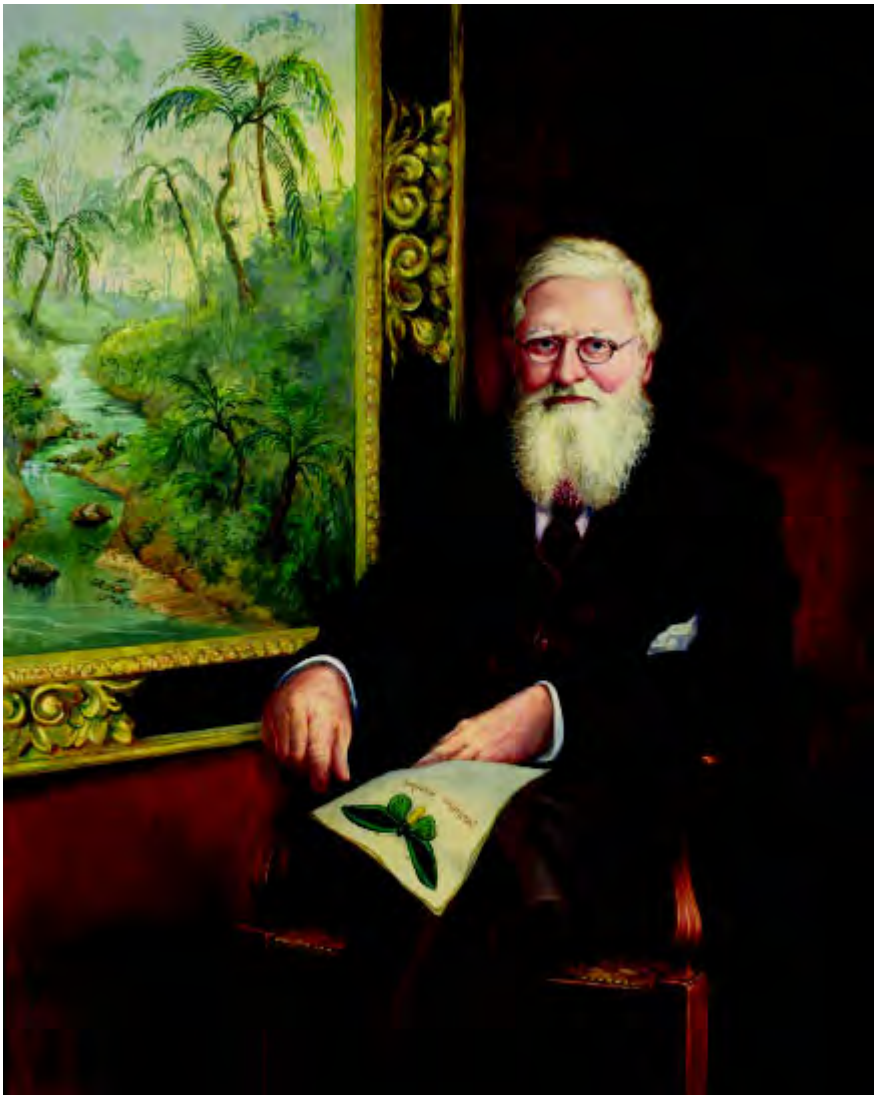
Alfred Russel Wallace is being celebrated this year on the 150th anniversary of the co-publication with Charles Darwin of their seminal papers on natural selection, under the general title of "On the tendency of species to form varieties; and on the



The portrait of Alfred Russel Wallace by Roger Remington that hangs in the Meeting Room of the Linnean Society of London. The birdwing butterfly, *Ornithoptera poseidon* Doubleday, as labelled on the paper in the portrait was described by Wallace as a variable species in 1865. It is now more often known as a subspecies or race of the very variable *O. priamus* L.

Wallace's birthplace – Kensington Cottage, Usk, also showing the seat on the flood bank (photo April, 2008).

perpetuation of varieties and species by natural means of selection" by the Linnean Society of London in 1858. By common consent, though revolutionary, these papers were certainly not recognised as such at the time. In the following year, 1859, Darwin truly caused a scientific revolution when he published the first edition of his major work *On the Origin of Species*. The role of Wallace in establishing the central idea was mostly either ignored, or at least subordinated to that of Darwin. In the past ten or twenty years the due importance of Wallace in developing evolutionary theory has been more widely recognised with several studies and influential biographies, most notably that by Peter Raby (2001). Less widely cited is that by John Wilson (2000), in which the author visited some of the places where Wallace lived and worked and the regions around the world where he travelled and collected.

There is still apparently some controversy about the relative credit that should be given to Darwin and Wallace for the theory of evolution by natural selection. This is odd because Wallace himself on many occasions made it very clear that he did not wish to be given any priority or special credit for his role compared to that of Darwin, whose contributions he regarded as much more significant. Indeed this is made very clear in his autobiography (Wallace, 1908) and, of course, one of his major books is entitled *Darwinism* (1889). Nevertheless in a recent issue of the *Sunday Observer* newspaper in the UK (22 July 2008), Robin McKie raises this question yet again. I suppose it makes for a good story!

Accounts of Wallace's scientific life generally give little account of his early formative years before the life changing expedition to the Amazon in 1878. In this essay I should like to concentrate on the influence of his early life in Wales – the Welsh

influence, and also on Wallace as an entomologist. For deep insights into the former, we are indebted to two important, but little cited, papers by my old colleague in Cardiff, Elwyn Hughes (1989, 1991).

Most biographical studies of Wallace have stressed the quite different social backgrounds of the two giants of evolutionary theory. Darwin was from a well-to-do professional family with a considerable private income – in fact a typical well educated Victorian gentleman. Wallace on the other hand was from a quite different and less privileged, not to say impoverished, background and was largely self-educated. He was born on 8th January, 1823, in the small Welsh town of Usk in the border county with England of Monmouthshire, part of Gwent*. The family lived on the banks of the river Usk, a short distance outside the town, at Kensington Cottage, Llanbadoc – a substantial house which still exists, now known as Kensington House. On the flood protection embankment (constructed since Wallace's day) beside the river a public seat has been erected by the local authority with an appropriate plaque commemorating the birth and life of the great man. Indeed in recent years the town has recognised its son with commemorative plaques outside both the town museum and Llanbadoc church just down the valley from Kensington Cottage. Though the family left Usk within five years of Alfred's birth, mainly for financial reasons, later in life he had many clear recollections of happy times beside the river, notably catching lampreys for supper and climbing on the steep hill behind the house (Wallace, 1908).

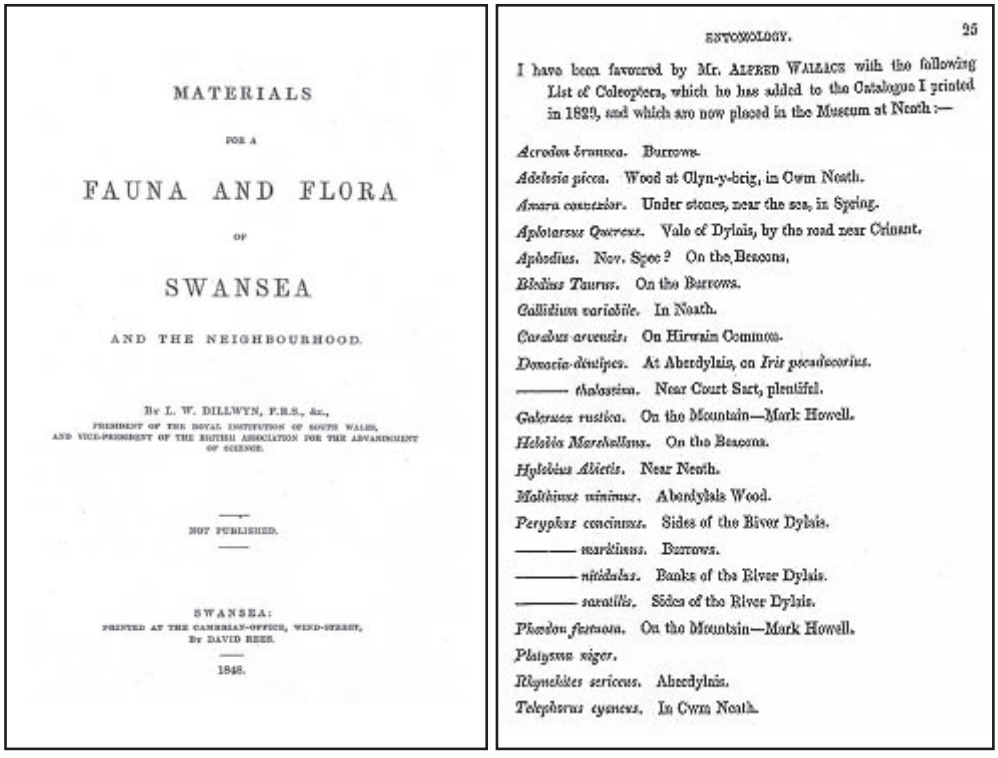
Wallace returned to Wales as a young man in 1839. In the intervening years the family had moved to the small English town of Hertford. He attended Hertford Grammar School where he particularly studied English and developed his life long interest in books and in writing. During his later years at school, no doubt to reduce costs, he functioned as a pupil-teacher to some of the younger students. After leaving school, Alfred began an apprenticeship as a surveyor with his older brother William in 1837. In 1839 they both returned to Wales to capitalise on the need for land surveyors in connection with the prevalent land enclosures of the day. They were based on the mid-Wales/England border at Rhyadr in 1839, Hereford in 1840, and Hay, Builth and Kington in 1841. Their work was relatively well paid, but Wallace came to detest the infamous enclosure acts and no doubt this contributed to his many radical and socialist views held throughout his long life (see Hughes, 1991, for more details). As Hughes (1989) has emphasised the rural parts of mid Wales were perhaps the last places one might have expected to find cultural and philosophical stimulation. However, the period of the 1830s and 1840s saw the emergence in towns across the country of "Mechanics Institutes" which were societies open to all with the purpose of disseminating learning. Wallace joined the institute in Kington in 1841. Here he contributed his first publication at the age of 18 in which he discussed the role of the institute and emphasised the main purpose of providing scientific instruction to all, especially the working class (Hughes, 1989, quotes at length from this publication). Wallace also emphasised the vital importance of libraries for the functioning of the institute. He recommended such seminal works for him as Humboldt's *Personal Narrative of Travels in South America*,

*As the author notes, Wallace was born at Usk, in the border county of Monmouthshire. However, Monmouthshire at that time was an English county – not part of the principality! Brian Gardiner.

Lyell's *Principles of Geology* and Darwin's *Journal of the Voyage of the Beagle* for the Kington library. As Hughes emphasises, it is probable that he himself read and assimilated some of these works during his time in mid-Wales. During his time in Wales he first became interested in natural history, particularly botany and he began to create his own herbarium.

By the end of 1841 Wallace and his brother had gravitated further south and west in search of work and settled in the port town of Neath where they were involved in a variety of surveying and architectural work. Work was nevertheless limited and Wallace had considerable amounts of spare time. Neath and neighbouring Swansea were centres of great scientific and intellectual activity at that time, no doubt accompanying the continuing industrial developments in south Wales. A Philosophical and Literary Society was established in Neath in 1834 and a Mechanics Institute in 1843 (Hughes, 1989, p 408). The libraries of these societies, in addition to those in Swansea, were very good, holding all major scientific texts, including those recommended by Wallace for the

Usk local museum (above) and (below)
its commemorative plaque (photo April.2008)



MATERIALS

FOR A

FAUNA AND FLORA

OF

SWANSEA

AND THE NEIGHBOURHOOD.

By L. W. DILLWYN, F.R.S., &c.,
PRESIDENT OF THE ROYAL INSTITUTION OF SOUTH WALES,
AND VICE-PRESIDENT OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

NOT PUBLISHED.

SWANSEA:
PRINTED AT THE CAMBRIAN-OFFICE, WIND-STREET,
By DAVID REES.

1848.

ENTOMOLOGY. 25

I have been favoured by Mr. ALFRED WALLACE with the following List of Coleoptera, which he has added to the Catalogue I printed in 1829, and which are now placed in the Museum at Neath :—

Acrodon brunnea. Burrows.
Adelosia picea. Wood at Glyn-y-brig, in Cwm Neath.
Amara communis. Under stones, near the sea, in Spring.
Aplotarsus Quercus. Vale of Dylais, by the road near Crinant.
Aphodius. Nov. Spec ? On the Beacons.
Bledius Taurus. On the Burrows.
Callidium variabile. In Neath.
Carabus arvensis. On Hirwain Common.
Donacia denticpes. At Aberdylais, on *Iris pseudacorus.*
——— *thalassina.* Near Court Sart, plentiful.
Galeruca rustica. On the Mountain—Mark Howell.
Helodes Marshallana. On the Beacons.
Hylobius Abietis. Near Neath.
Malthinus minimus. Aberdylais Wood.
Perypkus concinnus. Sides of the River Dylais.
——— *marginatus.* Burrows.
——— *nitidulus.* Banks of the River Dylais.
——— *serratus.* Sides of the River Dylais.
Phaedon fastuosa. On the Mountain—Mark Howell.
Platysma niger.
Rhynchites sericeus. Aberdylais.
Telephorus cyaneus. In Cwm Neath.

The title page of Dillwyn (1848) and Wallace's list of Coleoptera (p. 25)

Kington institute. Open scientific lectures and discourses were held regularly in Neath and Swansea. Both centres also had thriving and active museums holding natural history collections. Among the scientific establishment of the area, perhaps most notable and influential was the botanist and general naturalist, Lewis Weston Dillwyn, FRS, who was involved in the successful bid by Swansea to host the 1848 annual meeting of the British Association for the Advancement of Science. After his first short stay in Neath, Wallace left his brother to seek work as a teacher and migrated to Leicester in 1844 to take up a junior teaching post at the Collegiate School. There he developed some interest in mathematics. Again he found good libraries easily available, but undoubtedly the biggest influence on his future development was meeting and befriending Henry Walter Bates, a native of Leicester. Bates was two years younger than Wallace and like him was largely self-educated. He was already a very competent entomologist. He introduced Wallace to the enormous diversity of beetles that were to be found in the immediate area around Leicester. Wallace was astonished at the species diversity and was immediately hooked as an entomologist and quickly bought the necessary collecting and preserving equipment, together with a copy of Stephens's *Manual of British Coleoptera*. During his short stay in Leicester, he took every opportunity to join Bates in field excursions and his own entomological credentials were fully established during that period. Bates and Wallace became great friends and even during Wallace's stay in Leicester were already discussing the possibilities of collecting trips to tropical regions, partly as scientific, but also commercial, ventures.

In 1846 Wallace returned to Neath after the sudden death of his elder brother. This was just at the time of the great railways revolution and surveyors were in great demand, so he decided to stay. He was commissioned to help with surveying for the proposed rail link between the port at Neath and the industrial centre of Merthyr Tydfil at the head of the Vale of Neath. He became an active member of the Neath Mechanics Institute and continued his interest in insects. He collected widely in the region, particularly beetles and butterflies. His first scientific paper was a very brief note in the *Zoologist* for 1847 (5:1676) recording the striking, but rare, Scarabaeid beetle, *Trichius fasciatus* (L), in the Neath area. Wallace was never completely accepted into the local scientific establishment, no doubt because of his humble background – South Wales was a very class conscious area of Britain at that time! However, Dillwyn (1848) did include in his volume on the flora and fauna of the Swansea area a list of beetles collected by Wallace, though by the time it appeared he was on his way to South America and probably never saw it. Though his beetle collection was reported to be deposited in the Neath Museum, despite many efforts since to find it, no trace has yet been found. It is nice to think that it may be laying undiscovered still in some museum box or in a private collection somewhere. Wallace had a continuing correspondence with Bates over the two years he remained in Neath and in 1847 Bates visited him for a week for a few days of beetle collecting. They both left Britain in 1848 for their collecting venture in the Amazon basin, where both greatly expanded their entomological experience and expertise. Wallace never returned to Wales other than for a brief visit late in life.

Wallace's desktop in the Council Room of the Royal Entomological Society

I like to think of Alfred Wallace as truly Welsh. He was certainly born in Wales, albeit near to the English border. However, more certain are the obvious influences which Elwyn Hughes (1989, 1991) attributes to his formative years working in mid-Wales and the Neath area. His exposure to Welsh rural life and to the Welsh language, which he tried to learn but did not master, certainly affected his generally radical and non-conformist way of thinking. His sympathies for socialism were undoubtedly fuelled by the unfairnesses that he witnessed at first hand during land surveying in mid-Wales as a result of the land enclosures acts. Wales certainly left its mark on Wallace.

The case for Wallace the entomologist is much easier to make. His enthusiasm, kindled by his friendship with Bates, continued through his life and insects were central to the development of his ideas on evolution. His major paper on variation in Papilionid butterflies of the Malaysian region (1865) is a classic in mimicry and evolutionary biology generally and is still widely cited today, along with the equally important paper by his friend Bates on mimicry of South American Heliconiid butterflies (Bates, 1862). These studies analysed geographically highly variable, polymorphic and sexually dimorphic butterflies. Indeed the plethora of variation led Wallace to doubt the biological nature of species. However, later in more reflective mood he gives clear support for a more biological view of species in his compendium on Darwinism (1889).

Wallace and indeed Bates were active members of the Entomological Society of London. Both served as President, Bates from 1868 to 1869 and Wallace from 1870 to 1871. Whilst both were Fellows of the Linnean Society, sadly neither served as President. It would be interesting to know why. It surely could not have been on grounds of scientific expertise and achievement. Could it have been associated with social status, which was central even to scientific societies at the time?

In Wallace's day Presidential addresses of the Entomological Society were given at the Annual General Meeting and published as part of the *Proceedings* in the *Transactions of the Society*. The two addresses by Wallace (1870, 1871) are little cited and, I guess, little read. Indeed I have to admit that I had not read them myself until asked to write this contribution. However, they certainly demonstrate just how wide were his interests in entomology. Both addresses include details of the deaths of eminent entomologists and masterly reviews of major entomological papers published during the previous year. In 1870 he singled out for detailed discussion the geographical distribution of Coleoptera on the islands of the Atlantic and discussed the possible means of their origin and evolution. He thus anticipated his forthcoming major publications on zoogeography (1876) and island faunas (1880) for which he is now rightly hailed as the father of zoogeography. His 1871 address is concerned in part, certainly to my surprise, with some minutiae of Lepidopteran nomenclature. However, the bulk of his last address was concerned with broad ideas on the ancestry of insects, including a long discussion on the long discredited theory of Herbert Spencer that all segmented animals are essentially colonial, representing many individuals that have come together to form more complex organisms. Wallace was always ready to consider any way-out ideas, however apparently unlikely!

After Wallace's death in 1913, Professor Sir Edward Poulton, President of the Entomological Society three times, from 1903-1904, 1925-1926 and 1933 (the centenary year), presented to the society Wallace's simple desk top at which he had written most of his later publications. Unlike Wallace, Poulton also served as President of the Linnean Society (1912-1916)! The brass plate attached to the desk reads "This desk slope from 1865 to his death in 1913 belonged to Alfred Russel Wallace, OM, DCL, FRS, President of the Entomological Society of London 1870-71 and was in constant use for all his writings. Presented to the Society by Prof. E.B. Poulton 1921". Since 1921 it has been located in the Council Chamber of the Society's rooms, until recently at 41 Queens Gate, South Kensington, but now at the new headquarters at the Mansion House, St Albans, where it is used by the Chairs of all Council and Committee meetings.

I have attempted in this brief contribution to bring to a wider audience what we know about Wallace's days in Wales and their influence on much of his later thinking. Also it is a pleasure to demonstrate the nature of his very extensive entomological background, which clearly contributed in large part to his fundamental writings on evolution and zoogeography.

Acknowledgements

I am deeply indebted to Elwyn Hughes both for giving me copies of his publications and for discussions on his deep insights into Wallace's times in Wales. I thank also Dr M.R. Wilson, National Museum of Wales, Cardiff, for helping me to obtain rare publications by L.W. Dillwyn. Finally I thank Valerie McAtear, Librarian, Royal Entomological Society, for help in finding and copying critical Wallace publications and Mr W.H.F. Blakemore, Registrar, for permission to photograph the desk top and general encouragement.

References

Bates, H.W. 1862. Contributions to an Insect Fauna of the Amazon Valley. Lepidoptera : Heliconidae. *Transactions of the Linnean Society of London*, 23 (3): 495-566.

Dillwyn, L.W. 1848. *Materials for a Fauna and Flora of Swansea and the neighbourhood*. Privately printed and published, Swansea.

Hughes, R.E. 1989. Alfred Russel Wallace; some notes on the Welsh connection. *British Journal of the History of Science*, 22 : 401-418.

Hughes, R.E. 1991. Alfred Russel Wallace (1823-1913) : The making of a scientific nonconformist. *Proceedings of the Royal Institution*, 63 : 175-183.

McKie, R. 2008. How Darwin won the evolution race. *The Observer Review*, 22 June 08, 6-8.

Raby, P. 2001 *Alfred Russel Wallace. A Life*. Chatto & Windus, London.

Wallace, A.R. 1865. On the phenomena of variation and geographical distribution as illustrated by Papilionidae of the Malaysian region. *Transactions of the Linnean Society of London*, 25(1) : 1-71.

Wallace, A.R. 1870. The President's Address. *Transactions of the Entomological Society of London*, 1870 : xliv-lxix.

Wallace, A.R. 1871. The President's Address. *Transaction of the Entomological Society of London*, 1871 : li-lxxv.

Wallace, A.R. 1876. *The Geographical Distribution of Animals, with a study of the relations of living and extinct faunas as elucidating the past changes of the earth's surfac*e, 2 vols. Macmillan & Co., London.

Wallace, A.R. 1880. *Island Life*. Macmillan & Co., London.

Wallace, A.R. 1889. *Darwinism an exposition of the Theory of Natural Selection with some of its applications*. Macmillan & Co., London.

Wallace, A.R. 1908. *My Life. A record of events and opinions*, 2nd edit. Chapman & Hall, London.

Wilson, J.G. 2000. *The Forgotten Naturalist. In Search of Alfred Russel Wallace*. Australian Scholarly Publishing Pty Ltd., Australia.

The Two Wallaces Then and Now

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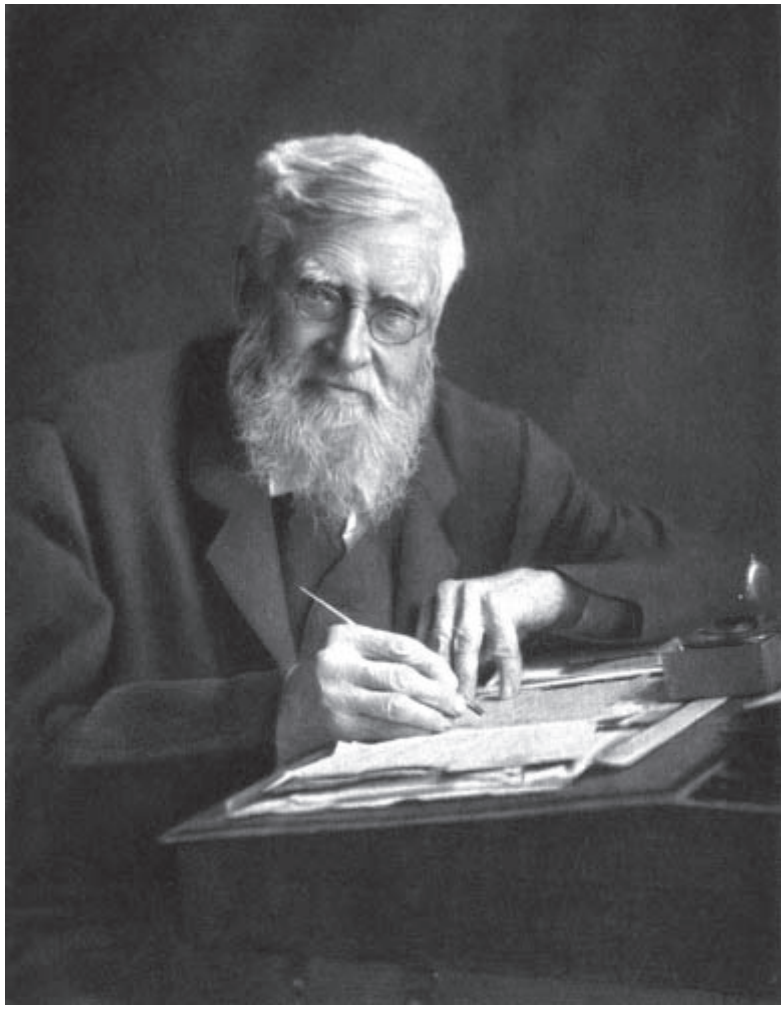
At the time of his death in late 1913, Alfred Russel Wallace (1823-1913) may well have been the most famous scientist in the world (Charles H Smith, 2007:97).

Nearing the end of his life, Alfred Russel Wallace wrote to his friend James Marchant (Marchant, 1913:xxxiv-xxxv; excerpts in Marchant, 1916, vol. 2:181; Fichman, 2001:245, 2004:314):

> The completely materialistic mind of my youth and early manhood has been slowly moulded into the socialistic, spiritualistic, and theistic mind I now exhibit – a mind which is, as my scientific friends think, so weak and credulous in its declining years,



Wallace in 1913, from Marchant (1916): Courtesy of George Beccaloni.

> as to believe that fruit and flowers, domestic animals, glorious birds and insects, wool, cotton, sugar and rubber, metals and gems, were all foreseen and foreordained for the education and enjoyment of man. The whole cumulative argument of my 'World of Life' [published in 1910] is that *in its every detail* it calls for the agency of a mind or minds so enormously above and beyond any human minds, as to compel us to look upon it, or them as 'God or Gods,' and so-called 'Laws of Nature' as the action by will-power or otherwise of such superhuman or infinite beings. 'Laws of Nature' apart from the existence and agency of some such Being or Beings, are mere words, that explain nothing – are, in fact, unthinkable. That is my position! Whether this Unknown Reality is a single Being and acts everywhere in the universe as direct creator, organiser, and director of every minutest motion in the whole of our universe, and of all possible universes, or whether it acts through variously conditioned modes, as H Spencer suggested, or through 'infinite grades of beings,' as I suggest, comes to much the same thing. Mine seems a more clear and intelligible supposition as stated in the last paragraph of my 'World of Life,' and it is the teaching of the Bible, of Swedenborg, and of Milton.

To his scientific friends, his two seemingly conflicting minds became evident in the 1860s, when he first showed his interest in spiritualism (Moore, 2006). The conflict subsequently appears in letters exchanged between Charles Darwin, Joseph Hooker, Thomas Huxley, Charles Lyell, and himself. Even so, modern interpretation tends to view him as a single integrated personality with, as he implied, his own developmental trajectory (e.g., Fichman, 2004; Slotten, 2004; and the six books reviewed by Endersby, 2003; also Harman, 2004; Axon, 2005). Fichman, for example (p. 192), terms the conflict – the change of mind – "a historiographic myth".

Charles H. Smith, who developed the very informative Wallace website (*http://www.wku.edu/~smithch/index1.htm*), and who probably has read more of Wallace's writings than any other person living or dead, also sees him as an integrated whole. Like Fichman, he believes that Wallace early committed himself to an alternative theory of evolution that, with time and consistent application, led him to his final view of things, which modern science might well yet vindicate (e.g., Smith, 2004a-b, 2005). Referring to the mid-1860s, he writes (his website: *Alfred Russel Wallace: A capsule Biography*):

> It is in fact generally thought that Wallace's thinking regarding the application of Darwinian concepts to the development of humankind's higher attributes changed around 1865 in response to this apparent new influence [spiritualism] in his life; I personally feel this is a mis-reading of the situation, and that the apparent "change" in his position simply represented a solidification of an already-existing, but not yet formally stated, evolutionary model.

Two decades later, the conflicting "two Wallaces" were a theme amplified by the published dispute in the 1880s between Wallace and George Romanes (1848-1894), an ardent Darwinian prematurely deceased, whom *The Times* of London itself prematurely described as "the biological investigator upon whom in England the mantle of [the late] Mr. Darwin has most conspicuously descended" (Anon., 1886).

Accordingly (Kottler, 1974:181):

> In 1886 Romanes first put forth his personally prized theory of physiological selection. Wallace engaged in a lengthy dispute with Romanes over this theory, which denied

> to natural selection the power of originating species in polytypic (branching) evolution, giving it only the power of accounting for adaptations. In one of the exchanges, after the publication of Wallace's *Darwinism* [1889], Romanes contrasted the two Wallaces he saw in that work. The Wallace of the final chapter on man was "the Wallace of spiritualism and astrology, the Wallace of vaccination and the land question, the Wallace of incapacity and absurdity".

Romanes continues (1890:831):

> The other Wallace – the Wallace of natural selection and geographical distribution, the Wallace of travel and observation, the Wallace of ingenuity and originality – we all agree in admiring. Therefore it was that in my review I devoted my space to considering the man of science, and refused to follow him where he became the man of nonsense.

Some two decades later still, the publication of Wallace's *The World of Life* provoked comment from a 21-year-old British geologist Arthur Holmes (1890-1965), then prospecting for minerals in Mozambique. On 13 May 1911 he wrote to his physicist, and boyhood, friend Robert Lawson (Lewis, 2000:93-94):

> Have you yet seen Dr. Russel Wallace's newest book 'The World of Life'? It is good while it remains scientific but philosophically and imaginatively it is insanely absurd – the sort of book which ministers will rave over [e.g., Mello, 1911] – excusing God's ways to Man and pointing out the contemptibly conceited idea, that the whole purpose of existence is MAN. You might read it during the vac. It is stimulating, but rather disappointing when he harps on the 'Purpose of God'.

Similarly, *The Athenaeum*'s reviewer writes (Anon., 1910b):

> It is curious to notice how convinced the author is, like Voltaire's Dr. Pangloss, that – for its purpose, viz., the development of man – this is the best of all possible worlds, and that the course of organic evolution, so far as we know it from the past, could not, for that reason have been otherwise.

Nature's (Anon., 1911f:480-481):

> Some of these tendencies to unbridled speculation seem to have reached an extreme limit in the twilight of a noble life, as when it is gravely suggested to substitute for the idea of a single Creator, orders of angelic beings, each charged with the task of originating and exercising supervision and control over special evolutionary processes!

The Times' (Anon., 1910a):

> He is convinced of the absolute necessity for an organizing and directive life-principle. This corresponds, we may say, to the Entelechy, on whose demonstrations Dr. Hans Driesch has bestowed so much patience and ingenuity. But Dr. Wallace goes further, postulating the directive action of organizing spirits – "ministering angels through many descending grades of intelligence and power".

A few other reviews tend toward the unfavourable (Anon., 1911a,b,e; Dendy, 1911; Windle, 1911). The tough-minded arch-rationalist Joseph McCabe (1867-1955) prophetically ends his review thus (1911:18):

> the creed of Dr. Wallace is an interesting personal expression, and will find hardly a single adherent among his colleagues throughout the world.

The American playwright George Cram Cook explains (1911): "Wallace arrived in advance at a conception which the thinking world has outgrown." And specifically, that:

> It [Wallace's book] makes its description of the feather of a bird lead to an argument for an organizing mind which thought out the perfect feather in advance.

In McCabe's later summation (1920:863-864):

> Unfortunately [in the 1860s], he had been seduced by one of the early mediums, Miss Nichol (afterwards Mrs. Guppy, a shameless adventuress), into accepting Spiritualism, and it spoiled his later work. He maintained that the human mind was not evolved, but infused into the prehistoric savage. The works of his last years (*Man's Place in the Universe*, 1903; *My Life*, 2 vols., 1905; *The World of Life*, 1910; etc.) are much enfeebled by this mysticism and Theism [cf., McCabe, 1945:90: ...he allowed himself to be duped by a fraudulent and impudent Spiritualist medium and the works of his later years were pathetic.].

Here Holmes and the reviewers exemplify the after-effects of the (Moore, 2006:140):

> critical years when the British scientific mainstream acquired its anti-spiritual slant. I focus on the individual who, perhaps more than anyone, helped clinch [unwittingly] this outcome, the brilliant, self-taught naturalist best remembered as Darwin's co-discoverer of natural selection, Alfred Russel Wallace

These opinions about Wallace, however, are much the same as zoologist Edmond Perrier's (1844-1921) view, a generation earlier in France, of the Swiss naturalist-philosopher Charles Bonnet of Geneva (1720-1793), neighbour to Voltaire during the last part of his life (Perrier, 1884:47):

> Nous arrivons ainsi dans le monde des esprits et de l'immortalité; nous sommes en pleine fantaisie. Une alliance singulière d'un raisonnement rigoureux, s'appuyant sur des faits mal connus, trop peu nombreux, avec les affirmations bibliques prises au pied de la lettre, conduit un des esprits les plus ingénieux d'une époque où le génie était commun, un observateur éminent, à des rêveries dans lesquelles son imagination ne connait plus d'obstacle, où non seulement le contrôle expérimentale des idées n'est plus possible, mais où les témoinages des sens sont d'avance récusés quand ils sont en désaccord avec les conceptions que le penseur attribue à sa raison.
>
> Thus we arrive in the world of spirits and immortality; we are in pure fantasy. A strange alliance – of a rigorous intellect, relying on facts, poorly understood and few in number, with biblical affirmations taken literally – leads one of the most ingenious minds of an era when genius was common, an eminent observer, to reveries in which his imagination knows no bounds, where not only experimental control of ideas is no longer possible, but where the testimony of the senses is rejected when it is contrary to the conceptions that the thinker attributes to his reason.

Still other reviews of *The World of Life* are mixed, or more or less favourable (Anon., 1911c,d,g,h; Buist, 1911; Cockerell, 1911; Spiers, 1911; Weaver, 1912). In this category falls an essay by Theodore Roosevelt, commenting on some dozen books. Taking exception, however, to Wallace's account of the Porto Santo rabbit, introduced to Madeira, and its divergence due to natural selection, he concludes (1911:827; passage omitted from Roosevelt, 1913):

> But Mr. Wallace, after having guessed that this is the case, then manufactures out of whole cloth a series of other guesses as a foundation for his first guess, and proceeds to treat these guesses as if they were observed facts. Any position more utterly unscientific could not possibly be imagined, and it is astounding to find one of the leaders of modern scientific thought, a man looked up to as such, willing to base his thought on guesswork no better than that of the average mediaeval schoolman or Greek philosopher.

In this category falls, too, a review by Scrutator (1911), a copy of which is in the Wallace archive of the Natural History Museum (London), annotated thus: "A very excellent Review, original, suggestive, and appreciate [sic] of the whole purpose & scope of the book, A.R.W." In it one reads (p. 141):

> If, as is held by Dr. Wallace, the purpose of creation and evolution is the development of individuality, and if, as is affirmed by other philosophers among both Idealists and Materialists, and supported by the observations of astronomers, the process of creation, of evolution and destruction, has been repeatedly enacted in the amplitudes of space, then there must exist orders of comparatively perfected Beings who, in relation to our own infant stage of development, may be to us as Gods. This conclusion, although advanced in this place as speculative, is, nevertheless, the faith of millions. It is the very essence of pure Hinduism and is, I venture to think, likely to appeal to the enlightened Theist of our later western development. The argument and conclusion arising from a careful survey of the great mass of scientific knowledge embodied in this work, are so convincingly and clearly stated by the learned author that I cannot do better than quote them directly. Dr. Wallace says:

It seems that equally, or even more than the first, the second Wallace resonates with today's world, which sees him thus (Berry, 2000:26; cf., Berry, 2002):

> Plunging into a second career as a socially engaged public intellectual, he wrote on socialism, in particular the nationalisation of land; on pacifism; on spiritualism (which he first espoused publicly in 1866, having earlier disavowed orthodox religion); on smallpox vaccination (he was opposed: his splendidly titled, *Vaccination a delusion; its penal enforcement a crime* was published in 1898); on the possibility of intelligent non-human life in the universe (whose existence he doubted); on votes for women (which he favoured).

The theme of Wallace as "public intellectual" is repeated by Tonkin (2002):

> It's easy to see why Steve Gould, whose death last week at 60 robs the literature of science of one of its towering talents, appreciated a public intellectual [ARW] who – so unlike the cautious Darwin – wrote controversially about whatever took his fancy.

In this activity Wallace would not have been alone (Goodman, 2005:286):

> It [writing] also allowed [TH] Huxley [1825-1895] to embark on a career of interpreting contemporary scientific research for the educated public, which actually brought him fame and fortune.

Other "modern" resonance is with the eternal themes of "Intelligent Design" (Osborn, 1894:42; Forsdyke, 2006) and of "conflict" or "warfare" between science and religion (Draper, 1874; White, 1876, 1896) – motifs replayed over many years by Richard Dawkins (Steer, 2003).

Cast as public intellectual, at a time when this role was not as clearly defined as

Wallace sitting in his greenhouse at Old Orchard.
(From the Quentin Keynes' Collection. Inscribed "To the great-great-grandson of Charles Darwin from the grandson of Alfred Russel Wallace.")

now, or rightly or wrongly as highly valued (Jacoby, 2008), Wallace might seem at most a reluctant player (1905:379):

> But if the entire proceeds of my Malayan collections had been well invested, and I had obtained a secure income of £400 or £500 a year, I think it probable that I should not have written another book, but should have gone to live further in the country, enjoyed my garden and greenhouse (as I have always done), and limited my work to a few lectures and review articles, but to a much less extent than I actually have done. It was the necessity of earning money, owing to my diminishing income, that caused me to accept invitations to lecture, which I always disliked; and the same reason caused me to seek out subjects for scientific or social articles which, without that necessity, would never have been written.

A reviewer of this source, Wallace's *My Life*, thought it a "frank" and "naïve [i.e., candid]... exposition of all that happened to the man from birth or before it to retirement" (Jacobs, 1906:13). This assessment accords with that, embellished by Milton's words on the death of Samson, of James Marchant, who published the first Wallace biography (1916, vol.1:vii):

> Everything Wallace wrote, all his private letters, could be published to the world. His life was an open book – "no weakness, no contempt, dispraise, or blame, nothing but well and fair.

In his review Jacobs (1906:14) states:

> Curiously enough, natural selection has not of recent years received any increased recognition of scientists as the vera causa of species. The pure Darwinists, among whom Dr. Wallace may be reckoned, still cling to it as all-explanatory, but other biologists are searching and finding specific causes for the differentiation of species. Strangely enough Dr. Wallace himself has been one of the chief incentives of this more specific kind of work. His views on the coloration of animals and insects have perhaps contributed more by example of method to the more modern researches into species than the general doctrine of natural selection, which, while declaring that the fittest shall survive, scarcely determines why any variation is fittest, and in the end only leaves us with the almost tautologous result that those who survive are the most fit to survive.

Wallace had himself previously noted this sort of criticism and on a few occasions had explicitly argued against it:

> Notwithstanding the objections which are still made to the theory of Natural Selection on the ground that it is either a pure hypothesis not founded on any demonstrable facts, or a mere truism which can lead to no useful results, we find it year by year sinking deeper into the minds of thinking men, and applied, more and more frequently, to elucidate problems of the highest importance (Wallace, 1873:227).
>
> And the more important principles arising out of these facts are also of the most simple and obvious nature, so much so that the objection is often made that they are self-evident truisms (Wallace, 1909:411).

Yet in his valediction he implies that natural selection is, at most, only a subsidiary factor in evolution:

> The whole cumulative argument of my 'World of Life' is that *in its every detail* it calls for the agency of a mind .... [see above – an "immanent directive and organising MIND, acting on and in every living cell of every living organism, during every moment of its existence" (Wallace, 1910:354); "a never-ceasing, *guiding agency*" (Wallace, 1912:6); "if you assume that the directing power is essentially a spiritual power, then you can understand all this, but without it you cannot understand it" (Wallace in Anon., 1912)].

And that after all (Wallace, 1913:97):

> It is a mere truism that the *fittest survive*.

If this "surprising conclusion" (Schilthuizen, 2004:62) or "unfortunate development" (Kutschera, 2003:358) marks the end of Wallace's personal trajectory, then it might seem but the reflection of "simple cowardice" (Gould, 1980:35); or a "disillusioned" (Simpson, 1947:488), "vitiated" (Fichman, 2004:316), "unsound" (Durant, 1979:32) or "wearied mind" (Anon., 1911e) or, more politely, of a "rebound of maturity" (Osborn, 1912:370, 1913:536); or rather the accommodation of a "social conscience" (Oppenheim, 1985:302) to a readership appropriate, *faute de mieux*, for a "socially engaged public intellectual" of renown:

> It was a matter of great pride and satisfaction to its enthusiasts that spiritualism appeared to solve that most agonizing of Victorian problems: how to synthesize modern scientific knowledge and time-honored religious traditions concerning man, God, and the universe [Oppenheim, 1985:59].

In Moore's summation (2006:151):

> For all his fame as Darwin's co-discoverer, Wallace was a radical round peg among the neat square holes of the rising scientific professions. He never fitted in, never specialized, never unlearned. His science sprawled untidily, from phrenology and mesmerism to spiritualism and socialism, confirming Darwin's fear that he might "turn renegade to natural history" (Marchant, 1916, vol. 1:318).

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References

Anon. 1886. Physiological selection and the origin of species. *The Times,* (London) Aug 16:8.

Anon. 1910a. [Prof. John Arthur Thomson, identified in *TLS Centenary Archive*]. Direction and purpose in nature. *The Times Literary Supplement,* (London) 468(Dec 29):523.

Anon. 1910b. The world of life. *The Athenaeum,* (London) 4340(Dec 31):825.

Anon. 1911a. Dr. Wallace on creative power. *The Nation* (London) 8(16, Jan 14):652-653.

Anon. 1911b. Darwinism and design. *The Saturday Review of Politics, Literature, Science, and Art* (London) 111(2882, Feb 4):147-148.

Anon. 1911c. Alfred Russel Wallace's conception of a divine hierarchy. *Current Literature,* (New York) 50(4, April):410-412.

Anon. 1911d. The great architect. *The Outlook,* (New York) 97(April 22):859-861.

Anon. 1911e. Wallace's "World of Life." *The New York Times Review of Books,* April 23:255.

Anon. 1911f. Science and speculation. *Nature* 86(2171, June 8):480-481.

Anon. 1911g. The world of life. *The Spectator,* (London) 107(4332, July 8):32.

Anon. 1911h. The world of life. *The Independent,* (New York) 71(3269, July 27):203-204.

Anon. 1912. The problem of life. *Daily News & Leader* (London) Sep 7:1 (reprinted as: Wallace ridicules the life producers. *The New York Times* 61(19,950, Sep 7):4).

Axon, T. 2005. There's only one Alfred Wallace [review of Fichman, 2004]. *Endeavour* 29(1):7-8.

Berry, A. 2000. An ugly baby [review of *Footsteps in the Forest: Alfred Russel Wallace in the Amazon* by Sandra Knapp]. *London Review of Books* 22(10, May 18):26-27.

Berry, A. (ed.). 2002. *Infinite tropics: An Alfred Russel Wallace Anthology* [with a preface by Stephen Jay Gould]. London: Verso.

Buist, W. 1911. The world of life. *The Bookman,* (London) 39(233, Feb):243-244.

Cook, G.C. 1911. Fifty years after. *The Chicago Evening Post, Friday Literary Review,* August 11:1.

Cockerell, T.D.A. 1911. A philosophy of life. *The Dial,* (Chicago) 50(596, April 16):304-305.

Dendy, A. 1911. The world of Life. *The Hibbert Journal,* (London) 9(3, April):673-677.

Draper, J.W. 1874. *History of the conflict between religion and science*. New York: D. Appleton.

Durant, J.R. 1979. Scientific naturalism and social reform in the thought of Alfred Russel Wallace. *The British Journal for the History of Science* 12(1):31-58.

Endersby, J. 2003. Escaping Darwin's shadow [review of six books]. *Journal of the History of Biology* 36(2):385-403.

Fichman, M. 2001. Science in theistic contexts: A case study of Alfred Russel Wallace on human evolution. *Osiris,* second series 16:227-250.

Fichman, M. 2004. *An elusive Victorian: The evolution of Alfred Russel Wallace.* Chicago: University of Chicago Press.

Forsdyke, D.R. 2006. Heredity as transmission of information: Butlerian "intelligent design." *Centaurus* 48(3):133-148.
Goodman, J. 2005. *The Rattlesnake: A voyage of discovery to the Coral Sea*. London: Faber and Faber Ltd.
Gould, S.J. 1980. Wallace's fatal flaw. *Natural History* (New York) 89(1, Jan):26-40.
Harman, O.S. 2004. The evolution of a naturalist [review of three books]. *American Scientist* 92(5, Sep/Oct):470-473.
Jacobs, J. 1906. An auto-didact: Alfred Russel Wallace's frank autobiography – a natural philosopher au naturel. *The New York Times Saturday Review of Books* Jan 13:13-14.
Jacoby, R. 2008. IMHO (In My Humble Opinion): Big brains, small impact. *The Chronicle of Higher Education, Section B, The Chronicle Review* 54(18, Jan 11):B5-B6.
Kottler, M.J. 1974. Alfred Russel Wallace, the origin of man, and spiritualism. *Isis* 65(2):144-192.
Kutschera, U. 2003. A comparative analysis of the Darwin-Wallace papers and the development of the concept of natural selection. *Theory in Biosciences* 122(4):343-359.
Lewis, C. 2000. *The dating game: One man's search for the age of the earth.* Cambridge: Cambridge University Press.
McCabe, J. 1911. The creed of Dr. Russel Wallace. *The Literary Guide and Rationalist Review*, new series (London) 176 (Feb 1):17-18.
McCabe, J. 1920. *A biographical dictionary of modern rationalists*. London: Watts & Co.
McCabe, J. 1945. *A biographical dictionary of ancient, medieval, and modern freethinkers*. Girard, Kansas: Haldeman-Julius Publications.
Marchant, J. 1913. The life story of the author. Pp. vii-xlv in A.R. Wallace, *The revolt of democracy*. London: Cassell & Co.
Marchant, J. 1916. *Alfred Russel Wallace: Letters and reminiscences, 2 vols*. London: Cassell & Co.
Mello, J.M. Rev. 1911. *The mystery of life and mind, with special reference to "THE WORLD OF LIFE" by A.R. Wallace, F.R.S., Etc*. Warwick: Henry H. Lacy.
Moore, J. 2006. Wallace in wonderland. *Annals of the History and Philosophy of Biology* 11:139-154.
Oppenheim, J. 1985. *The other world: Spiritualism and psychical research in England, 1850-1914*. Cambridge: Cambridge University Press.
Osborn, H.F. 1894. *From the Greeks to Darwin: An outline of the development of the evolution idea*. New York: Macmillan.
Osborn, H.F. 1912. Scientific worthies. XXXVIII – Dr. Alfred Russel Wallace, D.C.L., O.M., F.R.S. *Nature* 89(2224, June 13):367-370.
Osborn, H.F. 1913. Alfred Russel Wallace, 1823-1913. *The Popular Science Monthly* 83(Dec):523-537.
Perrier, E. 1884. *La philosophie zoologique avant Darwin.* Paris: Félix Alcan.
Romanes, G.J. 1890. Darwin's latest critics. *The Nineteenth Century* (London) 27(May):823-832.
Roosevelt, T. 1911. The search for truth in a reverent spirit. *The Outlook* (New York) 99(Dec 2):819-827.
Roosevelt, T. 1913. *History as literature and other essays*. New York: Charles Scribner's Sons.
Schilthuizen, M. 2004. A paradox to everyone but himself [review of two books]. *Natural History* (New York) 113(7, September):58-60, 62.
Scrutator [Walter Richard Old *aka* Walter Gorn Old *and* Sepharial, identified in Natural History Museum, Library Archive, Wallace Family Papers]. 1911. The new vedanta. *The Occult Review* (London) 13(March):139-143.
Simpson, G.G. 1947. The problem of plan and purpose in nature. *The Scientific Monthly* (Washington, DC) 64(6, June):481-495.

Slotten, R.A. 2004. *The heretic in Darwin's court: The life of Alfred Russel Wallace.* New York: Columbia University Press.
Smith, C.H. 2004a. Alfred Russel Wallace on man [review of three books]: A famous "change of mind" – or not? *History and Philosophy of the Life Sciences* 26(2):257-270.
Smith, C.H. 2004b. Wallace's unfinished business. *Complexity* 10(2):25-32.
Smith, C.H. 2005. Alfred Russel Wallace, past and future. *Journal of Biogeography* 32(9):1509-1515.
Smith, C.H. 2007. [review of Fichman, 2004]. *Journal of the History of the Behavioral Sciences* 43(1):97-98.
Spiers, W. 1911. Dr. Wallace's 'World of Life.' *The London Quarterly Review* 115(April):214-227 (fifth series: vol. 1).
Steer, R. 2003. *Letter to an influential atheist.* Cumbria (UK) Carlisle; Waynesboro, Georgia (USA): Authentic Lifestyle.
Tonkin, B. 2002. A week in books [review of Berry, 2002]. *The Independent, Magazine* (London) June 1:22.
Wallace, A.R. 1873. Modern applications of the doctrine of natural selection. *Nature* 7(172, Feb 13):277-279.
Wallace, A.R. 1905. *My Life: A record of events and opinions, Volume II.* London: Chapman & Hall.
Wallace, A.R. 1909. The world of life: As visualised and interpreted by Darwinism (Being the revised lecture, a portion of which only was delivered at the Royal Institution on Friday, January 22, 1909). *Fortnightly Review,* new series (London) 85(507, March 1):411-434 (old series: vol. 91).
Wallace, A.R. 1910. *The world of life: A manifestation of creative power, directive mind and ultimate purpose*. London: Chapman and Hall.
Wallace, A.R. 1912. The origin of life: A reply to Dr. Schäfer. *Everyman* (London) 1(Oct 18):5-6.
Wallace, A.R. 1913. *Social environment and moral progress.* London and New York: Cassell & Co.
Weaver, E.M. 1912. The new teleology. *The London Quarterly Review* 118(October):306-319 (fifth series: vol. 4).
White, A.D. 1876. *The warfare of science*. New York: D. Appleton.
White, A.D. 1896. *A history of the warfare of science with theology in christendom*. New York: D Appleton.
Windle, B.C.A. 1911. The world of life. *The Dublin Review* (London) 149(298, July):187-189.

What's In a Word? On Reading – And Misreading – Alfred Russel Wallace

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A few years back I received an email message from a biology professor who had been working up some materials on the early writings of Alfred Russel Wallace. He had noticed a passage in my *Alfred Russel Wallace Page* website transcription of the "Sarawak law" paper, 'On the Law Which Has Regulated the Introduction of New Species' (Wallace, 1855), that read: "The present inquiry, which seeks to eliminate from known facts a law which has determined, to a certain degree, what species could and did appear at a given epoch...". and wondered whether the word "eliminate" represented some kind of mistake in the original typesetting. At first I thought he might have a point, as on checking I determined Wallace had used the word "eliminate" on only a couple of other occasions in his early papers, whereas elsewhere he had used the seemingly better-fitting "elucidate" several times. I also looked at several examples of Wallace's handwriting, however, and it hardly seemed that the clear way he scrolled his "d's" could have led to such an error.

On then consulting the second edition of the *OED*, I found something interesting: the sixth definition for the word "eliminate" given there is: "Incorrectly used for: To disengage, isolate, extract (particular elements) from a compound; to disentangle (a fact, a principle) from a mass of confused details; hence, to elicit, deduce". Further, the several examples the *OED* gives of in-print usage of this variation are from a limited period starting with the 1840s and 1850s, and include sources Wallace might well have read. It is therefore very likely that Wallace's words did express what he meant, even if the usage was colloquial and a product of its time only.

Since this episode took place, I have become more and more intrigued with the way Wallace used language, and especially how that usage might provide clues about the evolution of his thought. One thing is clear: Wallace was a very effective wordsmith. The philosopher Charles Peirce once said of him that he "never wrote a dull line in his life, and couldn't if he tried, his very tables and diagrams being as entertaining as they are valuably instructive" (Peirce, 1906, p. 160). Certainly, Wallace was in high demand as a reviewer and commentator, as he published over one hundred book reviews after 1867 and was frequently called upon to serve up one or another kind of occasion-specific remark. And only this year I revealed (Smith, 2008a) that he was even engaged for a time as an "eyes-in-the-field" journalist, during the first years of his travels in the Far East.

Beyond merely being readable, moreover, Wallace was by all evidence effective at expressing just what he wanted to say. His vocabulary was extensive and his use of it mindful of purpose, and indeed a fair number of his shorter works directly addressed various aspects of word usage itself. Thus, at one time or another he concerned himself with vocabulary collection, encyclopedia entry organization, terminology definitions, rules of systematic nomenclature and revision, the use of neologisms, linguistic diasporas, poetic expression, and even some relationships of biogeography to folklore and myth.

His interest in words and language extended all the way to analyses of the origins of verbal communication itself, including his support for and development of what was termed the "mouth gesture" theory of the evolution of speech (Wallace, 1881, 1895). The nineteenth century philologist Hyde Clarke was particularly taken with this latter work, referring to it as "the Wallace formula" (Clarke, 1882).

All of which argues that perhaps we should be paying a little more attention than we have to Wallace's choice of words over his career – especially to critical terms whose introduction into his vocabulary at particular stages of his life might shed some light on the evolution of his thought process. This is what I hope to do in the remainder of this essay. Actually, some fair notice has already been taken of a few of Wallace's applications of language; two in particular that come to mind are his suggestion to Darwin that he adopt Herbert Spencer's phrase "survival of the fittest" in speaking of the process of natural selection, and the exact meaning he gave to the terms "varieties" and "variation" in his writings of the 1850s. The latter subject deserves a larger review than can be given now and will be spoken of no further here; in a moment, however, an attempt will be made to better contextualize Wallace's promotion of the Spencer term to Darwin in 1866.

On reading Wallace one quickly becomes aware of some grammatical and structural idiosyncrasies in his writing that are probably related, as Peirce (1906, p. 160) explains, to his lack of formal schooling combined with an over-emphasis on the inculcation of Latin during it. Still, Peirce also finds reason to point to his "remarkably lucid, easy, and harmonious style of writing; remarkable, we mean, in comparison with that of others who, like him, have never received any instruction in rhetoric". For modern readers, there is actually still relatively little to pointedly criticize, apart from his typically Victorian tendency to write long sentences, and occasional period-related complications of the "eliminate" variety noted above.

Attention to the matter shows that there really are certain key terms that Wallace uses again and again (and/or at particular times during his career) which seem quite instructive in context. One of the most revealing of these usages concerns the word "accumulate" (and its variants "accumulation," etc.), employed by Wallace in over one hundred of his writings spanning the whole of his career. In most of those instances he applies it in a straightforward and conventional fashion – *e.g.*, to "accumulations of belongings" or "accumulated facts" – but of more particular interest is the wonderfully descriptive way he often connects natural selection to character variation through its use, as in "natural selection accumulates variations". If one reads "accumulate" to imply, roughly, "addition through haphazard or irregular collection", Wallace's understanding of how natural selection is connected to evolution is at once made clear: certain variations, however emerging initially, are identified through the contingencies of environmental engagement as having survival value at a particular time, and on this basis are "accumulated" within the population through differential survivorship.

Wallace's first use of the term in this exact sense came in the essay 'Remarks on the Rev. S. Haughton's Paper on the Bee's Cell' (Wallace, 1863a), where he states: "...simultaneous favourable variations in structure and habits, accumulated by natural selection, may act and react on each other, and thus ultimately lead to such a modification of the insect as may better adapt it for constructing the most advantageous form of

cell" (p. 304), and "Natural selection, acting through advantage in the struggle for existence, *accumulates* favourable variations, but in no sense *causes* them" (p. 308; Wallace's italics). A few months later, in another article (Wallace, 1864a), he notes "those slight modifications which tend to bring a species into more exact harmony with surrounding conditions can be accumulated and rendered constant by 'natural selection' in an island where intercrossing with the forms of other districts is impossible" (p. 110), and a few months later again, in the famous 'Origin of Human Races' paper (Wallace, 1864b), "...every slight variation in his mental and moral nature which should enable him better to guard against adverse circumstances, and combine for mutual comfort and protection, would be preserved and accumulated" (p. clxiv), and "...by no other means can it be shewn that individual variations can ever become accumulated and rendered permanent so as to form well-marked races" (pp. clxviii-clxix). Further examples are scattered throughout the rest of his oeuvre. One might argue that Wallace picked up this usage from the *Origin*, where plenty of similar examples can be found, yet these post-1858/9 constructions are presaged by ten years by analogous thoughts related to physical nature appearing in his 1853 book *A Narrative of Travels on the Amazon and Rio Negro*: "When these rivulets meet together and accumulate into a river..." (p. 409), and "...during which time the stream will work for itself a wider and deeper bed, capable of containing its accumulated flood" (p. 427). Two subtexts in these earlier passages are worthy of note. First, Wallace's writing conveys an image of process in which the initial events – rain falling and collecting into rivulets – randomly enact, but then give way to increasing order. Second, there is a sense of guiding control by outside forces: gravity, and the pre-existing and confining stream bed. The "accumulated flood" thus initiates as a vast array of largely unordered events, but even once organized into a consequential flow remains an influence that is both controlled, and controlling.

This leads to an important point that is often glossed over, as it usually was by Darwin, and even occasionally by Wallace himself: the "accumulation of variations", which we may term "evolution" as a simple description of historical fact, is not quite the same thing as natural selection itself. Indeed, Malthusian pressures are such as to frame no more than a stalemate between continually procreating populations and their resource base – that is, just enough individuals are removed to bring the system back into equilibrium. This is the "extinction", "extermination", "weeding out", or "elimination", of the *unfit* – all of which terms Wallace used over the last several decades of his career, especially after C. Lloyd Morgan suggested the phrase "natural elimination" in 1888 to describe what Wallace was trying to get at.

One surmises that Wallace knew full well right from the beginning – for him, the mid-1840s – that in one fashion or another variations were being "accumulated", and that this was "evolution". But exactly how the adaptations that gave form to these "variations" developed over time was a puzzle he did not solve until it occurred to him in 1858 that there must be differential *removal* of individuals; that is, that the more poorly equipped individuals tended to die off faster than the better equipped ones did, with resulting generational implications. It was this removal of the unfit that actually constituted "natural selection" for Wallace; in the 1858 Ternate essay he likens this to the action of a governor on a steam engine.

As mentioned above, Wallace continued to use the allegorical term "accumulate" throughout the rest of his life to describe how the adaptive variations that emerged were retained, if not truly randomly, at least without preordainment. In this respect, no real revision of his thinking across the 1858 boundary was necessary, as before that time he apparently recognized no necessary utility to the role of adaptations, preferring to think their refinement was in some fashion shaped directly by the greater forces of environment (Smith, 2003, 2005). Once it occurred to him that utility was the key, he merely embraced the view that evolution enlisted *whatever* opportunities for productive environmental engagement variation made possible.

Still, this model left him with a new, and even more difficult, conceptual challenge. While, as stated above, "those slight modifications which tend to bring a species into more exact harmony with surrounding conditions can be accumulated and rendered constant by 'natural selection'," this governor-like function did nothing to guarantee any kind of progressive change, just a return to "harmony." Wallace had rejected Lamarckism from the beginning, and thus the only conclusion he could draw was that the selecting forces within the environment (as defined broadly to include *all* supra-organism involvements, including those with other organisms) had themselves to be changing over time, continually providing new and more challenging contingencies for engagement. Surely his consideration of the analogy provided by domestication processes helped him to understand this; there, humankind's immediate objectives propelled ever-more intricate selection strategies, and increasingly refined results. But in the case of *natural* selection, the more "recondite" (a favourite Wallace word) forces of environment were behind the selection, as he first makes clear in a passage from 'The Origin of Human Races':

> From those infinitely remote ages, when the first rudiments of organic life appeared upon the earth, every plant, and every animal has been subject to one great law of physical change. As the earth has gone through its grand cycles of geological, climatal and organic progress, every form of life has been subject to its irresistible action, and has been continually, but imperceptibly moulded into such new shapes as would preserve their harmony with the ever changing universe (Wallace, 1864b, p. clxvii).

In 1972 the anthropologist Gregory Bateson concluded:

> Wallace, in fact, proposed the first cybernetic model...Basically these systems are always conservative...in such systems changes occur to conserve the truth of some descriptive statement, some component of the status quo. Wallace saw the matter correctly, and natural selection acts primarily to keep the species unvarying..." (Bateson, 1972, p. 435).

Seven years later he added:

> ...If it had been Wallace instead of Darwin [who started the trend], we would have had a very different theory of evolution today. The whole cybernetic movement might have occurred one hundred years earlier as a result of Wallace's comparison between the steam engine with a governor and the process of natural selection" (Bateson, 1979, p. 43).

The implication is that Wallace's natural selection – the elimination of the unfit – describes the negative feedback loop component only, a simple return toward equilibrium, within

the evolutionary process. The adaptive structures selected enter into a form of stabilizing engagement with a population's surroundings that is somehow implicitly positive feedback-serving. Otherwise put, there is something about engagement with the environment, whether in terms of behaviour, migration, or dispersal, which *itself* produces a net "accumulation" of information. This in turn is genetically recapitulated through the individually surviving actors on the stage.[1]

Now no one is suggesting that Wallace had systematically thought out the matter of negative and positive feedback controls, but he apparently *was* aware that two contrasting components of the overall process of evolution were operating (sometimes referred to in systems terms as a "push-pull" coupling – see Maruyama, 1963), and needed to be kept separate to make sense of it all. To understand how this was reflected in his post-1858 thinking, we must now consider some other terms he was struggling with at the time.

"Natural selection" was a new term as applied by Darwin, so not surprisingly it does not appear in Wallace's writings until 1860, when he uses it in 'The Ornithology of Northern Celebes', published in April of that year. (Interestingly, according to the date he placed on the finished work he apparently completed it in October 1859. Thus, he actually first referred to the term – at least in manuscript – before the *Origin* itself appeared in print, a month later.) Somewhat more surprisingly, however, it does not turn up in any of his next twenty publications, finally resurfacing in the 1863 essay 'Who Are the Humming Bird's Relations?' From that point on, it appears regularly in his writings.

Pretty much the same thing is true of the word "evolution", which was not in common usage to convey the notion of "general organic change" at the time *Origin* was first published (though Herbert Spencer had begun to apply the word in the 1850s). Usually the term "transmutation" was seen instead, or "the development hypothesis". Wallace does use the word "evolution" a couple of times in the 1850s, but to a now archaic end referring to the irregular motions of butterflies or birds in flight. By the late 1860s he was beginning to use "evolution" in the currently familiar sense fairly regularly, and it is interesting to focus in on how this took place.

We should note first that Wallace apparently had some trouble coming to a decision as to how the noun "evolution," designating, in effect, a *summation* of process, should be connected to a word implying its own coming about. Amazing as it may seem, I have been unable to come up with even a single example of Wallace using any of the words "evolve", "evolves", "evolving", or "evolutionary" anywhere in his voluminous writings (and even as early as the 1860s other writers were). One can only conclude from this that his appreciation of the process of organic change did not extend to abstractions reducing it to a passive, "internal", coming about. Instead, it was, in the first instance, a *responsive* phenomenon. This impression is fortified by the fact that although he did employ the word "evolved" on a couple of dozen occasions (but only after the mid 1860s), on just one occasion was it used in the passive voice (this one exception referring to a non-biological aspect of evolution): in all the others, it appears as part of the active voice constructions "was evolved in/from", or, in the vast majority of cases, "has been evolved".

This is particularly interesting in view of more current usage, through which the notion that a plant or animal "evolves" conjures up images, not of complex patterns and cycles of environmental engagement, but instead of genetic continuities and phylogenetic trees. This latter appreciation of evolution, "tree thinking", has taken over our thoughts to such an extent that the very notion of what constitutes being "natural" has been equated with what is *actually* an abstraction: historical lineages – which exist only in the mind, and not as functional elements of planetary energetics.

In his 1858 essay Wallace took the first giant step toward ridding himself of this baggage. Nevertheless, as of 1864, and his 'Origin of Human Races' paper, he was still struggling with how it all fits together. How could the environment, as broadly defined, go "through its grand cycles", subjecting "every form of life... to its irresistible action", and moulding "such new shapes as would preserve... harmony with the ever changing universe", in a manner that accounted both for the observed biological outcomes, and the place of supra-biological attributes such as human morality, artistic talent, and mathematical skills? – the latter seemed to be attuned to more subtle influences. In late 1864 and early 1865 he released a series of commentaries designed to explore how the higher attributes might develop; more specifically, how culturally/ethically/morally less advanced individuals and societies might rise above the treadmill of mere survival and actually better themselves (Wallace, 1865a, 1865b, 1865c). While still pursuing this train of thought, he was introduced to and began to explore the literature and physical "manifestations" of spiritualism. Wallace soon came to the conclusion that the "realm of spirit" constituted a real – and thus causal (if nonphysical) – part of nature. His experiences at seances undoubtedly helped sell him on this model, but it is also likely that he adopted it *primarily* because spiritualistic philosophy suggested theretofore missing connections in the absence of which his understanding of evolution as a universal process would have remained, at least for him, uncomfortably incomplete (Smith, 2008b).

This is most evident from his 1866 study 'The Scientific Aspect of the Supernatural' (Wallace, 1866a), first published in instalments in a secular magazine around the middle of the year, then reissued in pamphlet form a couple of months later. This monograph-scale essay reviews the literature, philosophy and history of spiritualism, largely in the form of a plea for taking its investigation seriously. Apart from the extraordinary departure it represented in general, it is also remarkable for an entirely different reason: it was here, in of all places his treatise on disembodied spirits, that Wallace expanded his active vocabulary with his first use of the four terms "evolution", "evolved", "fittest", and "survival of the fittest". The first appears as:

> Is it possible, if these 'spiritual' communications are but the evolutions of the minds of weak superstitious or deluded human beings, that they should so completely contradict one of the strongest and most cherished beliefs of the superstitious and the religious... (p. 55);

the second in the "has been evolved" form mentioned earlier; the last two in the same thought as:

> Now here again we have a striking supplement to the doctrines of modern science. The organic world has been carried on to a high state of development, and has been ever kept in harmony with the forces of external nature, by the grand law of 'survival

> of the fittest' acting upon ever varying organisations. In the spiritual world, the law of the 'progression of the fittest' takes its place, and carries on in unbroken continuity that development of the human mind which has been commenced here (pp. 49-50).

The use of "evolutions" above, despite its closer synonymic approach in meaning to "creation" than to "transmutation" (and indeed when in 1875 the essay was included in Wallace's collection *On Miracles and Modern Spiritualism*, it was replaced with the word "workings"), nevertheless initiates a new direction in his use of the word.

More importantly, it was right at this time that Wallace decided to endorse Spencer's term "survival of the fittest" – and even use the word "fittest" – for the first time. Interestingly, the essay appears to have been submitted to the magazine around mid-July 1866 (a note printed in its 21 July issue reports they had received the manuscript and were ready to proceed with its preparation for publication); this postdates by no more than a week or two Wallace's famous letter to Darwin (dated 2 July 1866) suggesting the latter take up Spencer's phrase. Ironically, Wallace first suggests that Darwin make use of it to combat the impression many received that natural selection implies, in analogy with artificial selection, that a guiding hand must be at work to do the selecting. But then he moves on to what I believe is his real complaint:

> I find you use the term Natural Selection in two senses – (1) for the simple preservation of favourable and rejection of unfavourable variations, in which case it is equivalent to 'survival of the fittest'; (2) for the *effect or change* produced by this preservation, as when you say, 'To sum up the circumstances favourable or unfavourable to natural selection,' and, again, 'Isolation, also, is an important element in the process of natural selection': here it is not merely 'survival of the fittest,' but *change* produced by survival of the fittest, that is meant" (Marchant, 1975, p. 142; Wallace's italics).

Here we have Wallace stating in the clearest possible words his differentiation between what he sometimes referred to as the "law" of natural selection, and the larger reality, evolution. Given his train of thought over the preceding two years and the absence of any earlier efforts on his part to distinguish between the two ideas, it is difficult to believe that his dealings with spiritualism to that point had not helped to clarify his thought process in this regard. When he identified the notion of the "progression of the fittest" (and its attendant implications: progressive change at the level of conscious awareness), the way to contrast between adaptation-the-process and adaptation-the-structure became clearer, and the need to keep the two concepts separate, even more apparent. In parallel with "elimination of the unfit" at the biological level, spiritualistic "fitness" was defined in terms of the individual's rejection of immoral and unethical behaviours. Achieving such a goal depended on more than the individual simply willing it so, however; instead, spiritualists understood the "spirit realm" environment to be capable of "feeding back" instructive lessons through the medium of dreams, subliminal suggestion, and even on occasion more sensationally through what we would now term "paranormal" interventions (seance manifestations, etc.). To be sure, many or most such contacts would have no effect or be interpreted inappropriately (leading to fanaticisms, etc.), but on the whole a programme of ethical/moral elevation would ensue. Thus, Wallace's exclusive use of the "was evolved from" and "has been evolved" constructions: in both the physical and psychical instances an environment was serving as an external stimulus to change. After all, not all variations within biological structures

led to sustainable engagements with the physical world either.

Wallace's first use of the word "evolution" in a sense entirely familiar to us today came in a letter to the Editor of the *Athenaeum* referring to his recommenced studies on mimicry; it was dated 26 November 1866, and appeared in the 1 December 1866 issue (Wallace, 1866b). (Here too there is a spiritualism connection, as the pamphlet version of *The Scientific Aspect of the Supernatural* had been issued no more than two weeks earlier, and it was just at this time he began to witness convincing seance manifestations in his own quarters.) Specific contrastings between natural selection and evolution were not long in coming. In my *Alfred R. Wallace: Evolution of an Evolutionist* (Smith, 2003, Chapter 5) I comment:

> By 1869 and his Lyell review [*i.e.*, Wallace, 1869], however, he is more obviously contrasting natural selection with evolution, as at one point he states: "Neither natural selection nor the more general theory of evolution can give any account whatever of the origin of sensational or conscious life." His changing thoughts over this period are also mirrored in a small alteration made when he incorporated the essay "A Theory of Birds' Nests," first presented as a paper in 1867 but only appearing in total in print in 1868 [Wallace, 1868], into his collection *Contributions to the Theory of Natural Selection* in 1870: in the 1867/1868 version, the text reads "...on the theory of evolution, as worked out in detail by Mr Darwin, a wide range...", whereas in 1870 this had been changed to read "on the theory of evolution and natural selection, a wide range...". One thus gathers that his views on the hierarchy of causation involved were in flux over this period.

This separation is further reflected in Wallace's varying usage of the words "adapt", "adaptation", and other variants thereof. Before 1864 the word "adapt" appears only once in his writings, and "adapts" or "adapting" not at all. "Adaptation" turns up only twice over the same period (in the form "adaptation to"), but "adapted" is used over thirty times, invariably as "adapted to" or "adapted for". Thus he is restricting his usage of the concept to depict a state of interaction between organism and environment, and neither to the historical process of its generation, nor to specific adaptive structures. That Wallace was already predisposed toward accepting a complex interaction state view of evolution, and societal evolution in particular, even before all of this, is evidenced by words from a paper he first presented on 1 September 1863 (exactly six months *before* he read his 'The Origin of Human Races', and right around the time of his response to Prof. Haughton on natural selection as related to bees' cells):

> ...the absence of civilisation does not necessarily imply the want of capacity to receive it. An external impulse is in every case required; for I believe no instance can be shown of a homogeneous race having made much or any progress when uninfluenced by the contact of other races. Civilisation has ever accompanied emigration and conquest -- the conflict of opinion, of religion, or of race. In proportion to the diversity of these mingling streams, have nations progressed in literature, in arts, and in science; while, on the other hand, when a people have been long isolated from surrounding races, and prevented from acquiring those new ideas which contact with them would induce, all progress has been arrested, and generation has succeeded generation with almost the same uniformity of habits and monotony of ideas as obtains in the animal world... (Wallace, 1865d, on p. 206).

Two or three years later Wallace would conclude, finally, that the spark that had

infused humankind and moved us beyond a "uniformity of habits and monotony of ideas" had come from a hitherto unrecognised realm, a form of "environment" that transcended time and space (as, he no doubt felt, those habits and ideas themselves did).

There are those who would argue that Wallace's decision to pressure Darwin into adopting the term "survival of the fittest" was a bad one, because it made the notion of natural selection vulnerable to accusations of tautology. To the extent that the role in the equation of *heritable* variations does tend to get lost as a result, this is a fair criticism. Yet it is a criticism that misses the point, at least with respect to *Wallace's* goals. Considering his initial likening of natural selection to the action of a governor device, it is doubtful that he ever intended the concept to signify more than an elimination of the unfit. "Survival of the fittest", therefore, is by default nothing more than the immediate implication of removal of the unfit. It is still an unavoidable and implicit element in the unfolding of evolution – but, as I believe Wallace wanted us to understand by his choice of words, it is also only *one* element of that unfolding.

Note

1. It should be understood here that in making this observation I am not ignoring the point that it is the *heritable* characters in differential reproductive success that lead to change interpreted as evolution. Instead, my objection lies in the idea that it is not necessarily so that the resulting change need represent an increase in *organisation* – whether that increase be in the form of ever-more numerous and specialized insects, or organisms sporting growing levels of self-awareness. Thus, what is it about environmental engagement that promotes, not just a biolayer consisting of *different* assemblages of microorganisms at different times, but one characterised by *increasing* levels of temporary diversion of incoming extraplanetary energy sources over time?

References

Bateson, G., 1972. *Steps to an ecology of mind*. San Francisco: Chandler Publishing Co., 545pp.

Bateson, G., 1979. *Mind and nature: a necessary unity*. New York: Dutton, 238pp.

Clarke, H., 1882. The gesture speech of man. *Nature*, 26: 419.

Marchant, J., ed., 1975. *Alfred Russel Wallace; letters and reminiscences*. New York: Arno, 507pp.

Maruyama, M., 1963. The second cybernetics: deviation-amplifying mutual causal processes. *American Scientist*, 51: 164-179.

Morgan, C.L., 1888. Elimination and selection. *Proceedings of the Bristol Naturalists' Society*, 5 (n.s.): 273-285.

Peirce, C.S., 1906. [untitled review of Wallace's *My life*]. *Nation*, 82: 160-161.

Smith, C.H., 2003-. *Alfred Russel Wallace: evolution of an evolutionist*. [website: http://www.wku.edu/~smithch/wallace/chsarwp.htm]

Smith, C.H., 2005. Alfred Russel Wallace: past and future. *Journal of Biogeography*, 32: 1509-1515.

Smith, C.H., 2008a. Alfred Russel Wallace, journalist. *Archives of Natural History*, 35: 203-207.

Smith, C.H., 2008b. in press. Wallace, spiritualism, and beyond: "change," or "no change"?, in Smith, C.H. and Beccaloni, G.W. (editors) *Natural selection and beyond: the intellectual legacy of Alfred Russel Wallace*. Oxford: Oxford University Press.

Wallace, A.R., 1853. *A narrative of travels on the Amazon and Rio Negro*. London: Reeve & Co., 541pp.

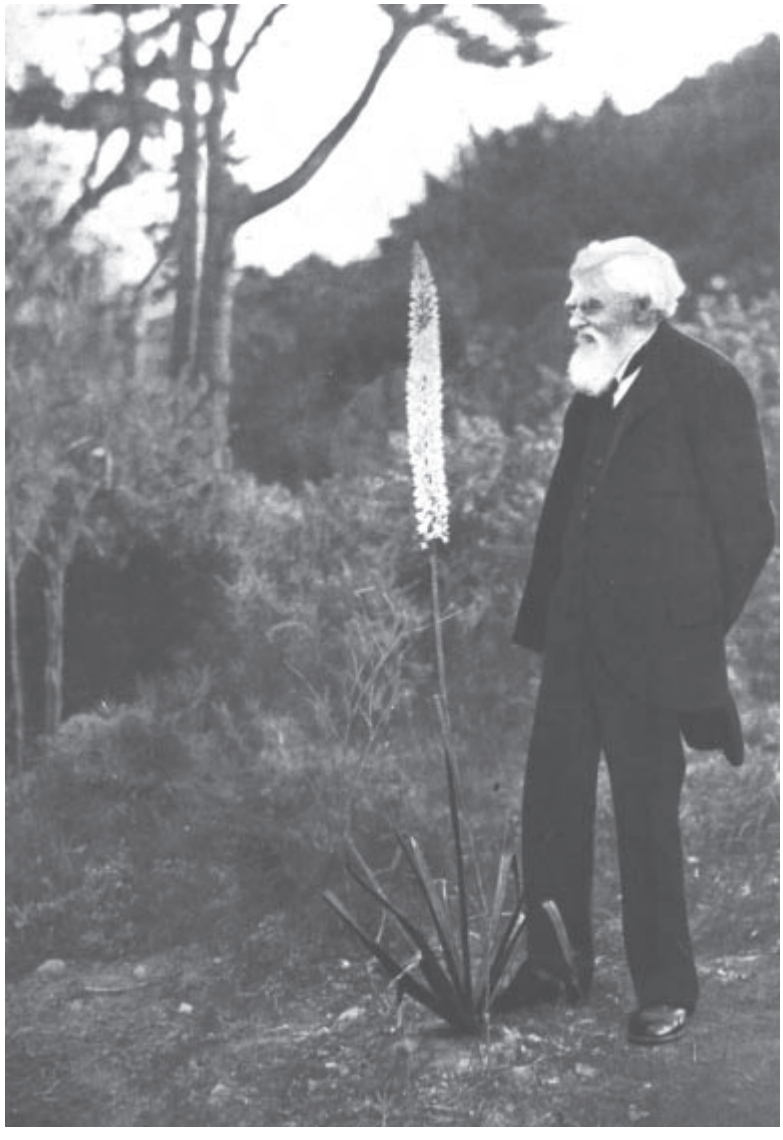
Wallace, A.R., 1855. On the law which has regulated the introduction of new species. *Annals and Magazine of Natural History*, 16 (2d s.): 184-196.

Wallace, A.R., 1860. The ornithology of northern Celebes. *Ibis*, 2: 140-147.
Wallace, A.R., 1863a. Remarks on the Rev. S. Haughton's paper on the bee's cell, and on the origin of species. *Annals and Magazine of Natural History*, 12 (3d s.): 303-309.
Wallace, A.R., 1863b. Who are the humming bird's relations? *Zoologist*, 21: 8486-8491.
Wallace, A.R., 1864a. Remarks on the habits, distribution, and affinities of the genus *Pitta*. *Ibis*, 6: 100-114.
Wallace, A.R., 1864b. The origin of human races and the antiquity of man deduced from the theory of "natural selection". *Journal of the Anthropological Society of London*, 2: clviii-clxx.
Wallace, A.R., 1865a. On the progress of civilization in northern Celebes. *Transactions of the Ethnological Society of London*, 4 (n.s.): 61-70.
Wallace, A.R., 1865b. Public responsibility and the ballot. *Reader*, 5: 517.
Wallace, A.R., 1865c. How to civilize savages. *Reader*, 5: 671-672.
Wallace, A.R., 1865d. On the varieties of man in the Malay Archipelago. *Transactions of the Ethnological Society of London*, 3 (n.s.): 196-215 (Pamphlet reprint: London: F. Farrah, 57pp).
Wallace, A.R., 1866a. The scientific aspect of the supernatural. *The English Leader*, 2: 59-60, 75-76, 91-93, 107-108, 123-125, 139-140, 156-157, 171-173.
Wallace, A.R., 1866b. Natural selection. *Athenaeum*, No. 2040: 716-717.
Wallace, A.R., 1868. A theory of birds' nests. *Journal of Travel and Natural History*, 1: 73-89.
Wallace, A.R., 1869. Sir Charles Lyell on geological climates and the origin of species. *Quarterly Review*, 126: 359-394.
Wallace, A.R., 1875. *On miracles and modern spiritualism*. London: James Burns, 236pp.
Wallace, A.R., 1881. [untitled review of Edward B. Tylor's *Anthropology*]. *Nature*, 24: 242-245.
Wallace, A.R., 1895. The expressiveness of speech, or mouth-gesture as a factor in the origin of language. *Fortnightly Review*, 58 (n.s.): 528-543.

Wallace defends Darwin's priority – 50 years on

A special meeting of the Society was held in the Theatre of the Institution of Civil Engineers, Great George Street, at 2.30 pm. on Wednesday, July 1st, 1908, to celebrate the Fiftieth Anniversary of the joint communication made by Charles Darwin and Alfred Russel Wallace to the Society, *On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection*.

Primary amongst the participants was the 85 year old Wallace and J.D. Hooker, in his 91st year. It was Hooker and the geologist Charles Lyell who convinced Darwin



An elderly Wallace admiring *Eremus robustus* in his Dorset garden about 1905. From Marchant (1916) courtesy of G. Beccaloni.

that a joint release would be an admirable solution to the conundrum that Darwin found himself in after receiving Wallace's Ternate letter on June 18, 1858. The President of the Society, Dr. Dukinfield H. Scott, presided, and he opened the celebrations saying:

> We are met together to-day to celebrate what is without doubt the greatest event in the history of our Society since its foundation. Nor is it easy to conceive the possibility in the future of any second revolution of Biological thought so momentous as that which was started 50 years ago by the reading of the joint papers of Mr. Darwin and Dr. Wallace, "On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection", communicated to our Society by Sir Charles Lyell and by Sir Joseph Hooker, whom we have the happiness of seeing with us to-day. The papers, it will be remembered, consist of an extract from Mr. Darwin's then unpublished work on Species, for which he had been preparing during the previous 20 years, of an abstract of a letter from him to Asa Gray, the famous American Botanist, and of Dr. Wallace's paper, which he had sent to Mr. Darwin, "On the Tendency of Varieties to depart indefinitely from the Original Type". In Mr. Darwin's contributions, the now classic terms "Natural Means of Selection" and "Natural Selection" are used for the first time. In Dr. Wallace's essay the same idea is expressed with equal clearness, as for example in the words "If any species should produce a variety having slightly increased powers of preserving existence, that variety must inevitably in time acquire a superiority in numbers". With both authors the key to evolution is at the same time the key to adaptation, the great characteristic by which living things are distinguished. Darwin and Wallace not only freed us from the dogma of Special Creation, a dogma which we now find it difficult to conceive of as once seriously held "Nec deus intersit, nisi dignus vindice nodus", (from Horace: "do not let God interfere if the knot can be untangled without Him") – they afforded a natural explanation of the marvellous indications of Design which had been the great strength of the old doctrine, and themselves, with their disciples, added tenfold to the evidences of adaptation. In like manner, if we are to see further advance now or in the future, any new development of the doctrine of evolution must be prepared to face, fairly and squarely, the facts of adaptation.

The President then called forward Dr Wallace, "...who was received with great enthusiasm," to receive his award, the Darwin-Wallace Gold Medallion. After giving a brief outline of Wallace's contribution, Wallace himself spoke:

> Mr. President, – I beg to thank the Council of the Linnean Society for the very great honour they have done me, in coupling my name with that of Charles Darwin on the celebration of this anniversary, and for the still greater and more exceptional honour, of perpetuating my features with those of my illustrious forerunner, upon the Medal you have now awarded me.
>
> With your permission I propose to make a few remarks both as to the actual relations between Darwin and myself prior to July 1858, and also to some peculiarities of our respective life-histories which brought about those relations, and which will, I hope, be both novel and of some general interest.
>
> Since the death of Darwin in 1882, I have found myself in the somewhat unusual position of receiving credit and praise from popular writers under a complete misapprehension of what my share in Darwin's work really amounted to. It has been stated (not unfrequently) in the daily and weekly press, that Darwin and myself discovered "natural selection" simultaneously, while a more daring few have declared that I was the first to discover it, and that I gave way to Darwin!

In order to avoid further errors of this kind (which this Celebration may possibly encourage), I think it will be well to give the actual facts as simply and clearly as possible.

The one fact that connects me with Darwin, and which, I am happy to say, has never been doubted, is that the idea of what is now termed "natural selection" or "survival of the fittest", together with its far-reaching consequences, occurred to us independently, and was first jointly announced before this Society fifty years ago. But, what is often forgotten by the press and the public, is, that the idea occurred to Darwin in October 1838, nearly twenty years earlier than to myself (in February 1858); and that during the whole of that twenty years he had been laboriously collecting evidence from the vast mass of literature of Biology, of Horticulture, and of Agriculture; as well as himself carrying out ingenious experiments and original observations, the extent of which is indicated by the range of subjects discussed in his "Origin of Species", and especially in that wonderful store-house of knowledge – his "Animals and Plants under Domestication", almost the whole materials for which works had been collected, and to a large extent systematised, during that, twenty years.

So far back as 1844, at a time when I had hardly thought of any serious study of nature, Darwin had written an outline of his views, which he communicated to his friends Sir Charles Lyell and Dr. (now Sir Joseph) Hooker. The former strongly urged him to publish an abstract of his theory as soon as possible, lest some other person might precede him – but he, always refused till he had got together the whole of the materials for his intended great work. Then, at last, Lyell's prediction was fulfilled, and, without any apparent warning, my letter, with the enclosed Essay, came upon him, like a thunderbolt from a cloudless sky! This forced him to what he considered a premature publicity, and his two friends undertook to have our two papers read before this Society.

How different from this long study and preparation – this philosophic caution – this determination not to make known his fruitful conception till he could back it up by overwhelming proofs – was my own conduct. The idea came to me, as it had come to Darwin, in a sudden flash of insight: it was thought out in a few hours – was written down with such a sketch of its various applications and developments as occurred to me at the moment, – then copied on thin letter-paper and sent off to Darwin – all within one week. I was then (as often since) the "young man in a hurry": he, the painstaking and patient student, seeking ever the full demonstration of the truth that he had discovered, rather than to achieve immediate personal fame.

Such being the actual facts of the case, I should have had no cause for complaint if the respective shares of Darwin and myself in regard to the elucidation of nature's method of organic development had been thenceforth estimated as being, roughly, proportional to the time we had each bestowed upon it when it was thus first given to the world – that is to say, as 20 years is to one week. For, he had already made it his own. If the persuasion of his friends had prevailed with him, and he had published his theory, after 10 years' – 15 years' – or even 18 years' elaboration of it – I should have had no part in it whatever, and he would have been at once recognised, and should be ever recognised, as the sole and undisputed discoverer and patient investigator of the great law of "Natural Selection" in all its far-reaching consequences.

The young Darwin in 1840
painted by George Richmond R.A.

The *Beagle* paintings of John Chancellor (1925-1984)

Gordon Chancellor

The UK Data Archive, University of Essex

The voyage of HMS *Beagle* from Christmas 1831 to October 1836 was arguably the most important scientific voyage of all time. It produced surveys of thousands of miles of South American coastline, mainly around Chile and Argentina, and established precise longitudes around the world. Before the *Beagle* returned to England, the ship's "unofficial" young naturalist, Charles Darwin (1809-82), worked out the still accepted explanation of how coral reefs and islands are formed, and collected a major archive of previously undescribed geological, zoological and botanical specimens. All this besides the surveying vessel's most enduring claim to fame: it became the birthplace of evolutionary biology.

But all these achievements, great as they were, were not sufficient to suggest to anyone the thought of preserving the little ship when her career ended around 1870. Today all that remains of the *Beagle* are some memorabilia and her bottom timbers, apparently lying peacefully but inaccessibly under three metres of Essex mud.

Today, as we celebrate the bicentennial of Charles Darwin's birth and the sesquicentenary of his great work *The Origin of Species* (1859), we have become acutely interested in the voyage of the *Beagle*.

Darwin was born into a large well-to-do family, although his mother died when he was small, in the same week as Jane Austen. As a young naturalist and gentleman, Darwin was plucked from Cambridge University as the best person to accompany Captain Robert FitzRoy (1805-1865) on his return to South America in the beautifully refitted *Beagle.* Darwin's father almost aborted his son's involvement before it began, but was persuaded by his brother-in-law Josiah Wedgwood (1769-1843) that the voyage would do the young Charles credit. Josiah was not just a superb judge of pottery kilns.

Darwin was already a moderately well-trained geologist at the start of the voyage and FitzRoy's embarkation present to him was the first volume of Charles Lyell's (1797-1875) *Principles of Geology,* which had been published in the previous year. Within months of leaving England, Darwin had committed to Lyell's 'principles' as the best explanation for the geological phenomena he was encountering, for example on the oceanic islands visited by the *Beagle*. Lyell argued that the surface of the earth had arrived at its present state over unimaginably long periods of time, exclusively by the same 'causes' as are observable today, such as rivers, volcanoes and earthquakes. This 'actualistic' method of Lyell's was nothing new to geologists; where his approach was highly distinctive was in arguing that the *intensity* of geological forces had never been greater that it is today (Rudwick 2008). Darwin was also a pretty well-rounded, if inexperienced, naturalist having been taught zoology by the likes of Robert Grant (1793-1874) in Edinburgh and botany by John Henslow (1796-1861) in Cambridge. By the end of the voyage Darwin was already being feted as a brilliant new member of the scientific élite.

As Darwin wrote in the first lines of the *Origin*, the voyage of the *Beagle* provided him with evidence that convinced him that species originated by descent with modification. In other words, the voyage was the foundation for Darwin's life's work – as he phrased it, "my first real education." Darwin and FitzRoy became great friends and collaborators during the voyage, but drifted apart afterwards; FitzRoy could never reconcile his friend's theory with his own biblical view of Creation. The ship which had carried them both on such a monumental voyage continued surveying missions for another decade, but then was eventually left to rot in the River Roach. When Darwin died, his son Francis (1848-1925) pulled together recollections of the voyage for a biography of his father, and by the end of the nineteenth century books began to appear with plans and diagrams of the *Beagle* based on the recollections of her officers and crew. Following the centenary of the *Origin* in 1959, by which time Darwin was recognised as one of the greatest scientists who ever lived, museums wanted models of the *Beagle* for exhibitions, and for the first time it was realised that not one single detailed painting of her could be found, although there were a few impressionistic renderings and sketches.

In the late 1970s while researching fossils for my PhD I, like thousands of others before and since, read the *Origin.* I was thrilled by its sheer intellectual force and its view of Nature which was exactly like my own – a secular view of evolution without divine plan or intervention. I became increasingly interested in the voyage of the *Beagle,* at that time the subject of a major TV series *The Voyage of Charles Darwin* for which the historical advisers had been Jon Hodge and the late David Stanbury. My father, John Chancellor (1925-1984), was by then established as one of the finest marine artists of the twentieth century and I did my best to encourage him ('goad' is the word he used in his first letter to David Stanbury) into creating a painting of the famous ship.

Chancellor was extremely reluctant to paint the *Beagle,* as she had been so extensively modified for surveying and because so few contemporary illustrations were even moderately accurate. By 1979, however, with the then approaching centenary of Darwin's death in 1982 and the realisation that Chancellor would never have any peace from his son, he struck up a lengthy correspondence with Stanbury and with Lois Darling, who had built a detailed model of the *Beagle*. After reading Stanbury 1977 and 1979, then FitzRoy's *Narrative* 1839, and while finishing his major study *HMS Victory in pursuit of Nelson* he finally decided to commit to the *Beagle.* The painting which finally came off the easel in October 1981 (but was slightly altered the following year) was *H M S Beagle in the Galápagos*. The painting and the second one done the following year are now recognised as the finest reconstructions of the ship on canvas. This essay is the story of Chancellor's involvement with his meticulous, documented visualisation of the *Beagle* during its second voyage round the world.

Chancellor was born of British parents in Portugal and as a small boy was fascinated by the sailing ships on the River Tagus. Back in England for his education he attended Wycliffe College and trained for two years at the London Polytechnic School of Art. He joined the merchant navy as a Deck Officer at sixteen or seventeen and I am the proud owner of what must be one of his earliest oils, painted on Christmas Eve 1941, which I have always assumed was from his personal war experience. He survived

H M S Beagle in the Galápagos by John Chancellor.

being torpedoed twice and although he never talked much about the war I remember him telling me that (being of quite short stature) he sometimes struggled to get his fair ration of water while waiting to be rescued in the lifeboats. In the late 1940s he served on oil tankers in the Dutch Antilles and I have three paintings, all dated 1947, which he did at that time. One is a portrait of a shipmate, one a blissful scene of a man in a canoe on a Venezuelan river, and the third a 'helicopter' view of a liberty ship in a hurricane. This picture was exhibited in New York and was awarded a watch, which I own. Chancellor was a small boat skipper during my formative years, working on tugs, barges and trawlers, only 'coming ashore' to paint in his middle age in 1972.

Chancellor's first exhibition in 1973 sold out in 45 minutes and this event meant that his family would never again have to wave him off at the quayside. In his short career as a professional artist he painted some seventy oils and a similar number of watercolours. There are two books about his work, the first by himself with a biography by his agent Austin Hawkins (Chancellor 1984), the second by my late mother Rita (1931-2008), again assisted by Hawkins (Chancellor and Hawkins 1989). Prints of some of his best paintings are available from my sister Tessa Makepeace at *www.chancellormaritimeprints.co.uk*, but his two *Beagle* pictures sold out years ago and are only available as re-sales.

Many of Chancellor's oils portrayed British naval sailing ships from the Napoleonic period, and these pictures often required significant research and months of highly detailed brushwork. Chancellor preferred watercolour for simpler, quicker pictures of the working sailing vessels which he knew intimately, some of which, such as Thames sailing barges, he had sailed himself and on which I spent my early childhood.

When my mother died in 2008, I inherited my father's copyright and also his diaries, which he kept right up to his sudden death in 1984. The diaries provide daily details of how the two *Beagle* paintings were planned and conceived and, I have to say, of the extreme stress that they sometimes occasioned. Until now, very few people knew that Chancellor almost despaired of finishing *Sorely Tried* – a rendering of the *Beagle,* tossing on monstrous swells in 1833, when she almost capsized. It was, by his own account, one of the most difficult pictures he ever tackled. However, not finishing a major work after months of struggle is not an option when you have to sell it to pay the bills.

The image of the *Beagle* during a sunny day in the Galápagos involved much original research, including reading the Captain's and Master's logs at the Public Record Office. Chancellor and I spent many hours poring over the charts and watercolours made by the crew, at the Hydrographic Office in Taunton, trying to find views made by the *Beagle* surveyors at any point during the voyage which might also have historical importance to Darwin scholars. I see from my father's diaries that Chancellor's first visit to Taunton, at the invitation of his friend Peter Treherne, was on 21 March 1980, a few days before his 55th birthday.

We were of course predisposed to look especially carefully at the survey archive for the Galápagos, as that was obviously a significant part of the voyage, and I was at that time beginning to think that I would visit the Islands (I did in fact go in July 1981 with the Friends of the California Academy of Sciences, along with paleontologist and essayist Stephen Jay Gould and Darwin scholar and botanist Duncan Porter). The

Galápagos are synonymous in the public imagination with Darwin because he himself made his first stumbling references to the possibility that species might evolve in notes on the land birds and tortoises of the islands.

Darwin himself attributed huge importance to the Galápagos in convincing him that species evolved, as for example in the introduction to his *Variation under Domestication* of 1868. There were, however, many other places visited by the *Beagle* which can be said to have played key parts in Darwin's rejection of the received wisdom that species were fixed (Chancellor and van Wyhe 2009).

Chancellor finally chose to portray the *Beagle* on the afternoon when FitzRoy sent in two boats to collect Darwin after his longest period ashore on James [Santiago] Island in the Galápagos. In 1981, through the kindness of the Captain of the M V *Santa Cruz*, I visited the exact spot depicted in the painting, and was able to confirm the accuracy of the landscape background. Chancellor had copied this from *Beagle* Lieutenant B.J. Sulivan's sketch made in the yawl some two weeks before the ship crossed the same spot. Chancellor selected this view on a second visit to Taunton on 21st May. I was working at the University Museum in Oxford at the time, but I was able to get down to Devon for a few days occasionally to see my parents and to help with 'the project' where I could. I am recorded as being with Chancellor on 23rd May,

Detail of Chancellor's *Beagle*. FitzRoy is searching for Darwin through a spyglass as the boats are lowered to fetch him from the shore.

the day after he was plotting bearings and two days before he chose the exact moment of the painting.

Sulivan's sketch has been reproduced in Keynes 2003, pp. 322-3 and has since appeared on John Woram's website at *http://www.Galápagos.to/ephemera/index.htm#Chancellor*. I have Chancellor's original photocopies of the sketch and of the detailed manuscript chart of James Bay (cat. No. L 957, Pacific Folio 3) on which there are notes and compass bearings (which of course had to be corrected, as magnetic north moves around).

Chancellor cut the canvas and pinned it to his easel on 27th May 1980 and started painting the sky the next day. Chancellor nearly always worked this way in oils: sky first, then land if applicable, then sea, then ship. He worked Monday to Friday, 8am to 5pm, standing all the time. Rarely, he would work on the weekends. His chief relaxation during these years was flying his Cessna 172, sometimes for the purposes of photographing the coast as research for a painting.

He reworked the sky on 5th June, the coastline the following week, then the sea, which required six days' work by itself. Seas were always incomparably the most demanding part of any Chancellor painting. He had to know exactly what conditions he wanted to show, and knew how to interpret ship's logs and local tides, ground swell, and so forth in order to achieve a fantastic sense of moving water. His thirty years at

John Chancellor painting *HMS Beagle*.

sea, including deep sea in the 1940s, allowed him accurately to visualise the waves and the colours of the water that FitzRoy had seen that day when he wrote his 'Remarks &c Saturday 17th Octr. 1835' in the Captain's log.

To paint his seas, Chancellor would seem to get into what sportsmen call 'the zone' – an intensely focused and concentrated state of mind that excludes all else. To a casual observer, he appeared to begin by slopping oil paint randomly onto the canvas with his palette knife. However, after a few days of putting in bold smears with the knife alone, the shape of the waves miraculously became obvious to the bystander and Chancellor would visibly relax. (Now he would hear your questions, although he still might not answer them.) Eventually he got out his brushes and started on the detail. At that stage he knew whether or not he had pulled it off. If not, he would scrape it all off

and start the sea again. Once or twice he left a sea to dry for some months before deciding what to do next. The *Beagle* sea was finished on 18th June; with the sky (but not yet any hint of the ship) he was now a month into the work.

Having left the sea to dry somewhat, he started to draw the ship on 8th July. At this point Chancellor was into unknown territory, as there are countless details of the *Beagle* about which we do not have, and almost certainly never will have, definitive answers. But the artist has to commit one way or the other, subject to the possibility of making what one hopes will only be small changes if new evidence crops up while the paint is still soft. Since Chancellor never used thinners, his ships would generally take a few weeks to dry safely enough for varnishing.

After checking drafts of frigates of the Cherokee class like the *Beagle*, including 'Sir Robert Sepping's modified profile 1817' at the Public Record Office on 11 July, and examining David Stanbury's collection of illustrations of the ship, Chancellor started to paint her.

Key areas of dispute about the *Beagle* are the number of gun ports, the colours of the masts (black, white, both, or ochre), the appearance of the transom and stern quarters (in other words, the back end of the ship), the exact position of the quarter davits (the 'cranes' for lifting and lowering the boats hanging over the side) and the position of the horizontal white stripe on her hull vis-à-vis the gunports. By far the most difficult area of uncertainty is the exact structure and colour of the ship's all-important surveying boats, of which there were several types, such as the yawl, the cutters and the whaleboats. It is not generally realised that Darwin himself spent a good deal of time in these boats, most famously perhaps in one of the three whaleboats on the Santa Cruz expedition in 1834. The whaleboats are instantly recognisable by their graceful 'double-ended' shape. Naturally I will take a great deal of persuading that Chancellor got any of these details wrong, but I am not closed to argument! By never showing the bow he dodged the issue of whether there was a beagle-shaped figurehead, an issue on which the jury is still out, although I believe there was one. His final decisions on the details are visible in the paintings and in the article which he wrote in October 1980 for *Mariner's Mirror* but never submitted. I have since published that article, entitled 'FitzRoy's *Beagle',* at the invitation of John van Wyhe.[1]

Suffice it here to say that Chancellor never had a tougher assignment than working out the exact appearance of the cutter (sometimes referred to as 'gig') which can be seen being lowered from the port davits. He corresponded at great length with Stanbury and Darling on this subject. Darling's (1984) article on the *Beagle* appeared just before Chancellor died, but I kept up correspondence with her until she too died not long afterwards.

It is a great shame that Chancellor never had the benefit of Keith Thomson's (1995) or Karl Heintz Marquardt's (2007) books and that neither of these authors referred to his literally painstaking reconstruction of the ship. I am glad, however, that I was able to arrange for Chancellor and myself to meet Thomson and 'talk Beagle' just three days before Chancellor died. It is sad that in our research both Chancellor and I missed the deep-sea reel which Marquardt has described so well. It should be clearly visible on the poop deck and if the owner of the painting ever allows me, I will paint it in!

Sorely Tried, the painting of *HMS Beagle* tossed in a gale near Cape Horn, 1833, by John Chancellor.

Chancellor's *Beagle* gradually took shape, starting with the bowsprit on 18th July with many hard days of highly detailed work through that month and August. In the close up photograph of Chancellor painting, his cardboard pointers to island features can be seen. This photo was staged for the local newspaper on 7th August; he would not have used those pointers while actually painting. Chancellor's own description of the painting is worth quoting in full:

> The whaler [that is, whaleboat] in davits on *Beagle*'s starboard quarter and the gig on the port quarter have been partially lowered and are being manned and prepared for launching. Practically all sail has been taken off to reduce speed. A single reef has been taken in in the fore tops'l and men are aloft doing likewise to the main tops'l…..A man on the poop can be seen preparing to hoist the ensign to the American whaler. *Beagle* has been firing one of her little six pounders forward from time to time to announce her approach to those ashore…Captain FitzRoy can be clearly seen steadying his telescope against the mizzen mast as he scans the shore in search of signs of Darwin and his party (Chancellor 1984).

The entry in Chancellor's diary for 19th August reads 'very exacting work. No check on smoking' reminding me that Chancellor was trying hard to give up the evil weed during these years and that he could not do this while concentrating hard for up to nine hours a day. 'Hand reefing the main tops'l' was the 21st and 27th another 'hard day on Beagle'. 8th September was back 'a beagling' after a short break then the 10th was a 'hard day of concentration on stern area and poop deck a rather complicated focal point' and 'exhausted'. By the 15th he had been on the rigging for a week and the next day he painted FitzRoy who had become something of a hero to him and a foil to my endless banging on about Darwin.

On 18th September Chancellor records 'this is a most demanding painting' but he is beginning 'to see the end of the road'. He started on 'the controversial boat', that is the cutter/gig on the port quarter, on the 26th but felt ill and must have suffered over the next few weeks of extremely intensive work. Photos were taken on 6th October but a week later he 'resolved the fold problem of the main tops'l – will attack it tomorrow but huge task with so much rigging to be repainted'. On the 13th he 'converted' the cutter/gig to clinker construction 'to conform to Stanbury's letter arrived this morning'. On the 15th he stretched and framed the canvas and prepared the painting to take it to the New Zealand embassy in London for the launch by David Attenborough of Nova Pacifica's facsimile of *The Zoology of the Beagle.*

The picture was essentially finished and Chancellor moved onto the comparative 'light relief' of some watercolours. At this stage the stern and davits of the *Beagle* were white, at Stanbury's recommendation, and this is how the painting appears in Nova Pacifica's *Centennial Commemorative* book, but Chancellor was never happy about this. On 26th January 1981 he started the switch to black, which took fifty hours. He made some further small alterations on 21st May and the painting was sold a week later. I went to the Galápagos in July (see above) and my photographs necessitated some minor adjustments to the Sugar Loaf on the 18th of August. Chancellor moved on to other work but noted on 27th December 1981 'Beagle sailed today 150 years ago'.

Alexander Galleries of Bristol produced a limited edition print which was launched on 25 March 1982. Chancellor had the gruelling task over the winter of pencil

'remarquing' fifty of these, for example mine and the Linnean Society's. This process for which he allowed two hours each took several weeks, along with signing all 850 prints and producing a cassette tape on which he and I discuss the painting and the voyage. Chancellor also did an ink drawing on 4 February which I now own, showing the scene off James Island with Darwin's shore party returning to the ship at about 4.30pm. I have painted my own oil version of this picture, as I knew the rigging and sails could be trusted and I only needed to glance up at my print to see that Chancellor thought the masts were ochre colour. This was a strange experience for me and was almost like talking to my father again.

The Galápagos painting itself consumed over 750 hours at the easel, but I know Chancellor was deeply pleased with the result. Purchasers of the print were provided with a leaflet in which Chancellor explained the background to the painting. A shortened version of that account was included in Chancellor 1984, a book which sadly he never saw published as he died a few hours after checking the proofs. It pleases me that one of the last 'Beagle' activities Chancellor undertook was to fly one of the prints to R.A.F. Brize Norton for it to be flown onwards to Ascension Island, which was of course one of Darwin's stops on his voyage.

The Galápagos painting shows the *Beagle* on a beautiful equatorial day, with everyone doing what they had set out to do, surveying and collecting. But this was not enough for Chancellor. He knew that the sea had almost destroyed the vessel two and a half years earlier, on 13 January 1833, and he wanted to remind us all just how vast is the ocean and how small our ships.

On 31st March 1982 Chancellor started the painting which he was then calling '*Losing the whaler'* but on 4th August renamed *'Sorely Tried'* in honour of FitzRoy's famous description of the *Beagle* at another critical moment in the voyage (1839, p. 125):

> At three in the morning of the 13th, the vessel lurched so deeply, and the main-mast bent and quivered so much, that I reluctantly took in the main-topsail (small as it was when close reefed) leaving set only the storm-trysails (close-reefed) and fore-staysail.[2] At ten there was so continued and heavy rush of wind, that even the diminutive trysails oppressed the vessel too much, and they were still further reduced….. Soon after one, the sea rose to a great height, and I was anxiously watching the successive waves, when three huge rollers approached, whose size and steepness at once told me that our sea-boat, good as she was, would be sorely tried……the third great sea, taking her right a-beam, turned her so far over, that all the lee bulwark, from the cat-head to the stern davit, was two or three feet under water. For a moment, our position was critical…

This is the moment of the painting, when the whole expedition nearly ended with only the few charts, specimens, letters and part of the diary of a young man who had shown great promise, all of which had already been posted to England, would be all that remained. No more FitzRoy, no more Darwin and no natural selection until Alfred Russel Wallace (1823-1913) hit on the idea in 1858. The cusp was passed, however, and you are reading this because, as FitzRoy continues, 'like a cask, [our ship] rolled back again, though with some feet of water over the whole deck'.

I had the great privilege of watching *Sorely Tried* evolve from a blank canvas to

an advanced stage, as I was in early 1982 living with one of my sisters in Torquay, near my parents, while waiting for my Oxford contract to be renewed. I took the opportunity of four months unemployment to commence transcription of Darwin's *Beagle* notebooks, working from microfilm at Torquay Public Library. I saw the *Sorely Tried* sea emerge in April, which was a very gloomy time for Chancellor in every way, as one of his best friends died tragically in that month and he was very upset about the loss of young servicemens' lives on both sides in the Falklands.

The diaries record 'struggling with the sea…great difficulty with the sea' and so forth, but by 29 April Chancellor was sufficiently comfortable with the sea to turn the canvas round and start painting the ship, which of course by now he knew in minute detail. On 18 May, 1982, he felt that the success of the painting was in the balance and this continued until early June when at last he felt he had broken the back of it.

After struggling with so many difficulties in the painting, the death of his friend, and his concern about the tragic loss of life in the Falklands, Chancellor badly needed a break. Fortunately, he was able to take a month-long respite touring France with my mother, which was probably the best holiday they ever had together.

Chancellor was back in his studio on 16 July 1982 and 'after a month resumed *Beagle* with fresh eyes'. On the 20 July he had realised that 1½ inches needed to be chopped off the bottom of the picture to improve the composition, so he reached for the scissors. On 4 August he named the picture and gave it a thin coat of varnish. The next day it was sold to the owner of *HMS* Beagle *in the Galápagos*. In November Chancellor made some small changes to the mizzen mast and gaff and the painting was finished.

Sorely Tried was also made into a print, this time posthumously in 1989, and was featured with Chancellor's own description in Chancellor and Hawkins' book the same year. On the open market, such as e-bay, the print of the *Beagle* struggling to remain afloat in tempestuous waters commands only about one-quarter of the resale value of its sunnier sister (since the Galápagos painting shows a historically later scene it should be thought of as the sequel to *Sorely Tried*). I believe, however, that to Chancellor both his *Beagle* pictures were of equal value and that *Sorely Tried* stands as a metaphor for his determination to prove that the most famous ship in history was going to finish her appointed task, come what may.

Footnotes

1. This article is available at:
   http://darwin-online.org.uk/content/frameset?itemID=A245&viewtype=text&pageseq=1.
2. The *Beagle* in 1833 had three masts which, from bow to stern, were the fore, the main and the mizzen. The foremast carried various triangular 'stay' sails stretched out along the bowsprit. Each mast also had a sail called a trysail set parallel to the length of the ship, mainly to provide ease of movement where there was not much sea room. The fore and main masts had sails set at right angles to the length of the ship; these were, going up the mast, the main sail (sometimes called a 'course') then the topsail, usually abbreviated to tops'l, then the topgallant sails and royals at the top. There were also various other sails only set for particular conditions, such as very light winds and the precise angles and heights of all the sails depended on the wind and the direction of sailing. Sails could be easily 'reduced' by 'reefing', that is hitching

them up by small ropes sewn to the front of the sail. By comparing Chancellor's two *Beagle* paintings it is easy to see that in *Sorely Tried* FitzRoy has 'struck' (that is taken down) the top parts of the masts and stowed away almost all the sails. Other terms used include 'cat-head', which is at the bow, and 'lee' which means the side of the ship 'sheltered' from the wind, as opposed to the 'weather' side.

References

Chancellor, John. 1984. *The maritime paintings of John Chancellor*. Newton Abbot: David & Charles.

Chancellor, Rita and Hawkins, Austin. 1989. *John Chancellor's classic maritime paintings.* David and Charles. Newton Abbot.

Darling, Lois. 1984. HMS Beagle, 1820-1870: voyages summarised, research and reconstruction. *Sea History.*

FitzRoy, Robert. 1839. *Narrative of the surveying voyages of His Majesty's Ships Adventure and Beagle between the years 1826 and 1836, describing their examination of the southern shores of South America, and the Beagle's circumnavigation of the globe. Proceedings of the second expedition, 1831-36, under the command of Captain Robert Fitz-Roy, R.N.* London, Henry Colburn.

Keynes, Richard Darwin. 2003. *Fossils, finches and Fuegians: Charles Darwin's adventures and discoveries on the Beagle, 1832-1836*. London: Harper Collins.

Marquardt, Karl Heintz. 2007. *H.M.S.* Beagle*:Survey Ship Extraordinary.* Conway. London.

Thomson, K. S. 1995. *HMS Beagle: The story of Darwin's ship.* New York and London: Norton.

Rudwick, M.J.S. 2008. *Worlds before Adam: the reconstruction of geohistory in the age of reform.* Chicago: University Press.

Stanbury, David. 1977. *A narrative of the voyage of HMS Beagle being passages from the 'Narrative' written by Captain FitzRoy selected and edited by David Stanbury.* The Folio Society. London.

Stanbury, David. 1979. H M S Beagle. *The Mariner's Mirror* 65: 355-7.

From the Origin of Species to the Origin of Civilization – A perspective from a corner of Kent

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When Charles Darwin published his *Origin of Species* in 1859, he did not spell out the specific implications for humankind. Indeed, it was not until the publication of *The Descent of Man* in 1871, that he revisited the subject. He wrote in his introduction to that work:

> During many years I collected notes on the origin or descent of man, without any intention of publishing on the subject, but rather with the determination not to publish, as I thought that I should thus only add to the prejudices against my views. It seemed to me sufficient to indicate, in the first edition of my Origin of Species, that by this work "light would be thrown on the origin of man and his history". (Darwin 1871:1)

The reason he gave for not publishing on this all-important topic may imply that Darwin hoped others would take on human evolution, which some soon did. such as the German evolutionist Ernest Haeckel. But the seminal book on early humans at the dawn of history was *Prehistoric Times: as illustrated by ancient remains and the manners and customs of modern savages* (1865) which predated the *Descent of Man* by six years. It was written by Darwin's friend, neighbour and protégé, John Lubbock, later known as Lord Avebury. Historian of science George Stocking has written that if anyone deserves to be called a student of Darwin prior to the publication of the *Origin* in 1859, John Lubbock stands alone (Stocking 1991: 151).

Lubbock not only promoted Darwin's ideas on evolution and natural selection, but also used the theory as the basis for his own original scientific research, which made his mentor proud. His wide-ranging natural history studies included contributions to discovering colour vision in bees, the structure of ant society and communication, and the classification of barnacles and water fleas. He wrote books on these arcane topics that were intended to be understood and enjoyed by the general public, not just by specialists. He also sought to explore, and extend the implications of Darwin's theory for the origin and evolution of humans.

What prepared Lubbock for this role? First, he had been raised in a scientific household: his father, John William Lubbock, in addition to being a prominent and wealthy banker, was a mathematician and astronomer – and like Darwin, the very model of a gentleman scientist. Both of his parents were keen to see education spread to the widest possible audience, and the father was particularly concerned with improving the nation's scientific education. In fact, the senior Lubbock had been one of the founders of the Society for the Diffusion of Useful Knowledge, an early attempt to spread the boundaries of education beyond its traditional audience and beyond classical subjects to knowledge of the latest science and technology.

High Elms, home of the Lubbocks – the original house.

As early as 1853 (aged 19) it seems John Lubbock had believed in the mutability of species saying in his diary recording discussions with his cousins "we all agreed that it seemed probable that they might change into one another". Patton considers that this opinion, at this time, would have largely been reached independently of any influence from Darwin, as the latter was then still reticent about sharing his views on such a topic with others (Patton 2007: 26).

The Lubbocks were Darwin's neighbours in the Kentish countryside around Downe village, near Bromley, although Lubbock's estate, known as High Elms, was incomparably grander than Darwin's modest Georgian mansion and grounds. Indeed, Lubbock was the largest landholder for miles around. Beginning in Lubbock's childhood, Charles had taken the young polymath under his wing and tutored him informally in natural history.

John learned at first hand what was in Darwin's mind and which subjects he was exploring, and frequently changed his research interests to track those of his mentor. John Lubbock was brilliant, inquisitive, talented, and hard-working. Of course, his precocious success in the scientific world resulted not only from his own efforts, but in part from his position in a rich and influential family. The Lubbocks had both scientific and political roots, a combination which enabled young John to command attention.

The number of well-connected family friends that John was able to call upon helped immeasurably to promote Darwin's somewhat blasphemous ideas, as well as his own prodigious research. Darwin, whose ill-health at times interrupted his ability to work, was somewhat in awe of John's output and declared in 1881 "How on earth you find time [to do all you accomplish] is a mystery to me" (Hutchinson 1914:176).

The families first came into contact when the Darwins moved to the village of Downe in 1842. At the time, Sir John William Lubbock had built the large 23-bedroom house at High Elms to accommodate his wife Harriet and their seven children. In addition to running the Lubbock and Company bank (which later became Roberts, Lubbock & Company), John William Lubbock was a Cambridge-educated astronomer and mathematician, and a leading light in the Royal Society. Among his scientific achievements, he advanced knowledge of how tides were correlated with the phases of the moon, and devised a method for calculating the orbits of comets and planets. Closer to home, he applied the mathematical theory of probability to life insurance calculations. John, his eldest son, was 8 years old when Charles and Emma Darwin visited their new house, prior to moving in. Charles wrote to his sister Emily Catherine ("Catty") on 24 Jul 1842:

> The great Astronomer Sir J. Lubbock is owner of 3000 acres here, & is building a grand house a mile off – I believe he is very reserved & shy & proud or fine – so I suspect he will be no catch, & will never honour us [with a visit] –.

It did not seem to occur to Darwin that the rich, socially prominent Lubbock would consider *him* a catch. But, in fact, he did.

In an account of his own childhood, John Lubbock later recalled:

> My father came home one evening in 1841, quite excited, and said he had a great piece of news for me. He made us guess what it was, and I suggested that he was going to give me a pony. 'Oh,' he said, 'it is much better than that. Mr Darwin is coming to live at Down'. I confess that I was much disappointed, though I came afterwards to see how right he was.

Darwin's scientific reputation was already well established by 1841 – almost twenty years before he published the *Origin of Species*. That year, soon after the Darwins moved to Downe, young Lubbock was sent away to his first boarding school. John was a generation apart from Charles Darwin with a 25 year age gap between them. Nevertheless, when he returned a few years later, and during a visit home, the middle-aged naturalist and the young boy struck up a close and long-lasting friendship.

Two factors seem to have drawn them together – John's love for natural history and his somewhat dysfunctional relationship with his own father. While he could be extremely kind to his son, John William Lubbock was often hypercritical, judgmental, and emotionally inaccessible. As Victorian fathers often were, the senior Lubbock was a rather distant patrician figure. When he was not immersed in the family banking business. he was deeply into his scientific pursuits. His interests lay in the physical sciences rather than the natural or biological. He frequently expressed despair at his son's inability to excel in mathematics, with the cry "Well, if Newton does not make it clear to you, I am afraid I cannot!" Charles Darwin showed an avuncular interest in

A daguerrotype of High Elms, the house that replaced the original in 1842.

young John from the first, and encouraged his enthusiasm for natural history. He would thus become a second father figure to the youngster.

A little over a year after the move to Downe, Charles wrote to his cousin William Fox about their quiet life in the village

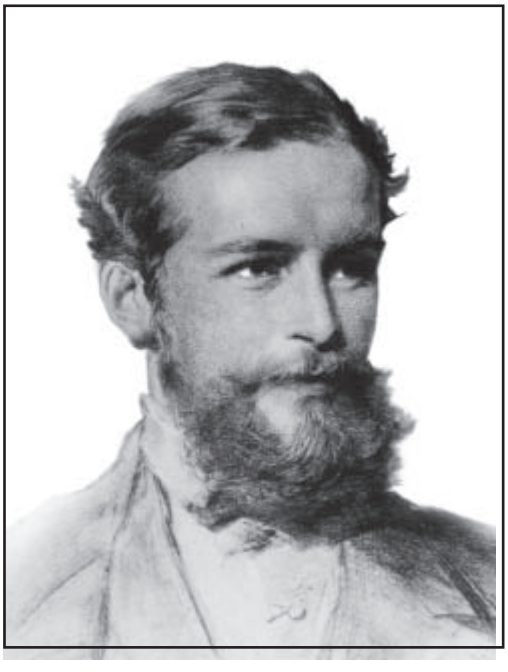
> We continue in the same profoundly tranquil state, as when you were here, & have only got to know one person well, namely Lady Lubbock [Harriet, mother of John] who is a very nice person, absorbed with the education of nearly a dozen very nice children.

Evidently, the women of the families were the prime movers in striking up new relationships. Over the next few years, they became regular visitors to one another's homes. In 1848, Charles persuaded John's father to purchase a microscope for the boy. Darwin then selected the instrument for him, and was keen to follow John's progress with it:

> Will you be so kind as to tell your son (in case my wife does not see Lady Lubbock, when she leaves this note) that I am anxious to hear about the microscope & if he would like half an hour's talk, I hope & trust I sh$_{d}$. be able to see him tomorrow (Thursday) at 2 o'clock or Friday at about same hour.

John later recalled, "he let me do drawings for some of his books, and I greatly enjoyed my talks and walks with him". He treasured the microscope to the end of his life; a descendant would subsequently bequeath it to the Darwin Museum at Downe House, where it can still be seen.

So close became the association between the youth and the mature naturalist that Lubbock began to become known to locals as "Darwin's apprentice". John spent hours peering through that microscope, while making detailed drawings of his observations. One early attempt was a small crustacean he discovered in Darwin's collection of pickled specimens, which he named *Labidocera Darwinii,* in honour of his mentor. These drawings are preserved in a scrapbook of the Lubbock children's drawings kept by their mother, Harriet, which is in my possession.



John Lubbock aged 33 in 1867, by George Richmond RA.

By 1850, John had gained enough confidence to give his first lecture to the villagers at Downe – "on the Wireworm" – which was "well attended". Darwin shortly afterwards proposed John as a member of the Entomological Society, to which he was duly elected on 1st July 1850. Darwin continued to give young Lubbock marine specimens he had collected during the *Beagle* voyage. The

work on *Labidocera Darwinii* culminated in John's first published scientific paper in 1853. At the time, Darwin himself was glued to his own microscope for an eight-year study of barnacles, during which he revised the classification of the entire group.

Lubbock also became very interested in the idea of deep time and the sweep of evolution over millions of years – much longer periods than the religious chronologies that were then widely accepted. The geologist Charles Lyell was a major influence in shaping Lubbock's views on how ordinary forces of wind and water, operating over immense periods of time, had shaped the Earth's features – the same uniformitarian ideas that had infuenced the young Charles Darwin when he had been a young man aboard *HMS Beagle.*

John's father had also introduced him to the astronomical idea that the tilt of the Earth's axis may change over time, causing major climatic changes. John became eager to gather evidence of prehistoric climates and changes to life on Earth. In 1855 he unearthed the bones of a large cold-climate mammal – the musk-ox – in gravel beds near the neighbouring village of Green Street Green. Darwin wrote "… you have found the first Ovibos Moschatus (Musk ox) ever discovered fossil in England. I must congratulate you on such a capital discovery". With such encouragement and praise, John's interest grew in making discoveries about the remote past.

An interesting record of the families' connection, previously unpublished, is Harriet Lubbock's sketchbook, in which she kept drawings and autographs of family and friends. Her sketch of Darwin's portrait, below, was evidently based on a photograph rather than a sitting. The drawing is dated 1855.

As well as introducing John Lubbock into scientific societies, Darwin was also instrumental in introducing him to individual scientists. At Down House, in 1856, Lubbock met two people who were to become friends and colleagues for life: the botanist Sir Joseph Hooker and zoologist Thomas Henry Huxley.

John Lubbock married a vicar's daughter, Ellen Hordern, in 1856. She was a shy, retiring person at the start of the marriage. However, she soon made many friends – both in Downe and among John's scientific colleagues. Charles Darwin's wife Emma and Ellen struck up a particularly close friendship, and often met and corresponded with one another. Ellen also took an active interest in John's scientific work and helped him with his experiments. She was a good draughtswoman and did many of the diagrams for his lectures. She would also comment on Darwin's work, so he well knew of her interest in such matters.

In 1857, Darwin submitted a paper written by the 22-year-old John Lubbock on water fleas (*Daphnia*). It received critical acclaim, and led to Lubbock being admitted to The Royal Society as its

Harriet Lubbock's sketch of Darwin from a photograph.

youngest member. By the summer, Lubbock was emerging from his apprenticeship with Darwin to make significant contributions of his own.

Once, Lubbock pointed out to Darwin some errors in his probability calculations. Darwin, whose maths were weak, was very gracious in accepting the point from his pupil, and wrote back in effusive terms thanking him. He also graciously acknowledged Lubbock's correction to his fellow scientists. Writing to Joseph Hooker, Darwin noted that "talking yesterday with Lubbock he pointed out to me the grossest blunder which I have made in principle". Darwin reassessed his conclusions and used the alternative method suggested by Lubbock.

Members of the two families sometimes participated in community activities together. In 1859, when Britain was undergoing one of its periods of nervousness about the French, local militias were established to defend the countryside against any Napoleanic incursions. John William Lubbock decided that he would fund a home-grown paramilitary unit, and allowed them to use High Elms to drill and practice. His son Montagu was appointed Captain. Among the officers, Charles' son William Darwin was given the rank of Ensign. When Montagu was injured in an accident, when his coach and horses overturned on top of him, his brother Alfred briefly took command, and then the baton passed to William (Eade 1977).

Publication of *The Origin of Species* in 1859 was not just ground-breaking on a global and national scale, but also had significant effects within the small community of Downe village. It was an immediate success, with the first run of 1250 copies sold the day it appeared. From that point onwards, John Lubbock saw it as one of his life's aims to not just defend but to reinforce the Darwinian principles set out in the *Origin*. He did, after all have a stake in its contents, having supplied some of the illustrations and his work on invertebrates, which Darwin used as examples.

After the release of his book Darwin sought support and reassurance from those he thought he could count on. He wrote to Lubbock:

> My book has been, as yet, very much more successful than I ever dreamed of: Murray is now printing 3000 copies. Have you finished it? If so pray tell me whether you are with me on the general issue or against me. If you are against me I know well how honourable, fair and candid an opponent I shall have, and which is a good deal more than I can say of all my opponents...

At first Darwin sought reassurance that Lubbock was "on his side" in publicly endorsing his doctrines, particularly his shaky theory of Pangenesis, an ultimately unsuccessful attempt to explain a mechanism for heredity. He asked Lubbock again directly:

> If you ever arrive at any direct conclusion, either wholly or partially for, or against, Pangenesis, I should very much like to hear; for I settled some time ago that I should think more of Huxley's and your opinion, from the course of your studies and the clearness of your mind, than that of any other man in England.

The response was positive, and consequently Lubbock appears on a list drawn up by Charles Darwin of a dozen supporters of his theories that he could count upon – 8 whole-heartedly, 4 with some qualification.

One of the most important and historic debates about evolution and the *Origin of*

Species took place in June, 1860 at the Oxford Union. Darwin was not present. The occasion was the meeting of the British Association for the Advancement of Science and John Lubbock was among those presenting papers. The debate took place on the Saturday and was attended by more than 700 people, most of whom had come to hear Bishop Wilberforce's response to John Draper of New York's speech on "Darwin's hypothesis". The Darwin supporters – chiefly Huxley, Hooker, and Lubbock – stayed on to defend their position against Wilberforce's anti-science rhetoric. Hooker's is the main account we have of the proceedings, and he does not credit Huxley's contribution with the central role in besting the bishop. Huxley did mention in his own account that Lubbock and Hooker spoke after him "with great force". John used reasoned and rather technical arguments whilst Hooker was more emphatic and made heavy use of rhetoric and irony. Darwin was probably glad to have missed such a heated confrontation, although the excuse given for his absence was ill-health. He later told Huxley "I would as soon have died as tried to answer the Bishop in such an assembly".

Huxley described himself as Darwin's bulldog for the robust defence he maintained of Darwinian ideas. John Lubbock might just as aptly be described as Darwin's publicist. Although that term was not then in use, Lubbock made major, successful efforts to promote Darwinian ideas to the general public. He also used his subsequent position as a Member of Parliament and his public reputation as a conciliator, to promote Darwinism through persuasion, popularization and diplomacy. Rather than attempt to break the mould of current thinking he attempted to bend it and where possible accommodate existing belief systems. Obviously, this was impossible for those who took the bible literally, but, unlike Darwin himself, John always believed in the co-existence of science and religion.

During the 1860s, John Lubbock was keen to travel and sometimes did so with scientific friends. In 1861 he hiked in the Alps with Thomas Huxley and John Tyndall, and visited archeological sites in Denmark with zoologist and paleontologist George Busk. Both visits led to a fascination with the respective countries and a deep influence on John's later thinking, and in particular on his view of prehistoric landscapes. During his Swiss visit John had been impressed by the remains of some wooden structures he saw around the shores of Lake Geneva – remnants of a prehistoric lake-dwellers' settlement. These were to later lead to a view of prehistoric man that he hoped to write about for a general audience. The Danish visit was his first foreign trip specifically devoted to archaeological interests. Early 19th century Danish ideas led Lubbock to popularize the Stone, Bronze and Iron Ages – and subsequently to coin the terms Paleolithic and Neolithic for the early and later periods of the Stone Age.

Further archaeological expeditions followed, notably to the Somme River in France, where exciting evidence for the co-existence of early man together with now-extinct animals had come to light. One such journey was made with his lifelong friend and colleague John Evans. Lubbock and Evans had much in common, with both being businessmen who were self-educated in science. Another journey the two men made together was to Halstatt. While there, they both acquired a number of fine stone and bone artifacts, which became the nucleus of Lubbock's archaeological collections. He used them to provide evidence for new theories, to illustrate his publications, and to gather evidence of prehistoric cultures that the public could see for themselves. Much

of the collection is now stored at the British Museum, although some was also donated to the Bromley Museum in Orpington.

Charles Darwin's recurring illness often confined him to his home for extended periods. In October, 1862, he had appeared at the Linnean Society to read a paper, but soon regretted it, as he was obliged to spend the following day in bed. He became increasingly apprehensive about becoming involved in public appearences, or stressful social interactions. A visit from three members of the *Beagle* crew for which he steeled himself by taking "every possible precaution" nevertheless left him "violent shaking & vomiting till the early morning". After such episodes, it was often John or Ellen Lubbock who was the first outside of his family to be granted an audience, even when he had to set strict conditions on a visit's duration.

On November 3 1863, the first meeting of what was to become known as the X club took place. This group of men, who were all to become famous and influential, included the Irish physicist John Tyndall, botanist Joseph Hooker, zoologist and essayist Thomas Henry Huxley, and John Lubbock. One of its members, the physicist and mathematician Thomas Hirst, wrote "Besides personal friendship, the bond that united us was devotion to science, pure and free, untrammelled by religious dogmas". Quickly the membership settled at 9 and remained so until the first death of one of its members (Barton 1990:54).

Ostensibly, it was an informal dining club whose meetings happened to take place monthly before Royal Society meetings. However, it soon became clear that X clubbers became leaders and officers of the various scientific societies, where they defended their friend Charles Darwin from criticism, took an active role in promoting his theories, and transformed the agenda of British science. Weekends at the Lubbock home, High Elms, sometimes saw groups of members and their families gathered together – known as country outings for "the X's and their y'vs". The wives developed good friendships and Ellen Busk and Ellen Lubbock were regarded by the men as particularly intelligent conversationalists. Ellen Lubbock would often relay conversations that took place on these occasions to the Darwins and would in turn carry news of them back to the group (Barton 1998:440).

During the period 1864-1865 John Lubbock was embroiled in a rather acrimonious dispute with the geologist Charles Lyell, who had been one of his longtime heroes. Lubbock had accused Lyell of plagiarism in using some of his words in the latter's book *Antiquity of Man*, which he failed to appropriately acknowledge. Darwin was upset at this dispute between two of his close friends, but took pains not to take sides (Patton 2007:60). However, Darwin was rather disappointed that Lyell had equivocated on evolution in that book, and had not come out more definitively in favour of his ideas. Later, when Lubbock had entered politics, Darwin refrained from entering public debates or controversies on his behalf, but allowed his name to be listed as a supporter.

One of the ways in which John Lubbock saw that he could reinforce Darwin's ideas was to show that mankind had a longer history than the few thousand years allocated by traditional biblical chronology. For John, this meant examining fossil and archaeological evidence. He summarized his thoughts in two books *Prehistoric Times* (1865) and *The Origin of Civilization and The Primitive Condition of Man* (1870). Much of these works consisted of material that has already been published elsewhere.

However, they demonstrated Lubbock's gift for synthesizing the thoughts and findings of specialists, and popularizing them for a wider readership. When *Prehistoric Times* was published, Darwin was pleased with the result, especially the last chapter called "*Savage life*", which he called "admirable & profound" and encouraged Lubbock to further develop the ideas. The book itself was immensely popular with the public, and went through seven editions during Lubbock's lifetime. Today it is little read, as many of its Victorian ideas have been superseded, but at the time it was extremely influential.

During the same year that *Prehistoric Times* was published, John Lubbock first stood for Parliament for the seat of West Kent. He narrowly lost this election by 55 votes, and felt that this loss was in part due to his controversial books on human origins and evolution. It was one thing to assert the antiquity of humankind, but quite another to attempt to reconstruct prehistory and ancient culture from a period that left behind no documentary writings. It is noticeable that successive editions of the books drew more and more on John's own collection of prehistoric artefacts as evidence (Owen, 2006: 17). Indeed, he was considered a leader of the "prehistoric movement," which irritated some theologians and classical historians.

An important means by which John Lubbock sought to make prehistory (and by extension) Darwinism digestible was through imagery. He commissioned a series of 18 paintings by the Canadian artist Ernest Griset. These depicted "everyday life" in various forms of activity and scenes. Faces of people are not shown in detail as not many skulls had been found in order to make educated guesses as to typical features. It is thought that the pictures were produced to illustrate *Prehistoric Times* but, for some reason they were never used. The pictures are significant in the sense that they are one of the first serious attempts to illustrate such scenes, although to the modern eye they seem rather anachronistic and open to criticism over the accuracy of their

Griset's painting of a prehistoric family living in a cave.

content. They drew heavily on John's travels and his discussions with Darwin over the years.

Not all the paintings show people. They are somewhat impressionistic and avoid any direct close-ups of facial features. This isn't surprising, given the uncertainty about what prehistoric men may have looked like (Milner 2007:241). The pictures opposite depict Man as hunter and reflect John Lubbock's view of him as a savage in a harsh environment. The picture below is an example showing Man in his habitat. Calling upon his past experience, this was for John most easily recalled by his visions of what he had seen in Switzerland at the lake dwelling sites.

Another way in which John Lubbock tried to build a stronger body of evidence for his and Darwin's ideas was through his collections. Darwin donated some items to John, but much more was given by other scientists, purchased from dealers, or collected by John himself on his travels. Unlike Darwin, he had plenty of room to display his prehistoric tools and modern items used by "primitive" tribes at his house High Elms. He displayed them in glass cases in the great hall, with the Griset paintings hanging on the walls above. (A version of that room has been re-created at the Orpington Museum in Bromley.)

There are many instances in the correspondence between Charles Darwin and John Lubbock where one asks the other for the loan of a book, a plant or some other object of common interest. Each was obviously aware of the current work of their friend and often the requests are for something that they know would be granted. John Lubbock was a great collector of prehistoric items – both from personal finds and from purchased material. However, his object was not collecting for its own sake but to support study and investigation. Together with his friend John Evans he had one of the best and most well-known collections in England (Owen 1999: 294).

A Griset painting of a lake village.

A mammoth hunt by Ernest Griset.

John Lubbock was eventually elected MP for Maidstone in 1870. Darwin was at best ambivalent about John's entry into politics as he wrote to say on a number of occasions such as this extract from an otherwise congratulatory letter shows:

> But even in the moment of triumph, I must let one little groan escape me for poor deserted science. Anyhow, I know that you will always love your first-born child [i.e. natural history], and not despise her for the sake of gaudy politicks.

A hunter chased by wolves painted by Ernest Griset.
(All the Griset paintings reproduced courtesy of Bromley Museum & the Lubbock family.)

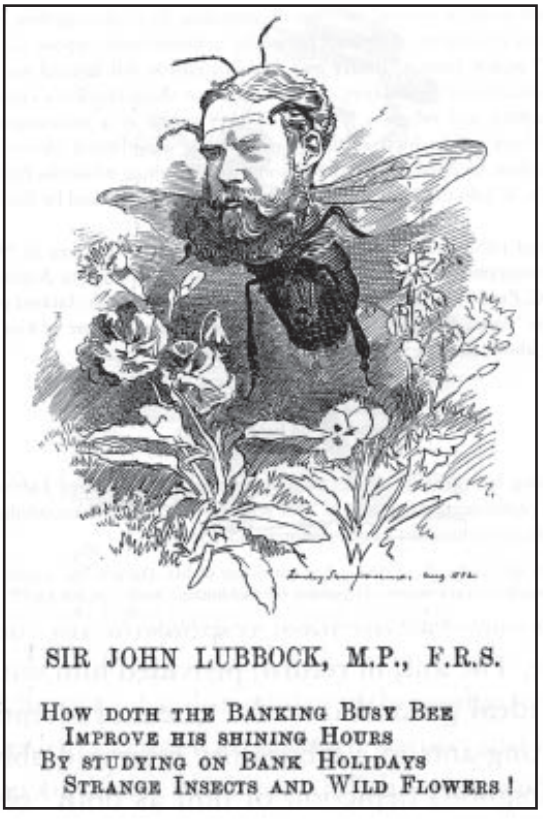
John was not deterred as he saw that Parliament could provide a vehicle for carrying forward his agenda of improving the lot of the population. In this he was guided by his view that civilization involved the general improvement of mankind. This idea was much encouraged by the prevailing atmosphere of Victoria as benign queen reigning over the British Empire, and John himself was a creature of that system. He therefore saw it as a moral duty to help lift people out of poverty and ignorance – a very paternalistic view to modern eyes.

In the same year, John's second major work on Anthropology was published. This was *The Origin of Civilization and the Primitive Condition of Man* (1870). This work built upon the ideas of *Prehistoric Times* and explored the world of Man in greater depth. Again, the book was very successful from the outset and ran to many editions. Much of it was concerned with religious belief and ritual, a subject to which he returned on subsequent occasions. In this exploration Lubbock betrays his paternalistic attitude in his conclusion that "savages have the character of children with the passions and strength of Men".

Right from the start Lubbock uses the idea that modern "savages" can teach us a lot about Primitive Man. He believes that they are the best guide we have in the absence of a formal historical record. They illustrate much of what may have been and he likens them to fossils in which a past can be read. Generally speaking the book also shows John's optimistic attitude and his view that "the past history of Man has, on the whole, been one of progress".

One of John's first acts upon becoming a Member of Parliament was to introduce the first Bank Holidays which are now a normal part of British life. They were very well received by the majority at the time. Just how much John had been associated with Darwin in public perception was illustrated by a *News of the World* article which suggested that John should be presented with "a testimonial in the form of a silver type of Darwin's ape".

Although a life in politics reduced Lubbock's time spent with scientific pursuits, it certainly did not halt it. He continued to seek evidence for pre-history and sought opportunities to extrapolate what the origins of human cultures were like at or before the dawn of history. Thus in 1873, he



A *Punch* cartoon of Sir John Lubbock as the "Busy Bee".

An entry in Amy Lubbock's scrapbook showing Darwin alongside her father, John (later Lord Avebury)

visited Troy where Heinrich Schliemann was undertaking his now famous excavations hoping to turn Homeric myth into historical fact. This resulted in renewed interest in late Bronze and Iron Age and considerable correspondence with many of his colleagues.

Part of this interest was in matters closer to home. For some time the village of Avebury had been the subject of unwelcome attentions of Victorian property developers. The village was based around and within an ancient stone circle and housebuilders had been using the stones as the basis for building new houses. They did this either by taking them away whole or by chipping pieces off. You can still see some of the marks

today. John Lubbock was approached by the local vicar and asked if he could do something. He chose direct intervention and his journal simply records "Bought Abury".

Later, he was to enshrine this protection in law by bringing the Ancient Monuments protection Act to Parliament. This and a partial prohibition of imports of bird plumage were among his protectionist measures aimed at preserving the past and preserving species. The Ancient Monuments Act was confined to prehistoric sites because it stood more chance of success by being limited in that way. Of course this brought the question of the age of such sites into sharp relief and there were some who regarded Avebury as post-Roman. The site at Avebury meant so much to him that he chose the title Lord Avebury when he was elevated to the peerage in 1900.

John Lubbock's eldest daughter, Amy, kept a scrapbook of autographs and letters which serve well to record some of the comings and goings to the family home in the latter half of the nineteenth century. She had these illustrated where possible and on page 73 is a page from her scrapbook showing a picture of Charles Darwin that he gave to the young Amy when she was 21. The tone of the Darwin entries illustrates the respect that the Lubbock children had for him and his celebrity status.

In April 1874, Darwin asked John Lubbock to finally sell him the parcel of land adjoining Down House, which included part of the Sandwalk, the "thinking path" Darwin had built through his woods and fields. Up to this point the Darwins had simply been leasing it, but considered it a familiar and vital part of their grounds. Many years earlier, in 1846, Darwin had written to John's father expressing gratitude for his having granted access to the "little piece of land". John agreed to sell, but only after determining its full market value from a local estate agent and offering it at full price. This hard-nosed business approach, which John had learned from his banker father, did not go down too well with members of his "other" family. who thought their close and longstanding friendship should have entered into the deal. (Some 30 years earlier, Charles had written to his sister Susan "old Sir John" (John's grandfather) "was [reputed to be] a very kind man to those who knew him but a most keen, harsh man of business".

There was a cooling of relations between the families for a while, although Charles and John continued to correspond on many matters. Ellen Lubbock was in the meantime picking up on some of her scientific interests. In 1875, to commemorate the publication of Darwin's book on "Insectivorous Plants," she wrote a charming, whimsical light verse, which is reproduced opposite. She titled it "From the insects to their friend, Charles Darwin".

John Lubbock studies his live captive colony of ants under glass.

From the Insects to their friend Charles Darwin.

We saw that you were watching us,
We felt you were our friend,
And as we, in a general way,
Come to a fearful end.

It suddenly occurred to us,
That we would have a look,
At what you said about us,
So we crawled upon your book.

We now have buzzed all over it,
And find that, as we feared,
Voracious plants could tell us
How our friends have disappeared.

(I never trusted Drosera,
Since I went there with a friend,
And saw its horrid tentacles
Beginning all to bend.

I flew away, but he was caught,
I saw him squeezed quite flat –
I don't go any more to plants
With habits such as that.)

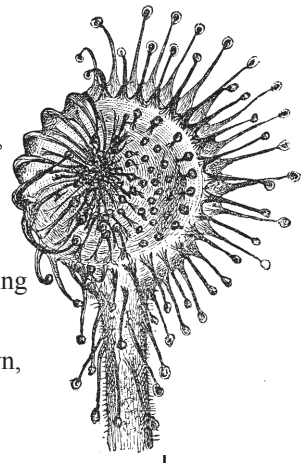
We are very much obliged to you,
For now of course we shan't
Be taken in and done for
By any clever plant.

But this has to be considered:
It isn't much we need,
But if we daren't go to any plant,
On what are we to feed?

We feel that you, in pointing out
The dangers that we run,
Have meant to do the kindest thing
To us that could be done.

Therefore, to your abode in Down,
With joyful buzz and hum,
From every quarter of the globe,
We insects all will come.

Great plates of honey you will set
For us upon your lawn;
Will feast away & bless the day
That ever you were born!



Written by Lady Ellen Lubbock for Charles Darwin on the occasion of the publication of his book on "Insectivorous Plants," in July 1875.

Darwin was delighted by the verse and wrote back to Ellen to tell her so. John Lubbock's most famous and popular work on natural history was on *Ants, Bees and Wasps* (the hymenoptera). His studies had begun early in life, and were fully supported by his wife, Ellen. At one point Darwin informed Emma that Lubbock's studies of aquatic hymenoptera had produced the observation that they were able to remain underwater for extended periods. She asks him how he determined that fact, and Darwin replied that "Mrs Lubbock sat for 4 hours watching"– an indication of her own enthusiasm (Somkin 1962:188).

Among the exhibits at High Elms were John's ants which he kept in display cases stacked in a structure of his own invention. The studies of these insects brought John Lubbock renewed fame as his book *Ants, Bees and Wasps* began selling in large numbers. This prompted the evolutionist Henry Drummond to comment: "A few years ago under the distinguished patronage of Mr Darwin, the animal in vogue with scientific society was the worm. At present the fashionable animal is the ant." One modern author writes that Lubbock effectively combined experimentation with parlour entertainment (Clark 1997:14).

Just how much Ellen Lubbock kept up her knowledge of insects is revealed by an article she wrote for the science journal *Nature*, which appeared in the edition of 15 July 1875. This is a critique of a work by Fritz Müller entitled "Addition to our knowledge of the termites". A year later she repeated the event by writing a longer article on Darwin's publication *The variation of animals and plants under domestication*.

This is a very positive review, largely intended to convey content rather than offer criticism of any kind.

Darwin was, through John Lubbock, often introduced to men outside his own scientific sphere. Lord Morley records a weekend party at High Elms in 1876, which included Morley, Huxley, Playfair and William Gladstone. On the Sunday afternoon they all went to Downe House "whence in his quiet Kentish village Darwin was shaking the world". Darwin and Gladstone had not previously met and whilst Gladstone was very talkative, Darwin was much the contented listener. Darwin remarked that he was honoured "that such a great man should come and visit me". Gladstone, on the other hand, was a little bemused at Darwin's quiet modesty and apparent simplicity (Grant Duff 1924:19).

The Lubbock home at High Elms was often the meeting place for scientists of different disciplines. On one occasion, in 1878, the pioneer of the telephone, Alexander Graham Bell, was invited with some colleagues, to "bring his apparatus" for an experiment to test the hearing and communication of ants (Keynes 2003: 20). The idea was to use the telephone to link groups of ants in one room to those in another by means of the telephone; listen out for sounds from ants in general and then also disturb one group and look for reaction in the other. The results were negative, but it serves to illustrate that Lubbock was always on the lookout for hitherto unseen talents in other species. He tended to anthropomorphize ants reading things into their societies that he saw parallels with those of humans. Perhaps this was inevitable given his quest to understand the details in order to hopefully provide small pieces in the chain of evidence supporting Darwin?

The Lubbock home at High Elms was a showcase for Darwinian ideas and the antiquity of Man, through the collections built up over John's lifetime. These collections drew in scientists and non-scientists alike and Lubbock loved showing them. The visitor's books of the house read like a who's who of Victorian society – politicians, scientists, artists, religious leaders and many other interested parties. All were invited to view what was on show; even friends found that there was usually something new to see.

Entries in the Lubbock family Guest Book during 1878.

There was a footpath (which still exists) through the High Elms estate which was the regular route between Lubbock's house and Down House. Often the two men would walk together on this path discussing matters of common interest. One such matter was their common interest in Education, and in particular the role of science in the curriculum. Together, Darwin and Sir John Lubbock senior, helped establish Downe School and continued to support it after the younger John succeeded his father. The desire to spread knowledge to the mass population was a long standing theme in the Lubbock family and it was a principle to which Darwin also gave his whole hearted support.

In 1879, Ellen Lubbock died after a short illness at the relatively young age of 44. Charles Darwin was quick to write in sympathy "I … tell you how deeply I sympathise with you in your dreadful loss. It is a terrible calamity. She used to show in every word and her expression how devotedly she loved you. Her image, so bright and beautiful now rises clearly before my eyes, as I saw her first years ago in the Crystal Palace." (Patton 2007:141) Charles Darwin had often apparently been captivated by her lively and somewhat capricious spirit.

In 1881, John Lubbock gave the 50th anniversary address of The British Association, of which he was then president, consisting of a review of scientific progress over those 50 years. A large proportion of the review considered the work of Darwin. Naturally, Lubbock expressed much appreciation of his mentor's achievements. There was certainly a sense of the closing of a chapter in the expression of these remarks. Afterwards Darwin wrote to Lubbock "I have read with pleasure your Address. You have piled honours high on my head". (Hutchinson 1914:176)

Throughout the period of their friendship, Darwin had set John Lubbock off on trains of thought that could lead to the latter spending what could amount to large amounts of time on projects. At first this was in the nature of teacher and student for simple learning, but it became a habit, driven by John's natural curiosity. A good example is a seemingly casual question posed by Darwin to Lubbock in asking what causes leaves to be the shape they are. This culminated in a book from John on that very subject published in 1881, in which the view that leaves' shapes are the result of environmental factors and the needs of the whole plant or tree, was carefully laid out (Lubbock 1886).

A significant entry appears in John Lubbock's diary on Sunday 19 March 1882. He writes "Went up to Darwin's", and then as a postscript "the last time I saw him". Charles Darwin died on the following 20 April. John expressed his sadness with the wistful remark "For thirty years he has been very good to me, and a talk with him was as good as sea air". It is interesting to note that he omits the first ten years of his acquaintance with Darwin and starts from his adulthood.

1909 saw the 100th anniversary of Darwin's birth and shortly after the 50th of *The Origin of Species*. At a celebration to mark both Darwin and his fellow evolutionist Alfred Wallace, John Lubbock spoke of his relationship with Charles Darwin with the words:

> I am one of the thousands whom Darwin has inspired by his writings, and of the few still living who have had the inestimable privilege of his friendship.

One reason that the Darwin-Lubbock relationship is under especial scrutiny at present is that there is a bid to get some of the land in and around Downe, Darwin's home from 1842, adopted as a World Heritage Site. The parcel of land under consideration includes a significant portion of High Elms, the Lubbock's family estate. Part of the case for proposing the boundaries of what constitutes the site is that the landscape can be said to have contributed to their ideas on evolutionary theory and early humankind.

Both Charles Darwin and John Lubbock seemed to draw significant inspiration from the local countryside. Many clues in the local environment remain today – from the "orchis bank" where Darwin studied Britain's native orchids, to the ponds in High Elms where young Lubbock caught his water fleas. Badgers and foxes still trot across Darwin's fields and woods, and the local "humblebees" still pollinate the flowers in Darwin's garden.

The whole story of the Lubbock and Darwin families is one of serendipity and great good fortune. Most of John Lubbock's scientific endeavours throughout his life were aimed at reinforcing and expanding on the Darwinian story. From the chance of living in such close physical proximity, Charles Darwin and John Lubbock forged a lifelong bond and intellectual alliance that had an enormous influence on furthering our understanding of the natural world and of mankind's immense, ongoing journey.

References used in writing this article

Barton, Ruth. 1990. An influential set of chaps: The X-club and Royal Society politics 1864-85. *British Journal for the History of Science*, 23:53-81.

Barton, Ruth. 1998. Huxley, Lubbock and half a dozen others. *Isis*, 89:410-444.

Clark, John. 1998. *Making sense of John Lubbock*, University of Kent.

Darwin, Charles. 1871. *The descent of Man, and selection in relation to sex*, John Murray.

Eade, K.R. 1977. *The Farnborough Rifle Corps*. Private publication.

Grant Duff, Ursula (ed.) 1924. *The life-work of Lord Avebury*. Watts & Co.

Hutchinson, Horace. 1914. *The Life of Lord Avebury*. MacMillan.

Keynes, Randall. 2003. *Darwin, Lubbock and the brain of an ant*. Cambridge University Discovery lecture.

Lubbock, John. 1886. *Flowers, fruits and leaves*. Longmans.

Milner, Richard. 2007. *Portraits of Prehistory: Imaging Our Ancestors*, from *The Last Human: A Field Guide to twenty-two Species of Extinct Humans*. Yale University Press.

Owen, Janet. 1999. *The collections of John Lubbock*. PhD thesis, University of Leicester.

Owen, Janet. 2006. Collecting artefacts, acquiring empire. *Journal of Material Culture*, 4(3):283-302.

Patton, Mark. 2007. *Science, Politics and Business in the work of Sir John Lubbock*. Ashgate.

Somkin, Fred. 1962. The contribution of John Lubbock to the Origin of Species. *Notes & Records of The Royal Society*, 17(2):183-91.

Stocking, George. 1991. *Victorian Anthropology*. MacMillan Free Press.

Other sources of information

Lubbock correspondence, The Royal Society, British Library & Lubbock family archive.

Darwin correspondence, published by Cambridge University, online & at Down House.

Diary of Harriet & John Lubbock, Lubbock family archive & British Museum.

‘I thought I’d try the telephone’ – Darwin, his disciple, insects and earthworms

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Darwin’s work with his many collaborators on the species question is well known. A cluster of interests he pursued with his disciple John Lubbock reveal another facet of his fascination with natural life.

When the eighteen-year-old Charles Darwin enrolled as a theology student at Cambridge University, he joined a group of friends in a passion for collecting beetles. He easily remembered ‘the exact appearance of certain posts, old trees and banks where I made a good capture’. ‘One day, on tearing off some old bark,’ he recalled in his autobiography*:*

Photo of Darwin by Maull and Polyblank, 1857.

> I saw two rare beetles and seized one in each hand; then I saw a third and new kind, which I could not bear to lose, so that I popped the one which I held in my right hand into my mouth. Alas it ejected some intensely acrid fluid, which burnt my tongue so that I was forced to spit the beetle out.

In 1831, Darwin abandoned his plan to spend his life as a country clergyman, and became *HMS Beagle's* naturalist for her five-year surveying voyage round the world. After returning to England in 1836, he married his cousin Emma Wedgwood in 1839 and in 1842 they moved to Down House, a modest 'gentleman's villa' near the village of Downe in Kent. At the other end of the village was High Elms, the imposing mansion and country estate of the distinguished banker and astronomer Sir John Lubbock, who was a Whig grandee and Vice President of the Royal Society.

Lubbock's eldest son, also called John, was to become Darwin's pupil and protégé as a naturalist. When he was four, Lady Lubbock wrote of him in her diary: 'His great delight is in insects. Butterflies, caterpillars or beetles are great treasures, and he is watching a large spider outside my window most anxiously'. His father tried to coach him in mathematics, but was disappointed when the youngster showed no aptitude.

In 1842, when young John was eight, his father came home one evening and announced that he had a great piece of news. 'He made us guess what it was, and I suggested that he was going to give me a pony. 'Oh', he said, 'it is much better than that. Mr Darwin is coming to live at Down'. The eight year-old was disappointed but eventually came to see how right his father had been.

John was sent to Eton College for a classical education but had to leave in 1848 when he was fourteen because his father's two partners in the family bank had fallen ill and Sir John decided he must bring his son into the business. From then on, the young John worked with his father at the bank in Lombard Street, where 'I was at first of course very much at sea, and found the City very lonely'.

That summer, at High Elms, he started a nature diary:

> 'August 19th. Found a many-coloured moth, violets in flower, also Laburnum. Found a large black spider in the garden. Very wet. Saw some wild ducks.'

> 'August 21st. Went to see Mr Darwin. Ordered a sweeping net. Caught a weevil with a red back and black legs.'

The diary entry for 21 August is the first record of Darwin's guiding the boy in natural history, a relationship that was to last through the rest of his life. Darwin had advised John to obtain a coarse, sturdy net for 'sweeping' through grass and shrubbery for insects. A week after catching the weevil, John went again to Down House and Darwin gave him a carrion beetle for his collection.

At that time, natural history ranked far below astronomy and physics in the hierarchy of the sciences. Naturalists squinted down into their microscopes, while the astronomers pointed their telescopes up to the heavens. But Darwin persuaded Sir John to give his son a naturalist's microscope for Christmas, one of the special kind he was using for his own work anatomising and classifying barnacles. From then on, Darwin became John's guide in dissection and taxonomic description. Unlike Darwin, who couldn't draw very well, John became an excellent draughtsman and eventually made a number of meticulous anatomical studies for his teacher.

Portrait of John Lubbock in 1851, aged 17 (by Maull & Co Piccadilly & Cheapside).

Sir John was a high-minded Whig financier; Lady Lubbock was devout, and John followed his parents dutifully in their principles and faith. He customarily rose at 6.30 am, said his prayers, read Bible verses, and had ten minutes of mathematics with his father before breakfasting at 8 am. Then he read natural history for half an hour, prayed for the same time, had two hours at his microscope, studied natural history for one and a half hours, and had lunch. Then two hours outside followed by poetry, political economy, and tea. Each day ended with an hour of science, then history, whist, mathematics and sermons, a final half hour of prayers, and bed. It was an arduous life for a youth born to wealth and privilege.

During the first years of their friendship, Darwin was working in his study at Down House on the barnacles of the world, carrying out an exhaustive study of the taxonomy of that one sector of the animal kingdom in order to be able to write with knowledge and authority on one important aspect of the 'species' question. He found John an eager and perceptive pupil. In natural history, John did not follow the uncritical routine he was subjected to at home. Instead, he began to think critically, to seek patterns and differences, the universal and the particular, in the natural world. He picked up one of Darwin's fundamental concerns – what is a species, what is a variety, and what are the boundaries between them? When he read Darwin's *Voyage of the Beagle,* his notes reflected his fascination with Darwin's questions about the distribution of reptiles, birds and plants on the different islands of Galápagos, and their implications for the origin of species.

When John turned fifteen, Darwin proposed him for membership of the Entomological Society of London, where he was accepted in 1851. Darwin told another naturalist: 'He is a remarkably amiable, pleasant young man, and has a strong taste for dissecting insects.' He was thus, in Darwin's view, becoming an analytic entomologist, not a mere bug collector.

In April 1852 John used his microscope and a camera lucida to illustrate minute water-creatures. He was studying them very possibly at Darwin's prompting as they had been Darwin's first strong interest as a young naturalist while he was a medical

Lubbock's watercolour of *Infusoria*: Courtesy of Lyulph Lubbock.

student at Edinburgh. In one illustration of a number of *Infusoria,* John included a microscopic marine organism like a spider's web from the Cape of Good Hope. This minute structure was very possibly provided by Darwin from his attic-full of specimens from the *Beagle* voyage which he had not yet been able to place with experts for identification and description.

Later that year Darwin gave John a specimen from Brazil for dissection. The fledgling naturalist identified it as a new species of copepod, a marine invertebrate of which the male has a hugely enlarged claw simply to clasp the female for sex. He named the species *Labidocera darwinii* in tribute to his teacher and showed the male's claw in his paper describing it (*Annals and Magazine of Natural History*, 1853). Many years later Darwin illustrated the claw in his treatment of sexual differences within species in *The Descent of Man* (1871).

The illustration of the male claw of *Labidocera* in *The Descent of Man* (1871) vol. 2 p.329.

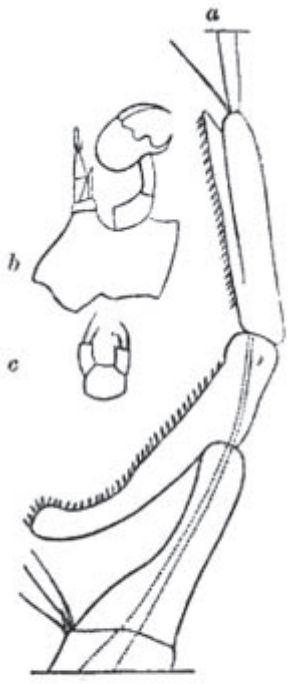


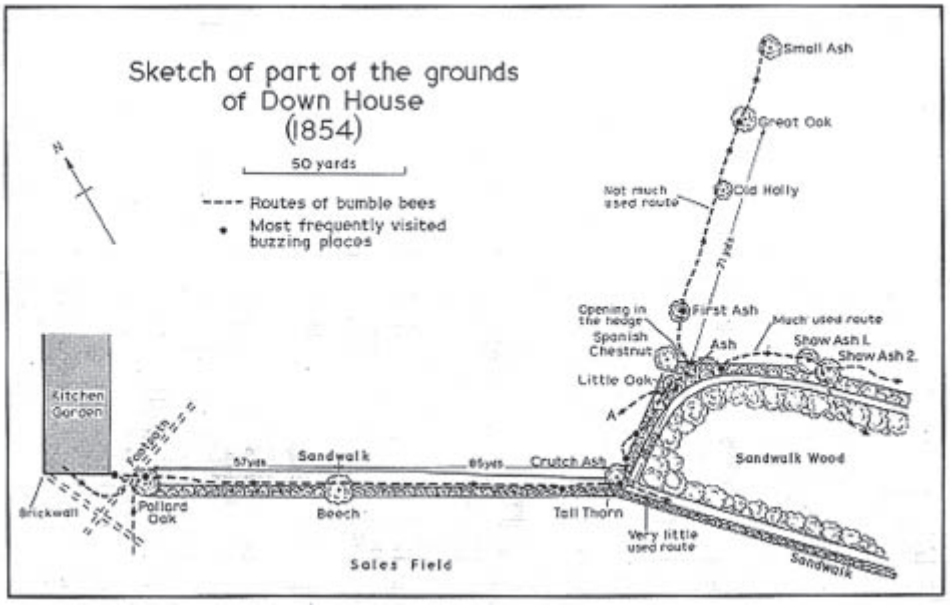
Fig. 3. Labidocera Darwinii, (from Lubbock).

a. Part of right-hand anterior antenna of male, forming a prehensile organ.
b. Posterior pair of thoracic legs of male.
c. Ditto of female.

Darwin gave him next some freshwater Entomostraca from Brazil, minute Crustacea of which *Daphnia* are the most familiar genus in Britain. One day, John wrote in his diary: 'Took my work up to Mr Darwin. … Brought home some *Daphnia* from Down Pond.' (The pond was on the road between Down House and High Elms.) Darwin must have pointed out the link between the specimens from Brazil and the organisms in the horsepond along the road, and suggested that John make the comparison. John studied his *Daphnia* under the microscope and was fascinated by their two ways of producing eggs. He investigated their reproductive physiology and eventually wrote a paper, on the strength of which he was elected to the Royal Society at the exceptionally early age of twenty four.

Darwin had given up collecting beetles after the *Beagle* voyage but through John's fascination with insects, was able to relive his old passion. In September 1854 he found a puzzling beetle, checked it in an insect book and sent it in a bottle to John, hoping he could identify it for him. 'I feel like an old war-horse at the sound of the trumpet, when I read about the capturing of rare beetles,' he wrote. 'Is not this a magnanimous simile for a decayed entomologist?'

That same month Darwin also focused on bumblebees with his own children. One of his sons had noticed that bumblebees were hovering near the base of an ash tree in their field, and suggested there might be a nest there. Darwin and his son searched but couldn't find one and then saw that the bumblebees were all coming from one direction and leaving in another. Darwin took a pot of flour from the kitchen, tied a cooking brush to a stick, posted his children along the flight path and then dusted each bumblebee as it came to the tree, so that his children could run after them to their next 'buzzing place' and map the route on from there. Working in this way they eventually found eleven buzzing places over a distance of three hundred yards to the kitchen garden wall, but they lost the trail when the bumblebees flew over the wall. Darwin dusted and the children chased through three summers, but he couldn't work out how and why the bumblebees chose the buzzing places and visited them as they did. He recognized that they were all young males that had been expelled from their home nest, and looked for any queen bumblebees they might be looking out for along the way, but never saw one. He'd found a pattern and teased it out with his children, but he couldn't answer the riddle.



R.B. Freeman's version of Darwin's sketch map in his article, 'Charles Darwin on the routes of male bumble bees'. *Bulletin of the British Museum (Natural History). Historical Series* Vol. 3, 1968, pp. 177-189.

Around this time, Darwin was working hard to prepare his theory of evolution and natural selection for publication. In April 1856, he held a critical discussion at Down House with Thomas Huxley, the botanist Joseph Hooker and the entomologist Thomas Wollaston, to test his theory against their questioning and see whether it was strong enough to risk announcing to others. He invited John, now twenty two, to join them for dinner, addressing him as 'Lubbock', now that he could treat him as a scientific colleague.

In 1857, Darwin showed Lubbock some notes on the proportions of various groups of plant in different parts of the world, offering rough statistical evidence, he hoped, for the role of a principle of divergence in evolution to explain what we now recognize as the global phenomenon of biodiversity. Lubbock's mathematics, if not up to his father's, was stronger than Darwin's, and he suggested a better way of presenting the calculation. Darwin wrote to him:

> You have done me the greatest possible service in helping me to clarify my brains . … I am quite convinced yours is the right way. … I am quite shocked to find how easily I am muddled. … What a disgraceful blunder you have saved me from. I heartily thank you.

Another key element in Darwin's species theory was the fact and extent of variability in natural forms. Lubbock gave Darwin an excellent example in an insect. He had been dissecting the microscopic nerve bundles of the scale insect, *Coccus,* all too familiar to every gardener as a destructive pest. Darwin wrote in *On the Origin of Species* (1859) that you would expect the branching of the main nerves close to the great central ganglion of an insect to be fixed in each species.

> Yet quite recently Mr Lubbock has shown a degree of variability in these main nerves in *Coccus*, which may almost be compared to the irregular branching of the

> stem of a tree. This philosophical naturalist, I may add, has also shown that the muscles in the larvae of certain insects are very far from uniform.

Darwin's phrase for his young colleague, 'this philosophical naturalist,' was high praise, suggesting a person who is always comparing and analyzing as he makes his observations, alert to points that may be of wider significance.

In the final months before publication of *On the Origin of Species,* Lubbock looked on and learnt about Darwin's experimental methods as he tackled one of the strongest possible challenges to his theory – the extraordinary geometrical perfection of the honey-bee's comb-making instinct. Darwin needed to be able to explain how such remarkable craftsmanship might be the outcome of simple bee behaviour evolved from habits with other functions, rather than evidence of the hand of an omnipresent and all-powerful Creator. Working with Mr Innes, the local vicar, he obtained a special bee-hive with removable frames to observe how bees built their honeycomb. By colouring the wax he gave the bees to start their combs from, he established how they worked. The evolved instinct led the bees

> to sweep equal spheres at a given distance from each other in a double layer, and to build up and excavate the wax along the planes of intersection. The bees, of course, no more knowing that they sweep their spheres at one particular distance from each other, than they know what are the several angles of the hexagonal prisms and of the basal rhombic plates.

He concluded,

> Thus, as I believe, the most wonderful of all known instincts, that of the hive-bee, can be explained by natural selection having taken advantage of numerous, successive, slight modifications of simpler instincts.

In the days after the publication of *On the Origin of Species* Darwin listed which men of science he knew to be for the theory and which were against. Although Lubbock was still only twenty five, his views were important to Darwin, and Darwin wrote to a friend that Lubbock was an 'enthusiastic convert'. Through the years that followed, Lubbock became one of his most active and influential supporters in scientific circles in London. He was a founder member of Huxley's 'X Club,' an elite group who met informally to set the agenda for progressive British science.

Lubbock was now an assured writer on natural history, and declared boldly in *The Entomologist's Annual* for 1858 that:

> The present has been called the age of insects; this century at least might be called the age of collections of insects, and not of insects only, for we have collections of almost everything, of shells and stuffed birds, of ferns and flowers, of grasses and coins, of autographs and old china. … Mr Darwin once expressed to me his surprise that he had never met with anyone who collected odd-shaped biscuits.

Lubbock had developed a special fascination with insects as 'very favourable subjects for those who wish to examine that most wonderful of all machines – an animal.' He wrote,

> A small Geneva watch is considered interesting, because the machinery is so delicate; but what shall we say then of a beetle, which, though no larger than a pin's head, can see, taste, touch and probably hear, … which having eaten a little sugar turns it into

Sir John Lubbock in 1870.

> chitine, blood and nerves, to say nothing of four wings, six legs, many hundred muscles and several thousand eyes? Any entomologist who attempts dissection will find before him an intricate and apparently confused labyrinth of nerves, tubes and vessels – a sort of Gordian knot, more easy, alas, to cut and spoil, than to unravel; a little microcosm.

There was also wonder in the strange beauties that organisms could reveal in their life-changes. One magical process was the transformation from insect larva to adult. In 1863, Charles Kingsley, the clergyman and writer who was an enthusiast for Darwin, gave children a vivid account of natural metamorphosis in his evolutionary fantasy, *The Water Babies*. In the third chapter Tom the chimney-sweep met a strange six-legged donkey-faced creature on the bed of a stream. '"I want to split," the creature insisted. "Don't speak to me! I'm sure I shall split!" … and at last – crack, puff, bang – he opened all down his back, and then up to the top of his head.' A soft, slender creature emerged from the skin and began climbing feebly up a plant stem to the surface. Tom peeped out to see what would happen.

> And as the creature sat in the warm, bright sun, a wonderful change came over it. It grew strong and firm; the most lovely colours began to show on its body, blue and yellow and black, spots and bars and rings; out of its back rose four great wings of bright brown gauze; and its eyes grew so large that they filled all its head, and shone like ten thousand diamonds. … The thing whirred up into the air … "I am a dragon-fly now, the king of all the flies."

On a June day that same year, Lubbock observed a mayfly larva under his compound microscope and wrote in his diary:

> This morning I noticed a full grown larva which had a glistening appearance, evidently owing to the presence of a film of air under the skin. I put it under a low power and then, having added a drop more water with a pipette, I put the pipette down and

> looked through the microscope. … I had scarcely waited two minutes when I had the satisfaction of seeing the skin crack and the insect come out. The thorax came first, the abdomen last. … In an instant the insect spread its wings and flew to the window. … From the time the skin on the thorax burst till the moment when the insect flew away was certainly not so much as ten seconds; I timed it by my watch. The gills were vibrating the instant before. Respiration – I counted 50 beats in a minute.

In 1865 Lubbock's father died and he succeeded to the baronetcy. In 1867, the new Sir John was President of the Entomological Society of London. In his annual address he mentioned that the latest edition of *On the Origin of Species* contained many fresh points from entomology including some suggestions on 'the influence which insects have exercised on the beauty of flowers'. Flowers that depend on insects for pollination, are conspicuous and beautiful 'so that they may be easily observed by insects'. He recognized that this claim about the function of flowers was a supposition, but 'We obtain from these facts the best evidence that insects possess the faculty of perceiving and distinguishing colours.' So much about insects' faculties remained to be discovered, and Sir John looked forward to contributing himself to the study.

Darwin had a way with insects, calm, patient and always discreetly enquiring. On 8 September 1868, sitting in the drawing room at Down House, his wife Emma watched as

> a wasp settled on Charles's face and put its proboscis into his eye, to drink the moisture apparently. He got up very quietly from the sofa and stood looking at himself in the glass till the wasp moved. A sting on the eye ball would have been horrid.

Sir John followed Darwin in this approach. In September 1872, the *Daily Telegraph* reported:

> One of the most curious attendants this year at the gathering of the British Association [for the Advancement of Science] in Brighton was a little gentleman in brown overcoat, with black and yellow nether garments, wearing a sharp sword poisoned at the tip. We are inclined to think that … this visitor might be called by far the most remarkable and best worth attention among all the assembled notorieties. It was Sir John Lubbock's pet wasp; and the respect which would naturally be paid to any friend of the benevolent savant, … was really due to this insect on its own account.

A cartoon in *Punch* of Sir John Lubbock and his wasp.

Early that summer, while on holiday in the French Pyrenees, Sir John had captured a small mountain wasp with her nest, and brought her back to England on the train. He wrote in his best-selling *Ants, Bees and Wasps* (1881):

> I had no difficulty in inducing her to feed on my hand; but at first she was shy and nervous. She kept her sting in constant readiness; and once or twice in the train, when the railway officials came for tickets, and I was compelled to hurry her back into her bottle, she stung me slightly – I think, however, entirely out of fright. Gradually she became quite used to me, and when I took her on my hand apparently expected to be fed. She even allowed me to stroke her without any appearance of fear, and for some months I never saw her sting.

When winter came in England, the wasp fell into a drowsy state. Sir John hoped she would hibernate and survive the winter.

> I kept her in a dark place, but watched her carefully, and fed her if ever she seemed at all restless. She came out occasionally, and seemed as well as usual until near the end of February, when one day I observed she had nearly lost the use of her antennae, though the rest of the body was as usual. She would take no food. Next day I tried again to feed her; but the head seemed dead, though she could still move her legs, wings, and abdomen. The following day I offered her food for the last time; but both head and thorax were dead or paralysed; she could but move her tail, a last token, as I could almost fancy, of gratitude and affection. As far as I could judge, her death was quite painless; and she now occupies a place in the British Museum.

Sir John's wasp, *Pollistes biglumis*, sits today transfixed by its pin on a cork in the Natural History Museum. The Museum's Register of Accessions records that the specimen is the one Sir John took to the British Association meeting.

While Sir John was working at his microscope on insect anatomy, Darwin had been developing a special interest in the behaviour of social insects, especially ants and bees. Both creatures were bywords for cooperation and hard work, but Darwin had to point out in *On the Origin of Species* how they had developed instincts, clearly essential for survival, that defied a liberal view of natural values. Darwin had studied the 'odious' slave-making instinct of certain ant species in the wild, and interfered experimentally in a number of situations to see how different ants recognized and treated each other. He declared that the queen-bee's 'savage instinctive hatred' of her daughters was essential for the good of the bee community according to 'the inexorable principle of natural selection'.

Sir John Lubbock's pet wasp, now in the Natural Hiatory Museum

Darwin wrote in *The Descent of Man* (1871) that the size of the human brain compared with that of apes is 'linked with … higher mental powers', and he considered ants the mental giants of the insect world. 'In ants the cerebral ganglia are of extraordinary dimensions,' he wrote, and 'many times larger than in the less intelligent orders, such as beetles'. Yet he marveled that ants conducted their –

> extraordinary mental activity with an extremely small absolute mass of nervous matter: thus the wonderfully diversified instincts, mental powers, and affections of ants are notorious, yet their cerebral ganglia are not so large as the quarter of a small pin's head. Under this point of view, the brain of an ant is one of the most marvellous atoms of matter in the world, perhaps more so than the brain of a man.

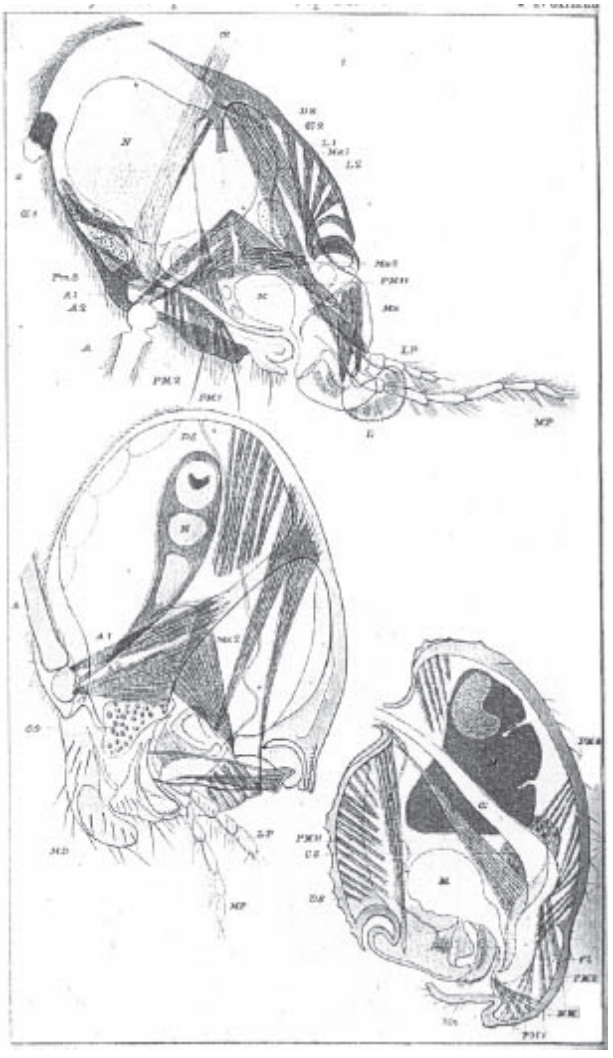
That suggestion by a Victorian gentleman in a community of scientists that considered mankind, and Englishmen in particular, to be the summit of perfection in the history of life, was a bold challenge to the arrogance and complacency of his class and time.

By the early 1870s, Sir John had become a leading figure in Britain's political and scientific establishment. With his involvement in Parliamentary affairs and his eminent house-guests each weekend at High Elms, Darwin now held him in awe, but they remained committed to their shared interest. In 1872 Sir John started an intensive investigation of insect behaviour and communication, following Darwin's example of close observation and experiment but developing his own methods for studying colonies in his own special enclosures rather than in the wild. He started with bees and wasps, finding apparent indications that they didn't tell their fellows about places where they had found honey, and so 'concluding that they are not in the habit of communicating facts'. Wanting to know whether bees could hear, 'I tried one of my bees with a violin. I made all the noise I could, but to my surprise she took no notice. I could not even see a twitch of the antennae'.

After a time, Sir John found ants easier and more rewarding to work with, first observing nests in the garden, then creating his own colonies in special frames of wood and glass stacked around his study. He kept up to thirty or forty colonies at a time, marking individual ants with spots of paint and then tracking them through the hours. One phrase is repeated day after day in his diary: 'Watched ants.'

Sir John was fascinated by insects' intricate interactions in a colony and the patterns of their social life. He believed he could identify a wide range of quasi-human qualities in their behaviour, such as social organization and harmony, industry, cleanliness, sport, sense of strategy, prudence and providence, helping the young, helping prisoners, pity and humane feelings, helping insensible and intoxicated friends, provident behaviour, building homes and roads, farming, domestic service and the moral effects of slavery, republicanism and loyalty to the queen! His own strong liberal values are clear in his understanding of what he saw, but he recognized some moral imperfections, ants' indifference to their friends and their hatred of outsiders.

Sir John was intrigued by the complexities of ants' dealings with each other, and the constant messages that must be passing between them. 'One cannot but long to know more of their character, how the world appears to them, and to what extent they are conscious and reasonable beings.' To find out whether ants recognized their fellows by appearance or some sign or password, he experimented to see if an ant could



Lubbock's illustration of the anatomy of an ant's head.
The Monthly Microscopical Journal (1877).

identify a friend when the friend was in 'a state of insensibility'. He chloroformed friend and stranger ants for his trials but couldn't see any difference in the watching ants' reactions and wondered whether that might simply be because the chloroformed ant appeared to be dead. 'I therefore repeated the experiment,' he wrote, 'only, instead of chloroforming the ants, I intoxicated them. … The sober ants seemed somewhat puzzled at finding their intoxicated friends in such a disgraceful condition, took them up, and carried them about for a time in a somewhat aimless manner'. Friendship appeared to count, though. Most friends were taken into the nest, while most strangers were ditched in some water close by. In another experiment on how ants find their way, Lubbock showed graphically by tracing their routes (see illustration opposite) how they were utterly disorientated if the place they journeyed to and from was moved.

Sir John wondered about ants' experiences of sight and sound. Were they similar or different to human sensations and impressions? In the late 1870s he focused on ants' compound eyes.

> If the male of *Formica pratensis* sees 1,000 queens at once, when only one is really present, this would seem a bewildering privilege, and the prevailing opinion among entomologists is … that each facet [of the eye] only takes in a portion of the subject.

On Sunday 23 February 1879 at High Elms, he laid on a striking demonstration for a gathering of weekend guests including Sir James Stephen, a prominent lawyer, and the politician and critic Sir Charles Dilke. Another of the guests noted in his diary that Sir John and Francis Galton, Darwin's cousin, 'contrived an arrangement with the microscope by which they enabled us to look through the eye of a beetle, seeing a perfectly distinct image at which we looked through each facet' of the eye. It must have been a weird, Kafkaesque experience for the grandees of Gladstone's England.

Sir John experimented with ants' sense of smell. Using a camel's-hair brush with pepper-mint water, essence of cloves, lavender-water, and other strong scents, he observed that some ants stopped when they encountered the scent, while others stopped after passing it by, then looked back but proceeded on their way. He judged therefore that ants' sense of smell must be highly developed. Moving on to hearing, he tried to spot ants' reactions to a penny pipe, a dog-whistle, a violin, 'as well as the most piercing and startling sounds I could produce with my own voice', but all without effect. He was careful not to conclude that ants were deaf, but realised that if they could hear, their range must be very different from ours. He needed special apparatus to test at higher frequencies and his friend Galton was able to provide a 'hydrogen whistle' he

Lubbock's diagram of ant routes in *Ants, Bees and Wasps* (1888, p. 252)

had fitted into a walking stick to take to the Zoological Gardens in Regent's Park and release blasts to see whether different animals could hear sounds above human hearing. He brought the device to High Elms and tried it on the ants, but again with no effect. In 1878, Sir John took another tack with a 'sensitive flame' apparatus devised by the chemist John Tyndall to detect the slightest sounds. He had the two-foot flame gently burning while ants responded excitedly to food, but yet again the experiments yielded no results.

Alexander Graham Bell had brought his telephone invention to London in 1877, and demonstrated a pair of instruments to Queen Victoria at Osborne in January 1878. Sir John met Bell in high political circles in which a telephone system for London was being discussed; Bell visited High Elms, and in August brought a specially sensitive microphone for Sir John to attach to the underside of one of his ant nests. Sir John wrote that they could 'distinctly hear the ants walking about' but could not distinguish any other sounds. In late November, he had a final try with a full telephone set. He wrote in the *Journal of the Linnean Society:*

> In order to ascertain if possible whether ants made any sounds which were audible to one another, I thought I would try the telephone. Accordingly I looked for two ants' nests … not far from one another, and then, after disturbing one of them, had a telephone held just over it. I then held the other telephone close over the other nest, each telephone being perhaps one to two inches above the ground. If the disturbed ants made any sound which was transmitted by the telephone, the ants in the other nest ought to have been thrown into confusion. I could not, however, perceive that it made the slightest difference to them. I tried the experiment three or four times, always with the same result.

Lubbock's failure with ants and the telephone was a disappointment, but Darwin followed his line of investigation with earthworms. He had been interested for many years in their ceaseless burrowing through the soil, an almost unrecognized process which he showed can eventually through the centuries and millenia shape whole landscapes. In his last book, *On the Formation of Vegetable Mould through the Action of Worms* (1881), he concluded, 'It may be doubted whether there are many other animals which have played so important a part in the history of the world as have these lowly organised creatures'. In his research for the book, he carried out two years of observations in his garden and the countryside around, and experimented carefully with earthworms 'in confinement'. Earthworms' senses and mental functions appeared to be as primitive as ants' were sophisticated, and Darwin's attention was seized. He wrote:

> As I was led to keep in my study during many months worms in pots filled with earth, I became interested in them, and wished to learn how far they acted consciously, and how much mental power they displayed. I was the more desirous to learn something on this head, as few observations of this kind have been made, as far as I know, on animals so low in the scale of organization and so poorly provided with sense-organs, as are earth-worms.

He revealed at one point how closely and patiently he observed them. 'Worms often lie for hours almost motionless close beneath the mouths of their burrows. … With worms kept in pots in the house, … by looking down into their burrows, their heads could just be seen.'

Darwin knew how rudimentary an earthworm's anatomy is. Earthworms have no eyes but Darwin found they could sense light slowly. The worms he tested were able to taste or scent cabbage, onion and other foods in the soil, but were indifferent to the mille-fleurs perfume and tobacco juice he offered them. Earthworms have no ears of any kind; Darwin's 'took not the least notice of the shrill notes from a metal whistle which was repeatedly sounded near them', and they failed to respond to the 'deepest and loudest tones' of his son's bassoon. In July 1880 Darwin took a pot containing two earthworms into the drawing room, placed it on the grand piano, waited for the earthworms to emerge from their burrows in the evening darkness and then asked Emma to play as loudly as she could. She struck a C in the bass clef and both worms 'dashed into their holes'. They emerged after a time but dashed in again when Emma struck G above the line in the treble clef. The following night Darwin placed some earthworms in a pot on a table near the piano, and they showed no reaction when Emma played some loud notes. Darwin decided that earthworms can sense vibration in the soil, and that is enough for their needs.

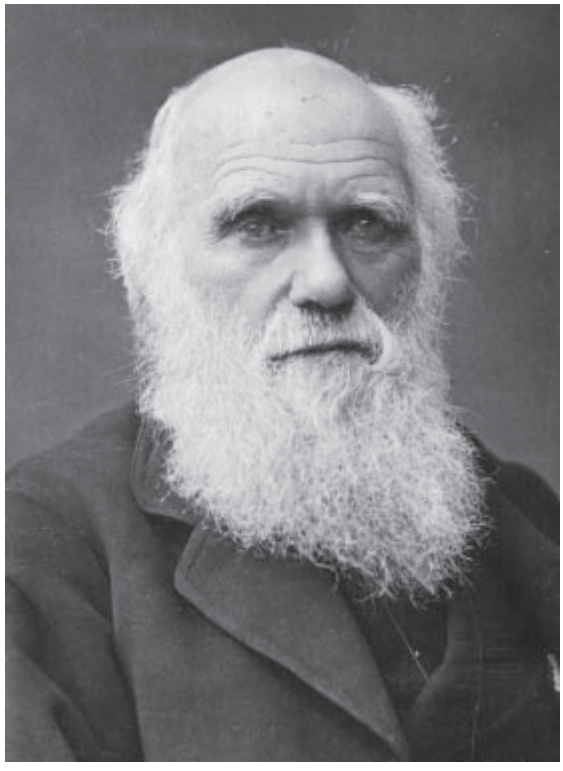
Darwin now had up to four pots of 'worms in confinement' under nightly watch and was suddenly struck when he watched the earthworms pulling cabbage and raspberry leaves into their holes, apparently feeling round the edges to decide which edge to pull in. Checking earthworms' burrows in the garden, he realised that his tame worms were trying to plug their holes according to a strong natural instinct, and he focused on what they were up to. Did they sense along the leaf and decide where to pull, in which case their action might involve some kind of reasoning for a purpose? Could earthworms then perhaps be credited with conscious thought? Looking on, Emma wrote to a family member that Darwin had

> taken to training earthworms, but does not make much progress as they can neither see nor hear. They are, however, amusing and spend hours in seizing hold of the edge of a cabbage leaf and trying to pull it into their holes. They give such tugs they shake the whole leaf.

In this 1881 Punch cartoon, published the year before his death, Darwin puzzles over the behaviour of earthworms.

Darwin set to work on the problem, checking how worm-holes in the garden had been plugged with leaves and stalks of different plants, and offering narrow and broad triangles of paper to his worms in confinement to see which they chose. Writing for advice to a young friend with a special interest in animal intelligence, he explained that in his analysis, 'I tried to observe what passed in my own mind when I did the work of a worm'. After considering his results and all possible explanations, he concluded that 'worms, although standing low in the scale or organization, possess some degree of intelligence'. *On the Formation of Vegetable Mould* appeared in 1881, and Punch's Almanac for 1882 featured Darwin in a cartoon celebration of evolution with the caption 'Man is but a worm'.

The Victorian cariacturist Sambourne portrayed evolution as leading from a worm up to the highest form of Victorian gentleman – Darwin himself.



The last known portrait of Darwin, made by Herbert Rose Bernard in 1881.

Darwin died at Down House in April 1882. He had hoped to be buried in the village churchyard but in the days after his death, Sir John and a group of friends persuaded the Church authorities to allow him to be buried in Westminster Abbey in recognition of his achievements for science. Sir John was one of the six men who bore the coffin to its resting place. He didn't write an obituary of his teacher, but noted simply in his diary, 'He has been very good to me and a talk with him was as good as sea air.'

After Darwin's death, Sir John lived on at High Elms collecting, investigating and writing about insects, plants and his many other interests. In 1888 he summed up his findings on animal experience in *On the Senses, Instincts and Intelligence of Animals, with Special Reference to Insects*. He wrote:

> We find in animals complex organs of sense, richly supplied with nerves, but the function of which we are as yet powerless to explain. There may be fifty other senses as different from ours as sound is from sight; and even within the boundaries of our own senses there may be endless sounds which we cannot hear, and colours, as different from red and green, of which we have no conception.

He concluded:

> These and a thousand other questions remain for solution. The familiar world which surrounds us may be a totally different place to other animals. To them it may be full of music which we cannot hear, of colours which we cannot see, of sensations which we cannot conceive. To place stuffed birds and beasts in glass cases, to arrange

> insects in cabinets, and dried plants in drawers, is merely the drudgery and preliminary of study. To watch their habits, to understand their relations to one another, to study their instincts and intelligence, to ascertain their adaptations and their relations to the forces of nature, to realise what the world appears to them; these constitute, as it seems to me at least, the true interest of natural history, and may even give us the clue to senses and perceptions of which at present we have no conception.

Since Darwin and Lubbock wrote, great advances have been made in the understanding of insect senses and communications. Darwin's buzzing places are now recognized to have been bumblebees' rendez-vous points for mating, marked by the queens with chemical signals for that essential purpose, and the full richness and sophistication of ant and bee languages has become evident.

When Lubbock died in 1909, one obituarist quoted a passage from a poem by George Meredith who admired Darwin's view of the natural world. The two lines speak equally for Darwin and for his disciple as each worked patiently and intently in their shared search for understanding of animal experience.

> The secrets held by the creatures nearer than we
> To earth he sought, and the link of their life with ours.

Published works quoted and referred to:

Darwin –

The voyage of the Beagle: *Journal of researches into the geology and natural history of the various countries visited by H.M.S. Beagle,* 1845.

The descent of man, and selection in relation to sex, 1871.

The formation of vegetable mould, through the action of worms, with observations on their habits, 1881.

'Darwin on the routes of male bumble bees', *Bulletin of the British Museum (Natural History), Historical Series* Vol. 3, 1968, pp. 177-189.

Autobiography: 'Recollections of the development of my mind and character', *Charles Darwin, evolutionary writings,* edited by James A. Secord, 2008.

The correspondence of Charles Darwin, edited by Frederick Burkhardt and others, 1985 -

Lubbock –

Description of a new genus of *Calanidæ*, *Annals and Magazine of Natural History* 2d ser. 11, 1853: pp. 25-9.

An account of the two methods of reproduction in *Daphnia*, and of the structure of the ephippium, *Philosophical Transactions of the Royal Society of London*, 147, 1857. pp. 79-100.

On the digestion and nervous system of *Coccus hesperidium, Proceedings of the Royal Society,* Vol. ix, 1858, pp. 480-486.

On the objects of a collection of insects, *The entomologist's annual for 1858.* 1858.

On the metamorphoses of insects, *Annals and Magazine of Natural History* 3d ser. 17, 1866, pp. 375-81.

[Article on telephone experiment.] *Journal of the Linnean Society* Vol. XV, 1881.

Ants, bees and wasps, 1881.

On the senses, instincts and intelligence of animals, with special reference to insects, 1888.

Mnanuscript sources:

Darwin scientific papers in Cambridge University Library; Darwin family papers; Lubbock family papers. (Details will be provided on request.)

Charles Darwin: Ghostbuster, Muse and Magistrate

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On a chilly, misty morning, several years ago, I rambled across a tract of woodland near the Kentish village of Downe, where I clambered down a muddy slope carpeted with dormant native orchids. It was the fabled "Darwin's orchis bank," which I thought had been destroyed years ago to make way for housing estates. My four knowledgeable companions, led by historian Randal Keynes, enthused about how beautiful this place becomes in spring, when thousands of wildflowers bloom, and how much they wanted to preserve it for posterity.

It is one of the remnants of Charles Darwin's favorite unspoiled natural places within walking distance of his country home, which is now the Darwin Museum. The Victorian naturalist, who was Keynes's great-great grandfather, had regularly walked these same footpaths a century and a half ago. He had been especially fond of the tiny orchids that still flourish here, but are becoming increasingly rare in Britain. Darwin wrote about them in *The Various Contrivances by which Orchids are Fertilised by Insects* (1862), the first book he published after the *Origin of Species* (1859).

Later that day, we raised our glasses in Ye Whyte Lyon Inn near Farnborough Common, in Locksbottom, Orpington, a centuries-old pub where the public-spirited biologist occasionally held court as a part-time magistrate, meting out verdicts and sentences to local law-breakers.

The author with Randal Keynes (right) and (left) Professor John and Irene Palmer. Photograph by Alistair Hayes.

The publican overheard our lively talk about Darwin having been to his restaurant – but the name failed to ring a bell. At Randal's urging, I showed the man a ten-pound note, which has displayed Darwin's magisterial likeness since 2002, when it replaced that of Charles Dickens. "See this old geezer on your money?" I said. "Well, he used to come in here all the time." The landlord was suitably impressed by the monetary portrait: "Oh, a regular, was he?"

Well, maybe not. But Darwin and his circle – Thomas Henry Huxley, Alfred Russel Wallace, Sir John Lubbock and others – have been "regulars" in my mental landscape for almost fifty years.

My Darwinising took root during my childhood in Bayside, Queens, New York City, where I became friends with a 12-year-old boy (my own age) named Stephen Jay Gould. Steve had two childhood idols: Charles Darwin and the legendary baseball star Joe DiMaggio. Little did I suspect that he would become a world-renowned paleontologist and inherit Thomas Huxley's mantle as a premier essayist on evolution – or that I would become his editor at *Natural History* magazine (Milner 2002). Nor could Steve have imagined that one day he would be seen by millions discussing evolution on American national television with his hero, "Joltin' Joe" DiMaggio.

From our shared boyhood passion for animals and dinosaurs, it was a short step to an interest in Charles Darwin. Even as kids, growing up before the advent of mass dinomania, evolution fascinated us; we were captivated by the pageant of the history of life on earth, and recognized, as Darwin phrased it, "grandeur in this view of life". A decade later, as an anthropology grad student at the University of California, I became fascinated with the intellect and character of the genius behind the theory. (By then, I had learned that there were *two* geniuses, the other being Darwin's junior partner Alfred Russel Wallace.) But the Darwin of the science books seemed cold and distant; early on, I developed a thirst to know something about the man himself, the flesh and blood behind the iconic legend.

1. Darwin as the Spiritualist's Nemesis

It turned out that there was a great deal known about Darwin's life and personality. His friends and relatives had left their memoirs, in addition to his Autobiography – (Darwin C. and Barlow N. 1993) and thousands of letters were still extant, although only a few hundred had been published at the time[1]. By the 1980s, I was well acquainted with the various Darwin biographies, and began a personal quest to know the man better – to seek "unknown" incidents in Darwin's life that might shed light on new facets of his personality. But what untold stories could I discover in a life so well raked over for more than a century?

By a very roundabout path, I arrived at a front row seat at one of Victorian England's strangest courtroom dramas: the trial of a celebrated American "psychic" known as "Dr." Henry Slade. I discovered that when the scientific establishment put Slade and his purported wife's "ghost" on trial in 1876, Darwin and Alfred Russel Wallace, the co-discoverers of natural selection, became adversaries.

Wallace was star witness for the defense, and Darwin secretly contributed funds toward the cost of the prosecution. (Milner 1990a and 1990b) England's two greatest

naturalists took opposing sides when the reality of supernatural phenomena was challenged in court. This long-forgotten episode appeared in none of the histories or biographies at the time, and remains largely unknown, even to Darwin scholars.

It was in a London bookseller's basement that I first became aware of this fascinating battle between evolutionists and Spiritualists. Antiquarian bookseller M.E. (Eric) Korn had arranged two long rows of facing bookshelves, with an aisle between them. On one side were volumes about Darwin, evolution, and history of science. Facing them were books on nineteenth-century Spiritualism and the occult. I wondered why anyone would collect so intensively on two such irreconcilable topics.

A few years later, I began to understand something about the cross-connections. Sometimes, both sides of the conflict co-existed in the same persons, such as Alfred Russel Wallace or the chemist-physicist William Crookes, discoverer of thallium and helium. It even turned out that some Victorian authors were writing science books under their own names while penning Spiritualist material under another. Wallace was respected as a great naturalist and biologist, but he constantly courted ruin by championing such disreputable causes as socialism, pacifism, land nationalization, wilderness conservation, women's rights, and Spiritualism. (Wallace 1905).

In addition to his classic works on zoogeography, natural selection, island life and the Malay Archipelago, he had written *Miracles and Modern Spiritualism*, which lauded spirit-mediums. As Chairman of the Anthropology Section of the British Association for the Advancement of Science, in 1876, he allowed a controversial paper on "thought transference" to be read at his session – touching off an uproar that divided the scientific community and caused him to avoid scientific meetings for the rest of his life.[2]

Like Wallace, Darwin's cousin and brother-in-law Hensleigh Wedgwood became convinced that the living could communicate with the dead, and that he was on to a major "scientific" breakthrough. A pair of swindlers, Charles Williams and Frank Herne, recognized that Wedgwood was the most gullible member of the clan. At their urging, he begged Darwin to come and see the self-playing accordions, levitating tables, automatic writing, and glowing spirit hands at Williams' séances. Darwin always managed to be too tired, too busy or too ill to attend.[3]

In January 1874, however, Darwin insisted that two close members of his circle, the combative zoologist Thomas H. Huxley ("Darwin's bulldog") and his own son George attend a séance with Williams. Huxley, was introduced as "Mr. Henry", his middle name. Bottles moved around the table, and a guitar played by itself, but the pair was not impressed by the "crude trickery". George, a budding astronomer, wrote that he was shocked to find his uncle Hensleigh's enthusiastic reports of Williams' miraculous phenomena "so worthless."[4]

After Darwin's ten-year-old daughter Annie, the light of his life, died in 1851, he became an implacable foe of heartless Spiritualistic swindlers who preyed on the bereaved. In the 1870s, when Williams tried to insinuate himself into the family circle through his brother-in-law, Hensleigh Wedgwood, Darwin tried to put him behind bars. In 1874, Darwin wrote to a newspaperman, urging him to expose Williams as "a scoundrel who has imposed on the public for so many years".[5] He was later delighted

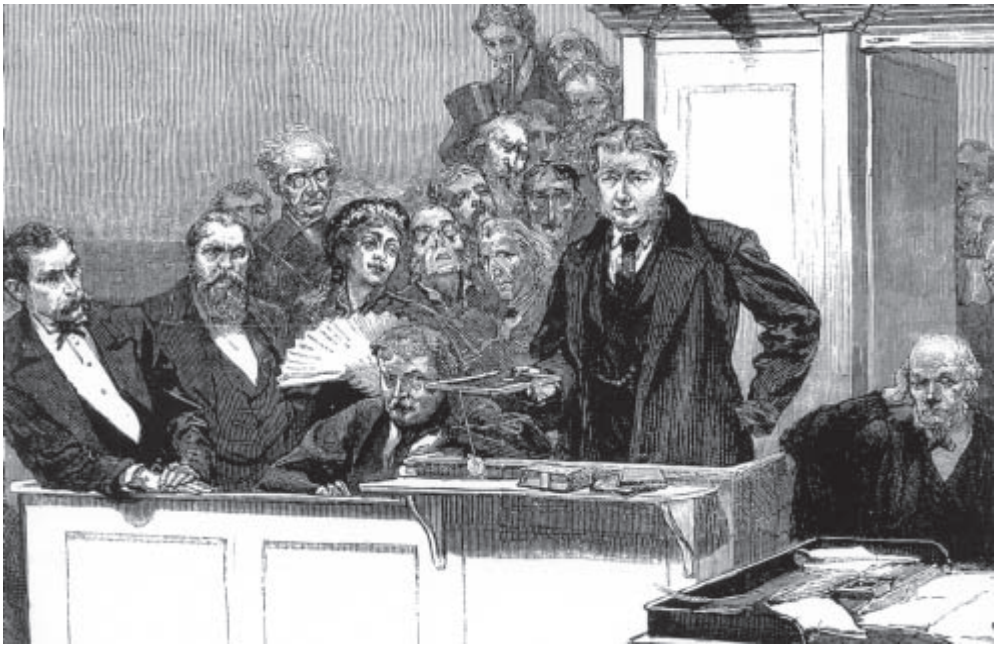
to read in the newspaper that another "ghostbuster" had ruined one of Williams's séances, revealing the "imposture" of his crude spirit impersonations. On hearing about the incident, Darwin absolutely gloated with delight.[6]

In contrast to Darwin's vehement animosity towards Spiritualists, Huxley regarded their shenanigans with either dismissive disinterest or amused good humor. Once he attended a gathering where a clever, attractive woman mystified the group with a demonstration of psychic powers and thought reading. Although Huxley easily saw through her game, he gallantly refrained from exposing her. "Fraud is often genius out of place," he mused, "and I confess that I have never been able to get over a certain sneaking admiration for Mrs. X."[7]

Huxley's range of responses to phony spiritualists included besting them at their own tricks – a theatrical strategy which never would have occurred to Darwin. A flamboyant master of the lecture platform (unlike the reticent Darwin, who almost never spoke in public) Huxley had practiced the technique of loudly snapping his toes inside his boots. He, too, could call forth "spirit raps".

"By dint of patience, perseverance [and] practice," he explained in the *Pall Mall Gazette*, the mysterious tapping "may be repeated very rapidly, and rendered forte or piano at pleasure. To produce the best effect, it is advisable to have thin socks and a roomy, hard-soled boot…[and find] a thin place in the carpet, so as to profit by the resonance of the floor."[8] Similarly, Huxley liked to embarrass churchmen in debates by quoting their own theology and Scripture at them better than they could.

One of Huxley's students in comparative anatomy, Edwin Ray Lankester, wanted to catch Williams and Herne in fraud – which he knew would impress his teacher, as



At the Slade trial at Bow Street Court in 1876, zoologist E. Ray Lankester holds a slate used for "ghost writing". "Psychic" imposter Henry Slade and his accomplice, at extreme left, appear stricken by his testimony, while a clerk, at right, is utterly bored.

well as his hero Darwin. But after Huxley's and George's séance with Williams, the grifters became wary of allowing evolutionary biologists to attend their "experiments" and "demonstrations."[9]

Then, in April 1876, a tempting new target presented himself to the zealous ghost-buster. A celebrated American psychic, "Dr." Henry Slade, had come to London "to prove the truth of communication with the dead". Slade's claim that his wife's spirit wrote messages on slates attracted a well-paying audience of believers.

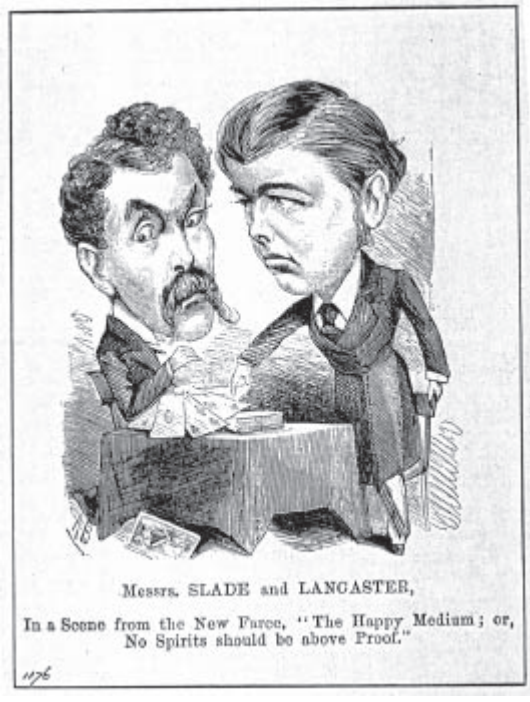
Lankester and a medical student, Horatio Donkin, went to Slade's rooms in Russell Square, paid the admission fee, asked questions of the spirit, and received answers mysteriously written on slates. Suddenly, in the darkened room, Lankester snatched a slate out of Slade's hands, found the written answer to a question he had not yet asked, and proclaimed him "a scoundrel and an impostor.[10]

The next day Slade and his partner, Geoffrey Simmonds, were in the hands of the police, charged with violating the Vagrancy Act, an old law intended to protect the public from traveling palm readers and sleight-of-hand artists.[11]

Throughout the fall of 1876, the little Bow Street courtroom was packed with Slade's supporters and detractors and 30 journalists, who spilled out into the street. The *Times of London* carried trial transcripts day after day.[12]

Darwin, whose beloved 10-year-old daughter Annie had died in 1851, had nothing but contempt for the "clever rogues" who preyed on grieving relatives. Yet he avoided saying so publicly – *On the Origin of Species* had stirred up enough controversies for a lifetime. Privately, he wrote Lankester an effusive letter of congratulations. Jailing Slade was a "public benefit," he said, and insisted on contributing £10 to the costs of prosecution – a substantial sum, comparable to a month's wages for a working man.[13]

Lankester's offhand acknowledgement of Darwin's cash contribution, buried in an obscure introductory note he had written years later in a reference book, turned out to be the key that enabled me to fit together all the pieces about the Slade trial and its significance. Odd bits of the story had been scattered throughout letters and fragmentary reminiscences of many people, who had often discreetly disguised the participants' names.



Messrs. SLADE and LANCASTER,

In a Scene from the New Farce, "The Happy Medium; or, No Spirits should be above Proof."

A comtemporary cariacture of Lankester exposing Slade as a common card sharp.

At the trial, Lankester and his friend turned out to be terrible witnesses; their observational skills, developed in anatomy and physiology labs, were useless in detecting fraud by professional cheats. As Huxley later noted, "In these investigations, the qualities of the detective are far more useful than those of the philosopher.... A man may be an excellent naturalist or chemist; and yet make a very poor detective".[14]

Indeed, Lankester and Donkin could not agree on anything much beyond their charge that Slade was an impostor. A chemist named Alexander Duffield was one of many witnesses for the prosecution. He said Slade had convinced him "that there could be established a sort of post office in connection with the 'other place'". But now he had his doubts. Another witness testified that a few years earlier, in the U.S., someone had similarly snatched a slate from Slade in mid-séance and exposed him in fraud.[15]

The high point of the trial was Wallace's appearance for the defense. His integrity and candor were known to all. When called, he said that he had witnessed the alleged phenomena but refused to speculate on whether the writings were caused by spirits. He considered Slade to be an honest gentleman, "as incapable of an imposture as any earnest inquirer after truth in the department of Natural Science.[16]

But nothing could save Slade. The judge said that he understood that spiritualism was "a kind of new religion" and did not wish to offend sincere believers. Still, the question before the court was whether Slade and Simmonds had fraudulently represented their own actions as paranormal phenomena. Concluding that he must decide "according to the well-known course of nature," the judge sentenced the defendant to three months' hard labor in the House of Corrections.[17]

In another twist, Slade never served his sentence. On appeal, another judge ruled that the Vagrancy Act, which prohibited palmistry, was not applicable to claims of spirit writing. Slade and his partner fled England for Germany. Within a short time, he had convinced the chief of police and several prominent German scientists (including the physicist Johann Zöllner of the University of Leipzig) that he could summon spirit entities and attract paranormal energies.

In 1879 Darwin tried to drum up support for a government pension for Wallace, in recognition of his outstanding contributions to natural history. Wallace, he knew, still had to support his family by grading examination papers. But when Darwin wrote to his friend Joseph Hooker, director of Kew Gardens, the botanist refused to help. "Wallace has lost caste terribly," he replied nastily, "not only for his adhesion to Spiritualism, but by the fact of his having deliberately and against the whole voice of the committee" allowed the paper on mental telepathy at the scientific meetings. In addition, he thought the government "should in fairness be informed that the candidate is a public and leading Spiritualist! "[18]

Undaunted, Darwin replied that Wallace's beliefs were "not worse than the prevailing superstitions of the country" – meaning organized religion. Darwin and Huxley twisted a few more arms, and then Darwin personally wrote to Prime Minister William Gladstone, who passed the petition on to Queen Victoria. In the end, Wallace got his modest pension and was able to continue writing his articles and books; he died in 1913, at the age of 90.[19]

A cartoon of E. Ray Lankester from *Vanity Fair* reflects his scientific work on hornbills and fossil armoured *Cephalaspid* fishes.

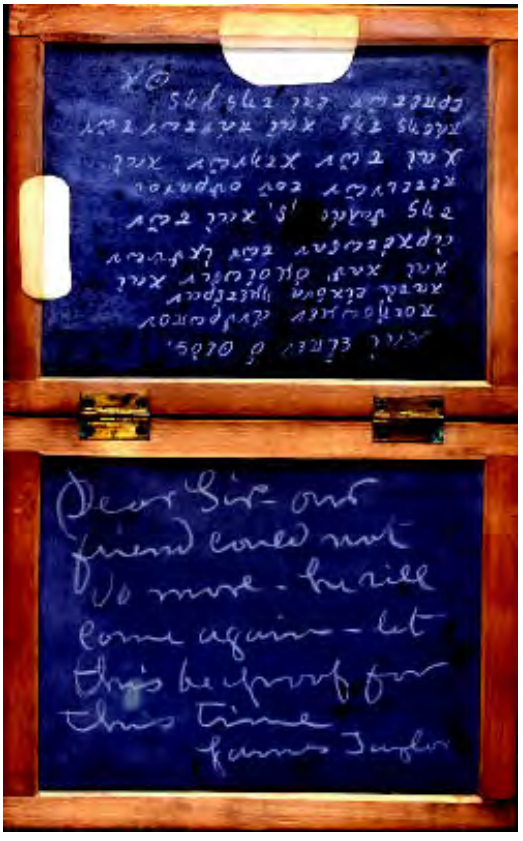
In 1880, Wedgwood sent Darwin a handwritten attempt at a synthesis of science and religion. Darwin certainly remembered the times Wedgwood had gone to bat for him many years before: he had helped persuade Darwin's uncle and father to let him go on the *HMS Beagle* expedition, and it was to Hensleigh that Darwin had once entrusted publication of his theory of natural selection.

"My dear Cousin," Darwin wrote, "It is indeed a long time since we met, and I suppose if we now did so we should not know one another; but your former image is perfectly clear to me." He refused even to read Hensleigh's paper, writing that "there have been too many such attempts to reconcile Genesis and science." The two cousins, who had once been so close, were now hopelessly estranged over the question of science and the supernatural.[20]

That same year Lankester, now a professor of zoology, declined requests to continue ghostbusting. "The Spirit Medium," he wrote in an 1880 letter to the *Pall Mall Gazette*, "is a curious and unsavoury specimen of natural history, and if you wish to study him, you must take him unawares.... I have done my share of the skunk-hunting; let others follow."[21] He was later appointed director of the British Museum of Natural History where he served for eight tumultuous years during a power struggle for its independence from the British Museum Library. A Fellow of the Linnean Society for 53 years, he was awarded its Darwin-Wallace Medal in 1908 and the Linnean Medal in 1920.

Ironically, in 1912 Lankester, the nemesis of fakers, was completely taken in by the Piltdown man hoax, one of the most notorious frauds in the history of evolutionary biology. For the next 40 years, scientists accepted the "ape-man" fragments, dug up about 25 miles from Darwin's home, as remains of the "missing link". Fired with enthusiasm for the Darwin-Wallace theory, Lankester and many of the younger generation of evolutionists uncritically embraced the famous fossil forgery.

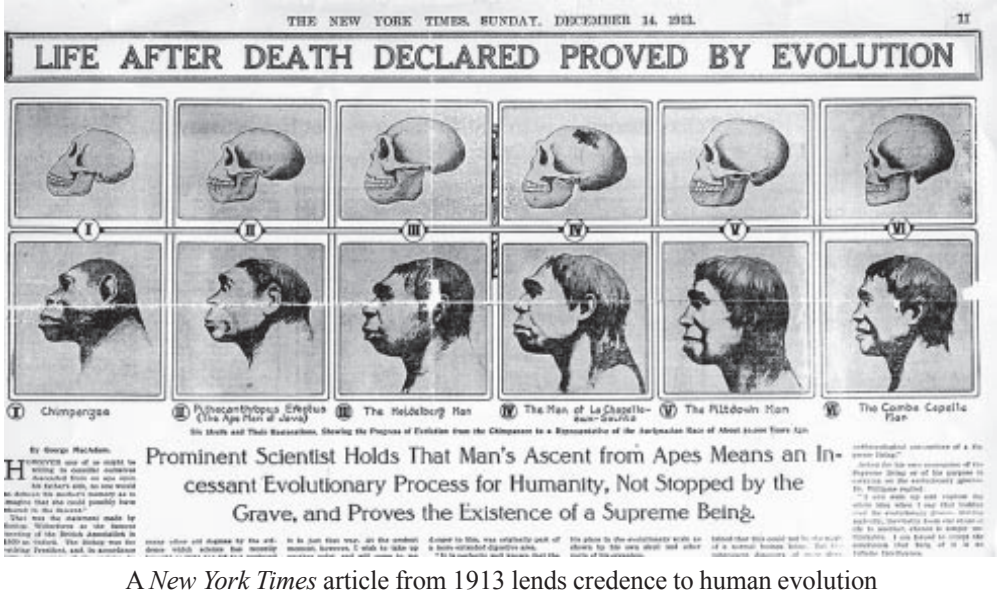
When I first approached *Scientific American* with the story of the Slade trial, the editors accepted it, but were concerned about how it could be illustrated. "We would like to show some relevant artifact to bring the history alive," they said. I was stumped by their request, and so the story remained in limbo for months.



One of Slade's slates, from 1876, with chalked ghost message still clearly legible. A letter affirming its authrnticity from Hensleigh Wedgwood, Darwin's brother-in-law was attached to the slate. (Courtesy of the London Psychic Society/ Cambridge Manuscript Library.)

I could have kicked myself, because a few years earlier, I had missed a chance to utilize a wonderful historical relic with the article. On a visit to the American Psychic Society's library in New York, a librarian had proudly produced an archival box containing a set of Henry Slade's slates, with the chalked "spirit-writing" still clearly legible. He told me it was his favorite object in their collection.

But when I returned some months later to photograph it, the slate had mysteriously disappeared, and so had the archivist. There was no record of it ever having been there, and files on the Slade trial had also gone missing. Frustrated, I complained to the new archivist, "How come you can't find Slade's slate? After all, *you're the psychic society*". He was not amused.


THE NEW YORK TIMES, SUNDAY, DECEMBER 14, 1913. 11

LIFE AFTER DEATH DECLARED PROVED BY EVOLUTION

I Chimpanzee II Pithecanthropus Erectus (The Ape Man of Java) III The Heidelberg Man IV The Man of La Chapelle-aux-Saints V The Piltdown Man VI The Combe Capelle Man

Six Skulls and Their Successors, Showing the Progress of Evolution from the Chimpanzee to a Representative of the Anthropoidan Race of About 10,000 Years Ago

By George MacAdam.

Prominent Scientist Holds That Man's Ascent from Apes Means an Incessant Evolutionary Process for Humanity, Not Stopped by the Grave, and Proves the Existence of a Supreme Being.

A *New York Times* article from 1913 lends credence to human evolution "not stopped by the grave". Many shared A.R. Wallace's belief that Spiritualism and evolutionary science were incompatible.

A few years later, however, at the Cambridge Manuscript Library in England, I was fortunate enough to come across another one. I was examining some uncataloged materials that had just been donated by a few old men, straggling survivors of the the Psychic Society of London. Immediately, among the trove of century-old séance photographs, I spotted *another* set of spiritualist slates. An accompanying note from (who else?) Hensleigh Wedgwood attested that he believed that the writing phenomena were genuine and that he was certain there was no fraud or trickery involved.

I had these slates photographed right away this time, and the *Scientific American* editors were pleased to publish them with the article (Milner 1996). Evidently, like Darwin's daughter's writing box, a family heirloom that inspired Randal Keynes to write his fine Darwin biography, (Keynes 2001) there is a certain magic and credibility in tangible mementos from another time.

2. Darwin as Magistrate

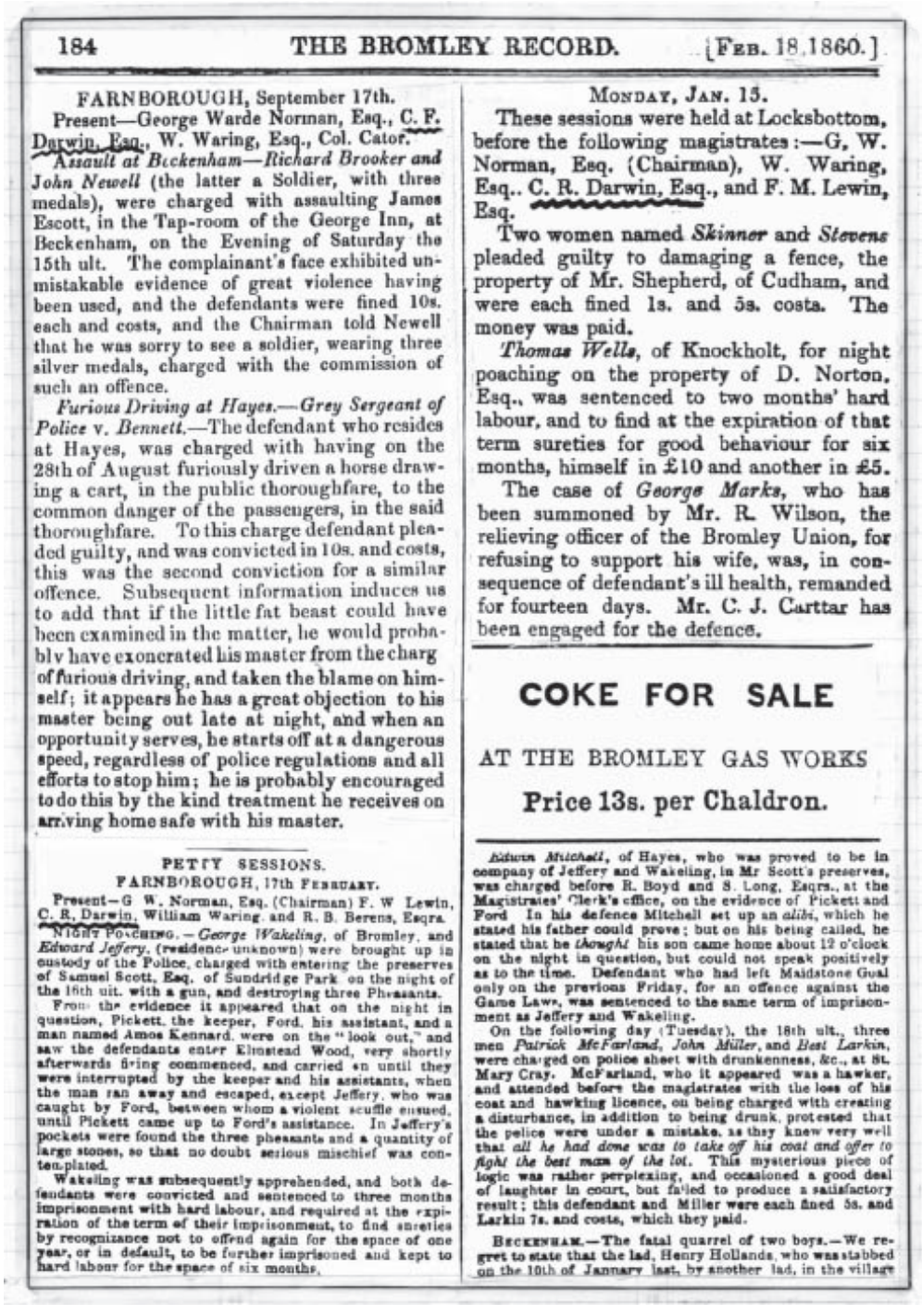
Even before I began investigating Darwin's private passion for exposing and prosecuting what he called "spiritualistic impostures," I became intrigued by his personal commitment to seeing justice done. He was, in fact a Justice of the Peace, a part-time magistrate in the local courts. When I first read a fictionalized account of his stint as a judge in Irving Stone's novel *The Origin* (1980), hardly any book on Darwin at the time had even mentioned the subject.

In 1984, I wrote the magistrate's courthouse at Bromley, where Darwin once sat upon the bench, to inquire whether they had any records of his cases. A few weeks later, just before my first visit to England, a court officer sent me a paper titled "Charles Darwin, Justice of the Peace" by one of their sitting magistrates, Joan Marsh. (Marsh, J. 1983) Fascinated by Darwin's name in gold letters on the courthouse wall, along with a roster of other previous magistrates, Mrs. Marsh wrote in the journal *Justice of the Peace* that she had vainly searched the courthouse's older records for his cases, but had concluded that none existed. (Apparently, many archives were lost during World War II; indeed, it is fortunate that Down House itself survived the German bombings, which saturated the area because of its proximity to the strategically important Biggin Hill airfield.)

Now I knew not to waste time searching the courthouse. As it turned out, however, a wonderfully astute librarian, Elizabeth Silverthorne, at the Bromley Library Local History Collection, steered me to their excellent archive of the local newspaper, the *Bromley Record*. After spending some weeks perusing years of local newspapers, both there and at the Colindale Newspaper Library, I managed to turn up many summaries of Petty Sessions cases, on which Darwin served as a magistrate.

I first published some of his cases in my short Darwin biography, *Charles Darwin: Evolution of a Naturalist* (Milner 1993). Randal Keynes, whom I did not know at the time, read it, became interested in the magistrate search, and began independently to discover related materials. Eventually, we decided to collaborate, and still plan to publish the results of our joint efforts. (In the meantime, a summary of our historical data has been archived with the Darwin Correspondence Project at Cambridge University Library.) The following is a partial sampling of what we have learned.

On July 3, 1857, two years before publication of the *Origin of Species*, Darwin took on the part-time job of Petty Sessions magistrate at Bromley, the largest nearby town to Downe Village. His neighbor, wealthy banker-scientist Sir John Lubbock (Senior) had talked him into accepting the honorary position to "help keep order in the



184 THE BROMLEY RECORD. [FEB. 18, 1860.]

FARNBOROUGH, September 17th.

Present—George Warde Norman, Esq., C. F. Darwin, Esq., W. Waring, Esq., Col. Cator.

Assault at Beckenham—Richard Brooker and John Newell (the latter a Soldier, with three medals), were charged with assaulting James Escott, in the Tap-room of the George Inn, at Beckenham, on the Evening of Saturday the 15th ult. The complainant's face exhibited unmistakable evidence of great violence having been used, and the defendants were fined 10s. each and costs, and the Chairman told Newell that he was sorry to see a soldier, wearing three silver medals, charged with the commission of such an offence.

Furious Driving at Hayes.—Grey Sergeant of Police v. *Bennett.*—The defendant who resides at Hayes, was charged with having on the 28th of August furiously driven a horse drawing a cart, in the public thoroughfare, to the common danger of the passengers, in the said thoroughfare. To this charge defendant pleaded guilty, and was convicted in 10s. and costs, this was the second conviction for a similar offence. Subsequent information induces us to add that if the little fat beast could have been examined in the matter, he would probably have exoncrated his master from the charg of furious driving, and taken the blame on himself; it appears he has a great objection to his master being out late at night, and when an opportunity serves, he starts off at a dangerous speed, regardless of police regulations and all efforts to stop him; he is probably encouraged to do this by the kind treatment he receives on arriving home safe with his master.

PETTY SESSIONS.

FARNBOROUGH, 17th FEBRUARY.

Present—G W. Norman, Esq. (Chairman) F. W Lewin, C. R. Darwin, William Waring and R. B. Berens, Esqrs.

NIGHT POACHING.—*George Wakeling*, of Bromley, and *Edward Jeffery*, (residence unknown) were brought up in custody of the Police, charged with entering the preserves of Samuel Scott, Esq. of Sundridge Park on the night of the 16th ult. with a gun, and destroying three Pheasants.

From the evidence it appeared that on the night in question, Pickett, the keeper, Ford, his assistant, and a man named Amos Kennard, were on the "look out," and saw the defendants enter Elmstead Wood, very shortly afterwards firing commenced, and carried on until they were interrupted by the keeper and his assistants, when the man ran away and escaped, except Jeffery, who was caught by Ford, between whom a violent scuffle ensued, until Pickett came up to Ford's assistance. In Jeffery's pockets were found the three pheasants and a quantity of large stones, so that no doubt serious mischief was contemplated.

Wakeling was subsequently apprehended, and both defendants were convicted and sentenced to three months imprisonment with hard labour, and required at the expiration of the term of their imprisonment, to find sureties by recognizance not to offend again for the space of one year, or in default, to be further imprisoned and kept to hard labour for the space of six months.

MONDAY, JAN. 15.

These sessions were held at Locksbottom, before the following magistrates:—G. W. Norman, Esq. (Chairman), W. Waring, Esq., C. R. Darwin, Esq., and F. M. Lewin, Esq.

Two women named *Skinner* and *Stevens* pleaded guilty to damaging a fence, the property of Mr. Shepherd, of Cudham, and were each fined 1s. and 5s. costs. The money was paid.

Thomas Wells, of Knockholt, for night poaching on the property of D. Norton, Esq., was sentenced to two months' hard labour, and to find at the expiration of that term sureties for good behaviour for six months, himself in £10 and another in £5.

The case of *George Marks*, who has been summoned by Mr. R. Wilson, the relieving officer of the Bromley Union, for refusing to support his wife, was, in consequence of defendant's ill health, remanded for fourteen days. Mr. C. J. Carttar has been engaged for the defence.

Edward Mitchell, of Hayes, who was proved to be in company of Jeffery and Wakeling, in Mr Scott's preserves, was charged before R. Boyd and S. Long, Esqrs., at the Magistrates' Clerk's office, on the evidence of Pickett and Ford In his defence Mitchell set up an *alibi*, which he stated his father could prove; but on his being called, he stated that he *thought* his son came home about 12 o'clock on the night in question, but could not speak positively as to the time. Defendant who had left Maidstone Gual only on the previous Friday, for an offence against the Game Laws, was sentenced to the same term of imprisonment as Jeffery and Wakeling.

On the following day (Tuesday), the 18th ult., three men *Patrick McFarland*, *John Miller*, and *Best Larkin*, were charged on police sheet with drunkenness, &c., at St. Mary Cray. McFarland, who it appeared was a hawker, and attended before the magistrates with the loss of his coat and hawking licence, on being charged with creating a disturbance, in addition to being drunk, protested that the police were under a mistake, as they knew very well that *all he had done was to take off his coat and offer to fight the best man of the lot*. This mysterious piece of logic was rather perplexing, and occasioned a good deal of laughter in court, but failed to produce a satisfactory result; this defendant and Miller were each fined 5s. and Larkin 7s. and costs, which they paid.

BECKENHAM.—The fatal quarrel of two boys.—We regret to state that the lad, Henry Hollands, who was stabbed on the 10th of January last, by another lad, in the village

Composite page of brief accounts of Darwin's court cases in the *Bromley Record* newspaper.

The names of Charles Darwin and Sir John W. Lubbock can still be seen listed with other former Magistrates on a wall in the Court House in Bromley, Kent. (Photo P. Morris)

neighborhood." As a magistrate, Darwin added to his credentials as a gentleman radical, campaigning for innovative ideas while maintaining a conservative life-style.

In his oath of office, he agreed to "Keep the Peace of one said Lady the queen in the said County, to hear and determine diverse felonies and also trespasses and other misdemeanours."[22] Ironically, in they same document, he was also enjoined from doing "anything to upset the religious values of the country." For almost two decades, his name remained on the list of active judges, and, when asked to fill out a Census or other official survey, enjoyed stating his occupation as Charles Darwin, J.P. (Justice of the Peace).

Most of the cases that Darwin helped to adjudicate included domestic squabbles, drunkenness, fights in the local pub, abuse of domestic animals, and, most commonly, violations of the tough anti-poaching laws.

Poaching game was considered an antisocial addiction, which in the words of a Royal Commission, "must be cut at the root among young boys" because it "leads man, step by step, to almost every other crime." Several poachers of the period wrote books expressing their love of constantly trying to outwit animals, gamekeepers, and police. In March 1860, a young man, was accused of "catching a rabbit [in a wire snare] on his father's plantation."[23] Magistrate Darwin slapped a fine on the youth, whose father was bent on teaching his son a stern lesson.

One man was charged with "furious driving" of a horse and cart in a public thoroughfare. The driver pleaded guilty to speeding and was fined, his second such offense. The *Bromley Record's* account of the case suggested that if the horse had been allowed to testify, the driver might well have gotten off free:

> The animal was well treated by his master, did not like staying out late, and was anxious to have a good feed in his stall…If the little fat beast could have been examined in the matter, [perhaps] he would have…taken the blame on himself. [24]

According to Darwin's son, Francis, he was a sympathetic and often lenient judge, but on one transgression he was implacably harsh: cruelty to animals. Once he witnessed

a man whipping his horse terribly on the road. Pulling to a stop from his own carriage, Darwin angrily told the driver that he was a magistrate in the district and that if he caught the man abusing an animal again, he would personally haul him into court and throw the law book at him.[25] Another time, a gentleman farmer had neglected his sheep, which starved to death. Darwin was ill at the time, but roused himself to collect the evidence and got the man convicted.[26]

One 1864 case that apparently amused Darwin and the other judges was that of a drunken peddler who was accused by the police of being belligerent. He protested that he did not "create a disturbance" as charged. All he had done, he testified, was "to take off his coat and offer to fight the best man of the lot." Apparently, he thought that he was being prosecuted for removing his coat. The *Bromley Record* reported that "this mysterious piece of logic was rather perplexing, and occasioned a good deal of laughter in the court, but failed to get the man off."[27]

A few years after Randal Keynes and I began our magistrate project, he became a consultant to the restoration of Down House. The dining room table looked bare, and needed some authentic "lived-in" decoration. Randal suggested that local law books be spread out as if Darwin was working on a case at home and had taken over the dining room, a scene for which he had found documentation in a letter[28] – and that is how it remains today, on public display.

3. Darwin as an Artist's Muse

The collaboration of an artist and a scientist to reconstruct the lost world of prehistory has become known as paleoart. A direct link between Darwin and the first serious attempts at this genre was a series of paintings commissioned by his only "student" and protégé, John Lubbock (1834-1913), who became a premiere prehistorian. (Milner, 2007)

In his *Descent of Man* (1871), Darwin begins by noting that "the high antiquity of man has recently been demonstrated by the labours of a host of eminent men…and [I] may refer my readers to the admirable treatises of Sir Charles Lyell, Sir John Lubbock, and others." (Darwin, 1871: 2) Scion of a banking family, Lubbock's father was the major landowner in the Kentish countryside near the villages of Downe and Farnborough, a few miles from Orpington. His family's huge estate, High Elms, with its 22-room mansion, was about a mile and a half from Down House. Indeed, Darwin's property was a small island in the holdings of Lubbock, who owned much of the countryside for miles around.

Young John eventually decorated his indulgent father's mansion with a collection of prehistoric stone tools, ethnographic artifacts, glass-enclosed colonies of social insects, and some of the first post-Darwinian works of paleoart. (See Lyulph Lubbock's and Randal Keynes's articles on the mentor-student relationship between John Lubbock and Darwin in this Special Issue.)

A leader of the "pre-historic movement," Lubbock commissioned a natural history illustrator named Ernest Griset (1844-1907), whose humorous anthropomorphic animal drawings often appeared in *Punch* magazine, to create eighteen paintings of early humans going about their daily lives. In these watercolors, the generic ancestral tribesmen

A Bison hunt painted by Ernest Griset.

were shown crowding into a ceremonial long house, crafting weapons and dugout canoes, and hunting bison and mammoths.

Griset created these paintings for Lubbock more than five years after the author had published his seminal work *Pre-Historic Times* (1865), in which he coined the terms "Paleolithic" and "Neolithic," and first popularised the term "cave-man." Darwin frequently walked the mile-and-a-half footpath between his home and Lubbock's mansion, where he undoubtedly viewed and discussed each painting as it was completed, and perhaps offered some advice during their planning. However, neither Darwin nor Lubbock ever used any of the paintings to illustrate their books.

Painted between 1870 and 1871, the pictures are now archived in the Priory Museum in Orpington (a.k.a the Bromley Museum), which is not far from Downe village. From time to time a few are featured in the permanent exhibition about Lubbock, but most are usually kept in a stone-brick storeroom, off public view. Fortunately, they had been removed from the Lubbock mansion, High Elms, which later burned down. The conditions under which the Lubbock family donated them to the museum do not allow the collection to be split up or sold off.

Thanks to then-curator Adrian Greene, I was able to photograph and publish two of the Griset paintings of prehistoric scenes for the first time in the *The Last Human* (2007), a book based on new paleoart by the artist-scientist team of Viktor Deak and Gary Sawyer of the American Museum of Natural History.

When I visited the Bromley Museum's storeroom with the late John Marsden, the erstwhile executive secretary of the Linnean Society and his wife Hazel, and the painter Errol Fuller, the curator showed us painting after painting. We also got to examine artifacts from Lubbock's ethnographic and archeological collections, including Paleolithic stone hand axes and ingenious tools made by nineteenth-century Eskimos and tribal peoples.

Finally, he pulled out a large triptych – an elongated frame with three panels. It was a lovely, idyllic watercolor of a tropical coral atoll island, fringed by palm trees,

ringed with white sand, and enclosing a blue lagoon in its center. "This one is signed and dated 1871 by Griset," he said. "We don't have any idea what it is, or why it is tucked away here with Lubbock's prehistory collection."

My heart raced a bit, as I suddenly realized what I was looking at. In the central panel, a tiny, sketchy watercolor detail of a sailing ship near the horizon, approaching the island, caught my eye. Could that be an image of *HMS Beagle*, painted for Darwin's delectation, that had not been seen or recognized for 130 years? An enlargement is reproduced here. It is unmistakably a classic sloop brig of the Cherokee class; it even has the *Beagle's* stripe along the hull, and painted dots representing its gun ports. I think it is indeed meant to depict the *Beagle*.

The scene was painted around the twentieth anniversary of Darwin's first scientific book, *On Distribution and Formation of Coral Reefs*, which appeared in 1849. He was about to publish a revised, updated version of that book. Lubbock, it appears, had commissioned Griset to paint the kind of atoll island that had so captivated his mentor almost four decades earlier. (Darwin had described his initial visits to coral atolls in *Voyage of the Beagle*, published in 1839.) It seems plausible that Lubbock planned to present it to Darwin as a surprise to commemorate the twentieth anniversary and reissue of Coral Reefs, his first scientific book. John Lubbock was fascinated by tales of the South Seas and was very interested in corals. He build an artificial grotto decorated with exotic corals and shells near the big house.

The painting inspired me to look into the comparatively unknown history of Darwin and his theory of coral reefs – a story that clarifies and exemplifies Darwin's quest to demonstrate Charles Lyell's uniformitarian principles (Milner, R. 2009). Coral reefs, he thought, were a perfect exemplar of how small, insensible forces, operating over immense periods of time, are capable of shaping major geological features.

In fact, I soon learned, the saga of Darwin's coral reef theory had recently been brilliantly and beautifully told in the underappreciated book *Reef Madness; Charles Darwin, Alexander Agassiz, and the Meaning of Coral* (2005) by David Dobbs. Griset's coral island painting at the Bromley Museum storeroom led me to appreciate Dobbs's full account, which bears summarizing here.

When Darwin set sail on his five-year voyage of discovery aboard *HMS Beagle* in 1831, sailors and explorers were quite familiar with coral reefs and coral islands, but no one knew how they got there. While exploring South America, Darwin devoured Lyell's just-published first volumes of *Principles of Geology* (1830-1833), and realized that coral reefs were perfect exemplars of his uniformitarian doctrine.

> We feel surprise when travelers tell us of the vast dimensions of the Pyramids and other great ruins, but how utterly insignificant are the greatest of these, when compared to these mountains of stone accumulated by the agency of various minute and tender animals! This is a wonder which does not at first strike the eye of the body, but, after reflection, the eye of reason. (Darwin 1842, entry for April 12, 1836)

For two years, Darwin had observed the shorelines of South America, which seemed to show contradictory evidence of having been repeatedly built up and worn down. Before he ever had actually seen a coral reef, he began to form a theory of how they were formed, based on the effects and distribution of subsidence and uplift of the ocean floor.

Above: The central painting in Ernest Griset's 1871 triptych of a coral lagoon island, or atoll, with an approaching ship (enlarged right) which may well be *HMS Beagle*.

At Tahiti he made his first field studies of reefs, and gathered other evidence at Cocos, Keeling and Mauritius that convinced him he was on the right track. Upon his return to England, he couldn't wait to explain his theory of coral reefs to Lyell. In an introduction to a later edition of Darwin's *Structure of Coral Reefs*, the geologist John W. Judd recalled "a remarkable conversation" he had with Darwin after Lyell's death, in which Darwin recalled that Lyell, on receiving from the lips of its author a sketch of the new theory, was so overcome with delight that he danced about and threw himself into the wildest contortions, as was his manner when excessively pleased. He wrote shortly afterwards to Darwin as follows: – "I could think of nothing for days after your lesson on coral-reefs, but of the tops of submerged continents. It is all true, but do not flatter yourself that you will be believed till you are growing bald like me, with hard work and vexation at the incredulity of the world." (Judd, 1909, p. 5)

Darwin's theory of coral reefs starts with the fact that live corals grow only in shallow water. He combines that with the observation that reefs seem to be associated with sea floors or submerged volcanoes that are subsiding. Accretions of rock build up as millions of coral animals secrete calcium carbonate atop the accumulated skeletons of older colonies. As the "basement" on which all are resting continues to settle, the

As we go to press, this engraving of Whitsunday Island, and possibly HMS Beagle (which never visited there) was found in an 1890 edition of *Voyage of the Beagle*. Unravelling the history of Darwin's association with coral island artworks continues.

"live areas" thrive only near the surface, where they can receive sufficient light to catalyze the production of nutrients. In other words, colonies keep reaching upwards to receive sunlight, while the ocean floor beneath them keeps sinking. The process of how the tiny "coral insects" could create great reefs a mile long and thousands of feet thick filled him with awe and admiration. He described his exploration of a Keeling atoll he had explored with FitzRoy using two of his favorite words about natural productions, "grandeur" and "simplicity":

> …there is to my mind a considerable degree of grandeur in the view of the outer shores of these Lagoon Islands. There is a simplicity in the barrier-like beach, the margin of green bushes & tall Coca nuts, the solid flat of Coral rock, strewed with occasional great fragments, & the line of furious breakers all rounding away towards either hand.[29]

Throughout the nineteenth century, Darwin's theory about reef formation remained contentious. Alexander Agassiz, son of the Harvard zoologist Louis Agassiz, spent forty years and his considerable fortune visiting hundreds of the world's reefs, trying to disprove Darwin's explanation and come up with a better one. He never succeeded, and died without having completed or published his projected magnum opus.

Beginning in the 1880s and continuing for decades after Darwin's death in 1882, controversies over coral reef formation raged anew. Agassiz and others thought they had found reefs forming in areas where the seafloor was lifting rather than snking. Some geologists even blasted Darwin's method of doing science. Rather than seeking patterns of coral reef distribution from charts and maps, they argued, he needed to visit more reefs firt-hand, as they had done. However, Darwin thought that more visits to

reefs were pointless unless "some doubly rich millionaire" could be induced to make deep core drillings that would definitively reveal their structure.

Not until 1950 – while attempting to destroy Eniwetok, a remote coral island in the Marshall group – did science find definitive answers. Preparatory to testing an H-bomb there, the U.S. Government sent geophysicists to drill test cores deeper than anyone had previously done. David Dobbs relates that finally, at 42,00 feet, the drills hit

> greenish basalt, the volcanic mountain on which the reef had originated. Dating of the tiny fossils in the bottommost layer of coral showed that the reef had gotten its start in the Eocene. For more than thirty million years this reef had been growing – an inch every millennium – on a sinking volcano, thickening as the lava beneath it subsided. Darwin was right, Agassiz wrong. (Dobbs, 2005:255)

Over the next few years, many more drillings and echo soundings confirmed that reefs had formed only in areas of sea floor subsidence all over the Pacific and Caribbean. As it turned out, Darwin's 1842 model also fits perfectly with theories of plate tectonics, which were only developed in the 1960s. In Dobbs's words, "the movement of the earth's huge plates explains the subsidence of the Pacific and many other reef areas… Darwin's theory was astoundingly correct." (Dobbs, 2005:256)

"Reef Madness," as Dobbs has dubbed it – with incessant debates over reef formation persisting on for a century, and Darwin's ultimate, posthumous vindication – is a fascinating episode in the history of science. The painting led me to it.

That lovely image of the coral lagoon island, which at first seemed enigmatic and out of place in Sir John Lubbock's collection of paleoart, seen in context, made perfect sense. It had nothing to do with prehistory, but a great deal to do with Charles Darwin's mentoring relationship with John Lubbock, sometimes known as "Darwin's apprentice." The reissue of Darwin's *Coral Reefs* book in 1874 was an important milestone, and it seems reasonable that Lubbock commissioned the painting as a celebratory commemoration and homage to his teacher. It was republished again several times between 1876 and 1910. (The 1890 version contains essays by the geologist J.W. Judd.)

In Griset's rendering, the beautiful coral island appears to be isolated beneath a vast sky, desolate but jewel-like, yet somehow pristine and mysterious.

Still locked away against the English winters in its stone-brick storeroom at the Bromley museum, the Darwin-inspired watercolor of an eternal tropical lagoon has survived since 1871. For anyone who sees it, or a reproduction, it tells its tale for a new generation – as well as that of the familiar surveying vessel in the painting that is fast approaching it. The coral atoll island, a spectacular and complex natural marvel, cannot know that a young man aboard that sailing ship has already begun seeking solutions to its mysteries.

4. Epilogue

One sunny spring afternoon last year, several friends and I were treated to an unforgettable walking tour of the ruins of High Elms, guided by Lyulph Lubbock, the last of the family to have been raised on the estate grounds. In 1967 the great mansion burned down (ironically, on "St. Lubbock's Day," the August secular bank holiday that

Sir John himself had instituted). The bucolic, popular public park and nature reserve is characterized by a delightful combination of well-planted and manicured trees and plants with patches containing ponds and remnants of wild woodlands.

Fortunately, all of the Griset paintings of prehistoric scenes commissioned by Lubbock and the coral island tryptich had been rescued years before High Elms burned down, and are safely archived at the Bromley Museum. On our walk, Lyulph carried with him an astonishing collection of family photos and heirlooms, including the guest book from the great house – treasures which he has generously shared by reproducing some of them with his article in the present special issue.

When I first began trying to piece together bits of forgotten or "unknown" history of the evolutionists, I was unprepared for so many delightful personal connections that would enrich my life. Thomas Huxley's great-grandson Michael shared previously unseen family photographs of "Darwin's bulldog" (Desmond, A. 1999); Randal Keynes has become a dear friend and valued colleague, to whom I am grateful for steering me to the Griset paintings. Many Darwin descendants attended my historical musical, *Charles Darwin: Live & In Concert*, which I have performed throughout the U.S., as well as in Germany, the UK, Australia, and – most recently –aboard a cruise ship in the Galápagos Islands.

In 1996, when the Linnean Society of London sent me to lecture in the persona of Darwin at the Edinburgh Science Festival, the gracious botanical ecologist and illustrator Sarah Darwin sent flowers and a note: "Break a leg. With love, from your great-great granddaughter." Gareth Nelson, who has contributed an article on Wallace to this special issue, represented Wallace in that program.

At a Dresden performance at the Deutsches Hygiene-Museum in 1994, I was introduced to Alfred Russel Wallace's grandson Richard, a teacher of mathematics. His direct and forthright demeanor were so reminiscent of his grandfather's portraits, that I was emboldened (or impertinent) enough to ask: "Does the Wallace family resent the Darwins for having received the lion's share of the glory?" (Milner, 1995) I'll never forget the playful expression in his clear blue eyes. "Grandfather didn't mind," he replied, with a kindly but ironic smile, "Why should we?"

Footnotes

1. The Charles Darwin Correspondence Project has undertaken to retrieve, catalog, transcribe, annotate and publish both sides of the entire known correspondence of 15,000 letters, of which about half were written by Darwin. It is located both at Cambridge University Library, England, its headquarters, and at the American Philosophical Society in Philadelphia. All the letters have been transcribed and stored in an extensive computerized archive. The first of a projected thirty volumes of *The Correspondence of Charles Darwin* came out in 1985; a total of fifteen volumes have been published to date. Various letters referenced in these footnotes can be accessed from these sources or online.

   In the 1870s, the newly invented telephone became a fad among the well-to-do, and many rushed to have one installed. To our everlasting benefit, Charles Darwin refused to allow one in his home., and continued writing and receiving letters to the end of his life in 1882.

2. An account of the British Association meetings appeared in the *London Times*, September 13, 1876. Alfred Russel Wallace's (1874) *Miracles and Modern Spiritualism,* Nicols and Co.,

London, includes many of his earlier articles and statements on the subject. In letters to *The Times* (Sepember 17 and 18, 1876) before the trial, Wallace expressed his confidence in Slade's integrity in producing unexplainable or paranormal phenomena.

3. Henshaw Ward (1927), *Darwin the Man and His Warfare*, Bobbs-Merrill, N.Y. p. 395. Quotes Henrietta Darwin regarding the popular fad for spiritualism in January, 1874 and the séance conducted by Charles Williams at her uncle Hensleigh Wedgwood's. In Henrietta Darwin, Ed., *Emma Darwin: A Century of Famiily Letters*.

   Herne and Williams were not the first mediums to go after Darwin in an attempt to convince him of the reality of the "phenomena." In a872, the famous "Prince of Spiritualists" D. D. Home tried to lure him to attend a "test séance" through Darwin's cousin Sir Francis Galton. (Apparently, Home had offered a cash challenge if scientists could catch him in fraud.) Darwin begged off on grounds of ill health: "the subject should be investigated…but I dare not accept Mr. Home's remarkably liberal offer…Can you not get some man known for physical sciences to join you?" Darwin used his wife Emma, in her role as nurse to the invalid, as an excuse: "she thinks even more strongly than I do, that it would be impossible for me" [to attend the séance.]" Charles Darwin to Francis Galton, April 21, 1872.

4. George Darwin to Thomas H. Huxley, January 1874. Thomas Huxley Papers. Darwin Library, American Philosophical Society, Philadelphia.

5. Charles Darwin to an unnamed journalist, September 26, 1878. Also, Charles Darwin to George J. Romanes, September 21, 1878, "Williams is proved a rogue."

6. Charles Darwin to George J. Romanes, May 23, 1877. "Your negative results are highly pleasing—delightful to me, for I felt convinced Williams was a very clever rogue…"

7. Huxley, Thomas. Reflections on a Philosopher's Big Toe. *Pall Mall Gazette*, January 1889.

8. Huxley, *Ibid.* The title refers to Huxley's practiced ability to produce mysterious "spirit raps" by snapping his big toe loudly inside his boot.

9. Harry Houdini (1924) *A Magician Among the Spirits.* Harper, New York, p. 81: "While touring Europe in 1929 I had the pleasure of meeting Sir Ray Lankester and hearing from him an account of Slade's undoing. Both he and Donkin were physicians. They had been laying their plans to expose the two other mediums, Herne and Williams, but Slade's unexpected arrival in London changed these plans, and instead they plotted the séance which proved to be Slade's downfall." I am indebted to Malcolm Jay Kottler for supplying this important piece of my evidentiary mosaic.

10. Lankester and his associate Dr. Horatio Donkin both gave accounts of the incident in letters published in the *Times* on September 16, 1876. See also their court testimony reported in the *Times* for October 11, 1876. In his groundbreaking study, "Alfred Russel Wallace, the Origin of Man, and Spiritualism (1974) *Isis,* 65: pp 146-192, Malcolm Kottler notes (p, 179) that "Although Lankester later claimed during his lawsuit [against Slade] that he had gone to the séance unpredjudiced, it seems as if he had for some time been intent on exposing the mediums Herne and Williams" Charles Williams was also the longstanding target of Darwin's attempt to expose him; it seems likely that Lankester's and Darwin's efforts were connected, particularly in the light of Darwin's later offer of financial aid to the costs of prosecuting Slade.

11. Henry Slade and his partner Simmonds were charged with "unlawfully using subtle craft, means and device to deceive and impose uupon certain of Her Majesty's subject." *London Times* for October 3, 1876.

12. Accounts of the Slade affair were featured prominently in the *Time of London* from September 16 through November 1, 1876. Extensive reportage of the trial appeared on October 3, 11, 21, 23, 28, 30, and November 1. There were also heated exchanges of letters by Slade, Lankester, and Wallace on September 16, 18, 19, 20, and 21.

13. Professor E. Ray Lankester's remarkable little introductory memoir (1896) to a selection from Darwin's writings in the *Charles D. Warner Library of the World's best Literature,* pp 4385-4393, gives brief but very valuable recollections about Darwin which appear nowhere else, and appears to have been overlooked by historians.

    In these recollections, Lankester refers to a letter Darwin wrote to him concerning the Slade trial, although the original document has never surfaced: "When I prosecuted Slade the spiritualistic imposter, and obtained his conviction at Bow Street as a common rogue, Darwin was much interested…[and wrote that] he considered [it] to be a public benefit and that he should like to be allowed to contribute ten pounds to the cost of the prosecution. He was ever ready in this way to help by timely gifts of money what he thought to be a good cause…" (p. 4391).

14. Huxley, T., *Op. cit., Pall Mall Gazette.*
15. Truesdell, J. W., 1883. *The Bottom Truth Concerning the Science of Spiritualism.* New York.
16. Wallace's testimony was reported in the *London Times* for October 30, 1876.
17. Many subsequent notices in the *London Times* included Slade's appeal, in which the conviction was quashed (January 31, 1877; March 3, 1877), and meetings of the British National Spiritual Society in support of Slade.
18. Joseph Hooker to Charles Darwin, December 18, 1879. Hooker's mean-spirited letter demonstrates the extent to which the scientific establishment rained abuse on Wallace for his Spiritualistic unorthodoxies.
19. Into his mid-seventies, Wallace struggled in near-poverty, grading school exams to maintain his family. He was extremely grateful for Darwin's efforts to get him a modest pension of £200, which, he wrote, "will relieve me from a great deal of the anxieties under which I have laboured for several years." (That amount was only slighter smaller than the annual bill for meat at Darwin's home.) See Colp, R., Jr. 1992 "I will gladly do my best": how Charles Darwin obtained a civil list pension for Alfred Russel Wallace."? *Isis*, 83.
20. Charles Darwin to Hensleigh Wedgwood, May 5, 1880.
21. Lankester, E. R. Letter, "The Spiritualistic Challenge," in *Pall Mall Gazette*, January 13, 1885.
22. Quoted in Marsh, J. 1983, p. 636.
23. *Bromley Record*, March 1, 1860, p. 1
24. *Bromley Record*, Oct 1, 1860: Grey Sergent of Police v.s. Bennet
25. Francis Darwin, 1902, "Reminiscences" in *Life and Letters of Charles Darwin*, London: John Murray, p. 287: "He returned home from his walk pale and faint from having seen a horse ill-used, and from the agitation of violently remonstrating with the man."
26. William Darwin recalled, "Though he was ill and weak and it was most painful to attack a near neighbor, [my father] collected all the evidence himself…and had the case brought before the magistrates, and…got the man convicted." Litchfield, H. ed., 1915, *Emma Darwin: A Century of Family Letters*, ii, p. 168.
27. *Bromley Record*, October 1, 1860.
28. Letter from Emma Darwin to William ,March 11, 1858 (probable date) 'The other day when Papa was doing some justice work in the dining room [Lenny] went upstairs to Miss Pugh saying "There is Papa being Judge, jury & policeman all himself."
29. The description of a coral island in "the Keelings" that Darwin and FitzRoy explored, appeared in both *Darwin's Diary* and its successor, *Voyage of the Beagle* (1839). Sandra Herbert, in *Charles Darwin, Geologist* (Herbert, 2005, p. 236) points out that he used "two of his favorite words – "grandeur" and "simplicity"" in his description" — a usage that is strikingly reminiscent of the famous last sentence of the *Origin of Species*: "There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into

one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved."

References

Darwin, C. 1839. *Voyage of the Beagle.* (Diary of the Voyage of *HMS Beagle*) Nora Barlow, ed. Cambridge: Cambridge University Press, 1933.

Darwin, C. 1842. *The Structure and Distribution of Coral Reefs.* London: Smith, Elder.

Darwin, C. 1863. *The Various Contrivances by which Orchids are Fertililsed by Insects.* London: John Murray.

Darwin, C. 1871. *The Descent of Man.* Darwin, and selection in relation to sex. New York: Appleton and Co.

Darwin, C. 1993. *The autobiography of Charles Darwin, 1809-1882: with original omissions restored.* Barlow, Nora, ed. 1958, 1969, 1993.

Desmond, A. 1999. *Huxley: From Devil's Disciple to Evolution's High Priest*. Cambridge: Michael Joseph.

Dobbs, David, 2005. *Reef Madness; Charles Darwin, Alexander Agassiz, and the meaning of coral.* New York: Pantheon Books.

Herbert, Sandra, 2005. *Charles Darwin, geologist*. Ithaca: Cornell University Press.

Huxley, T. H. 1870. *Corals and Coral Reefs.* Dodo Press Reprint, 2008.

Judd, J. W., 1909. "Critical Introduction," in C. R Darwin, *On the Structure and Distribution of Coral Reefs*, etc. (London: Ward, Lock, 1909: pp 3-10.

Keynes, R. 2002. *Annie's Box; evolution and Darwin's daughter*. London: Fourth Estate. Published in USA under title *Charles Darwin, his daughter and human evolution*. New York: Penguin, Putnam.

Lubbock, J. 1865. *Pre-historic times, as illustrated by ancient remains, and the manners and customs of modern savages*. London.

Marsh, J., 1983. Charles Darwin – Justice of the Peace in Bromley, Kent. *Justice of the Peace,* 147: 636-37.

Milner, R. 1990a. Darwin for the Prosecution, Wallace for the Defense. Part I How two great naturalists put the supernatural on trial. *North Country Naturalist* 2: 19-35.

Milner, R. 1990b. Darwin for the Prosecution Wallace for the Defense, Part II. Spirit of a dead controversy. *North Country Naturalist* 2: 19-35.

Milner, R. 1993. *Charles Darwin: evolution of a naturalist.* New York: Facts on File.

Milner, R. 1995. Charles Darwin: The Last Portrait. *Scientific American* 273,5 (Nov): 60-61

Milner, R. 1996. Charles Darwin and Associates, Ghostbusters, *Scientific American,* Vol-275, 4 (Oct): 72-77.

Milner, R. 2002. Farewell, Fossilface; a memoir of Stephen Jay Gould (1941- 2002). *Skeptic* 9,4: 30-35.

Milner, R. 2007. Portraits of Prehistory; imaging our ancestors in Sawyer, G., Deak, V. *et al, The Last Human: a guide to twenty-two species of extinct humans.* New Haven: Yale University Press.

Milner, R. 2009. *Darwin's Universe; evolution from A to Z*. Berkeley: University of California Press.

Stone, I., 1980. *The Origin; a biographical novel of Charles Darwin.* New York: Doubleday.

Wallace, A. R., 1905. *My Life: a record of events and opinions.* Dodd, Mead, New York.

APPENDIX
Darwin Lyrics

DARWIN'S NIGHTMARE

(in homage to W. S. Gilbert and Sir Arthur Sullivan)

I was lying awake with a dismal headache,
And my sleep was put off by anxiety.
For I feared that my plan of explaining how man
Had evolved would provoke notoriety.

Though I'd fled London town for the village of Down
And a home that is quiet and regal,
Yet I get no respose, and I can't even doze
Without dreaming I'm back on the Beagle.

We are rounding the Horn in a furious storm
And our progress is measured in inches,
Then we're rolling around 'til the crew's
almost drowned
And they scatter like terrified finches.

Cap'n FitzRoy's in a mood, and he's coming unglued
And cannot say where our next port is.
I fear he's unwell, for he's sprouted a shell,
And turns into a monstrous tortoise.

He ignores the enormity of this deformity,
Carapace, scales, and the rest of it.
And vows his complexion is close to perfection,
And as for my fears, makes a jest of it.

After ten thousand miles--the Galapagos isles,
Now I'm tense and exceedingly wary.
For I fear that this place could result in disgrace
When I use it to further my theory.

Then I scramble ashore as the sea lions roar,
And I hear a contemptuous snicker,
I glance up in a tree, and there what do I see?
Seven chimps and an Anglican vicar.

It's not hard to tell that they're all mad as hell,
So I ask, "What's the source of your fury?"
His Grace's retort is "Silence in Court!"
For I am your judge and your jury."

With a barrister's smile, he declares I'm on trial
And tells me the cause of his action.
"You cannot escape, for you said 'man's an ape,'
And my clients demand satisfaction."

To challenge my fitness, he calls his first witness
An albatross down from Guiana.
But the bird flips its tail and turns into a snail,
Then uncoils and becomes an iguana.

The judge is perplexed, and I say, "Don't be vexed,
We've been changing since Adam's arrival.
The monk in his cloister descends from an oyster,
The fittest have mastered survival."

His Honor says,"Quiet! The court will not buy it,
You mock, Sir, the truth of Creation,
You've played fast and loose, now your
neck's in a noose,
And you're off to eternal damnation."

I've given up hope as he tightens the rope
And the chimps start to make a commotion
Then a wave hits the shore with a volcanic roar
And the island sinks under the ocean.

With a shriek I awake, and it's all a mistake,
The iguana is really a kitten.
No chimps are in sight on this miserable night,
And no wonder --- I'm back in Great Britain.

I'm a regular wreck with a crick in my neck,
My anxiety's hardly diminished.
And the night's been too long, ditto-ditto my song,
And thank goodness -- they're both of them finished!

WHY DIDN'T I THINK OF THAT?

Lyrics ©1992 by Richard Milner. Music by Jacques Semmelman

(When Darwin's friend Thomas Henry Huxley first read "The Origin of Species" in 1859, he exclaimed, "How incredibly stupid not to have thought of that myself!")

Of course! Of course! It must be so.
I should have seen it long ago.

'Twas adaptive radiation that produced the mighty whale
His hands have grown to flippers and he has a fishy tail.
Selection's made him streamlined for his liquid habitat.
Why didn't I think of that?

There was an ancient mammal that could hop and leap around
But with webbing 'twixt his fingers, he could fly right off the ground.
And so this mousy creature evolved into a bat.
Why didn't I think of that?

There are fossils in the ground, protozoa in the sea
All these unrelated facts
Made a monkey out of me.
But now I see how species were selectively defined.
Oh, how could I have been so ruddy blind?

There was an ancient monkey with a long and curly tail.
This ape evolved into a man
(He's teaching now at Yale.)
A chimp could pass for upper class
In gloves and a cravat
Why didn't I think of that?

The struggle for survival lies outside the jungle, too.
Just take a look at Parliament, it's better than a zoo!
We're at each other's throats just like
the bulldog and the cat.

But why didn't I, why didn't I –
Your ideas on evolution will create a revolution!
Why didn't I think of that?

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