Charles Darwin / by Arthur E. Shipley.

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CHARLES DARWIN,

BY

ARTHUR E. SHIPLEY.

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CHARLES DARWIN[1].

THIS is the year of Centenaries. Perhaps in no other year in History were so many men born destined to impress their genius on the Literature, the Politics and the Science of the world as in 1809. The number of literary men who first saw the light in that "annus mirabilis" is almost too long to mention—Mark Lemon, the genial Editor and one of the founders of *Punch*, "Crimean" Kinglake, John Stuart Blackie, till lately a well-known figure in Edinburgh, Monckton Milnes, the first Lord Houghton, "poet, critic, legislator, the friend of authors." One could prolong the list, and one must at least mention the names of Louis Braille, the inventor of the Braille type for the blind, of Edgar Allen Poe, of Oliver Wendell Holmes, of Fanny Kemble and of Elizabeth Barrett Browning, before passing on to remind you that this year is also the Centenary of Tennyson who with Browning formed the twin stars of poetry during the reign of Queen Victoria and who from his intimate knowledge of natural history and his keen power of observation was essentially the Poet of Darwinism. Of his lifelong friend, born the same year, Edward Fitzgerald, the translator, one feels almost inclined to say author, of Omar Khayyám, and of the gifted musician Mendelssohn there is no time to speak.

[1] Portions of this Lecture have been taken from my Address as President of the Zoological Section of the British Association, at the Winnipeg Meeting, 1909.

Three other names stand out. William Ewart Gladstone, that leader of men, a politician and a statesman capable more than most men at once of arousing the warmest affection of his followers and the bitterest hatred of those who went the other way. Cultured as he was and widely read, he had his limitations, and although his tenacious memory was stored with the humanities of all the ages, he was singularly devoid of any knowledge of Science. If we may paraphrase the words of Lord Morley in his estimate of Gladstone's writings we would say that his place is not in Science "nor in critical History but elsewhere."

Abraham Lincoln, the greatest man born on the American continent since the War of Independence, was some ten months older than Gladstone. Both men were great statesmen, both men were liberators; for we must not forget that in many minds the help Gladstone gave to Italy in her struggle for freedom and union remains the most enduring thing he achieved.

Yet in externals how different! One the finished, cultured product of the most aristocratic of our public schools and the most ancient of our Universities, the other little read in the classics or in medieval and ecclesiastical lore, yet deeply versed in the knowledge of men and how to sway them. Rugged, a little rough if you like, humorous and yet sad, eminently capable, a strong man, and at heart "a very perfect gentleman."

On the same day, the 12th February, upon which Lincoln first saw the light, was born at the "Mount," Shrewsbury, a little child destined

as he grew up to alter our conceptions of organic life perhaps more profoundly than any other man has ever altered them, and this not only in the subjects he made his own but in every department of human knowledge and thought.

Being as I am a member of Charles Darwin's own College, recalling as I do the celebration of a few months ago in which the whole world united to do his memory honour, it would seem meet that I should in this year of the centenary of his birth devote this address to a consideration of his life and of his work, and of such confirmation and modification of his theories as the work of the last fifty years has revealed.

As to the man I can but quote two estimates of his character, one by a College companion who lived on terms of close intimacy with Darwin when at Christ's, the other the considered judgment of one who knew and loved and fought for Darwin in later life.

Mr Herbert says:—

"It would be idle for me to speak of his vast intellectual powers...but I cannot end this cursory and rambling sketch without testifying, and I doubt not all his surviving College friends would concur with me, that he was the most genial, warm-hearted, generous, and affectionate of friends; that his sympathies were with all that was good and true; and that he had a cordial hatred for everything false, or vile, or cruel, or mean, or dishonourable. He was not only great, but pre-eminently good, and just, and loveable."

Professor Huxley, speaking of the name of Darwin, says:—

> "They think of him who bore it as a rare combination of genius, industry, and unswerving veracity, who earned his place among the most famous men of the age by sheer native power, in the teeth of a gale of popular prejudice, and uncheered by a sign of favour or appreciation from the official fountains of honour; as one who, in spite of an acute sensitiveness to praise and blame, and notwithstanding provocations which might have excused any outbreak, kept himself clear of all envy, hatred, malice, nor dealt otherwise than fairly and justly with the unfairness and injustice which was showered upon him; while, to the end of his days, he was ready to listen with patience and respect to the most insignificant of reasonable objectors[1]."

Although the Darwin family trace their ancestry to about the year 1500, we need not I think go further back than Charles' grandfather, Erasmus (1731—1802). This distinguished physician, the author of the *Loves of the Plants* and of *Zoonomia*, transmitted to his grandson his benevolent and sympathetic character and a remarkable charm of manner, as well as his great stature.

In many respects Erasmus Darwin was in advance of his times. He was for instance a great advocate of temperance, and Mr Lucas has lately reminded us of his inhuman advice "If you must drink wine let it be home-

[1] *Life and Letters of Charles Darwin*, Vol. II. 1887, p. 179.

made," surely the shortest cut to total abstinence yet devised by the wit of man.

He wrote innumerable verses in the somewhat stilted style of the period. They were immensely admired by his contemporaries, and Cowper, who could have had little or no sympathy with most of Darwin's views, wrote in conjunction with Halley a poem in his honour which begins:—

"No envy mingles with our praise,
Tho' could our hearts repine
At any poet's happier lays,
They would, they must, be thine."

The third son of Erasmus, Robert Waring Darwin, was the father of Charles. Like his father he was a physician, and for many years he enjoyed a large practice at Shrewsbury. He married Susannah, the daughter of his father's friend, Josiah Wedgwood, of the well-known pottery works at Etruria. The Mount, a large, red-brick, comfortable-looking, square house, was built by him about the year 1800, and here as I have said Charles Darwin was born.

In his charming and frank fragments of autobiography Darwin recalls many incidents of his own childhood. As a boy he early developed a taste for collecting plants, shells, minerals and other natural objects, and he was at pains to learn their names. He tells a curious story of himself pretending that he could alter the colour of flowers by watering them with coloured fluids, curious because at his age boys are not as a rule interested in such problems of vegetable physiology. It is characteristic that in the earliest portrait of him,

a charming crayon sketch in which his youngest sister Catherine also appears, he is depicted holding a pot of flowers in his hands. At the age of nine he was sent to the school at Shrewsbury then in its picturesque old buildings in the town; he was a boarder there and thus had as he says "the great advantage of living the life of a true schoolboy." The school was but almost a mile from his father's house, and he used often to run home between roll-calls. He remained at school until he was sixteen, and then his father, thinking he was not doing much good, sent him to join his elder brother who was studying medicine at Edinburgh University. At this period, like his grandfather, his father and his brother, Darwin was destined to study medicine, and he attended the medical course which consisted entirely of lectures, all of them with but one exception "intolerably dull." Apart from the lectures, which were evidently almost useless, Darwin acquired a good deal of miscellaneous information whilst at Edinburgh; he did much collecting along the shore, learnt the art of the bird-stuffer, frequented two or three Societies and doubtless, as is the habit of those of his age, took part in many and interminable discussions. He also became an ardent sportsman and was especially enthusiastic about shooting. Apparently however his heart was not in his medical work, and in 1827 his father proposed that he should become a clergyman and with this in view decided to send him to Cambridge.

The Admission Book at Christ's College, which in those days was very negligently kept, contains the following entry: "Admissi sunt

in Collegium Christi a Festo Divi Michaelis 1827 ad Festum eiusdem 1828:

[No. 3.]

Octobris 15. Carolus Darwin admissus est pensionarius minor sub Mro Shaw."

Charles Darwin came into residence in the Lent Term of 1828, with a view of taking Holy Orders, and graduated in the Easter Term of 1831. The reason for his not joining the College in the usual month of October was that, although he had been educated at Shrewsbury, one of the best classical schools in England, during the two years he had spent at Edinburgh studying the preliminaries for the medical profession he found to his dismay that never having opened a classical book since he left school he "had actually forgotten, incredible as it may appear, almost everything which he had learnt, even to some few of the Greek letters, so that between October and Christmas he was with a private tutor at Shrewsbury." But as he records, "I soon recovered my school standard of knowledge, and could translate easy Greek books such as Homer and the Greek Testament, with moderate facility."

Charles Darwin probably came to Christ's College because his elder brother Erasmus was a student there. Erasmus in fact proceeded to the M.B. Degree in the year Charles Darwin came up. Why Christ's was chosen for this generation of Darwins does not seem clear. Their grandfather Erasmus, author of *The Loves of the Plants*, was at St John's, a College closely connected with Shrewsbury, but at that period the life of an undergraduate

at that College seems to have been a somewhat troubled one, whereas, to judge from the expressions of contemporaries of Charles Darwin, Christ's was in their day "a pleasant, fairly quiet College, with some tendency towards horsiness," although betting was not a regular practice. Many of the men made a custom of going to Newmarket during the races, in this they were by no means discouraged by the tutor, Mr Shaw, who was himself generally to be seen on the Heath on these occasions. It is in the recollection of those now living that one of the College "gyps" used to recount how when young he had seen a number of students in scarlet coats ride round the first court. Mr Shaw before his death had held every preferment which it was in the power of the College to confer. At the age of 64 he was elected to the mastership; but the seclusion of the Lodge proved intolerable to one who for 42 years had lived practically in the Combination Room, and he resigned in three weeks. Three years later he accepted the living at Kegworth, but was back in College within two months. He tried no further change, until he died in 1859, and after holding a Fellowship for 52 years, he was laid to rest in the ante-chapel. Shaw was evidently, as the manner of the times was, an easy-going tutor, and there is no indication that he or any of the other authorities did not get on perfectly well with the young naturalist.

Shaw gave up the tutorship in 1829 and was succeeded by John Graham, one of the most brilliant of the *alumni* of the College (fourth Wrangler and Chancellor's Classical

Medallist in 1816), who was elected Master of the College in 1830, and was appointed to the Bishopric of Chester in 1848. Graham was one of the small band of Cambridge Liberals in the days of the first Reform Bill, and a strong supporter of the abolition of University tests. As a disciplinarian in College he is said to have been somewhat too easy-going, a fault which Darwin would probably be very ready to forgive him.

Late in life men are apt to look back upon their College days with a somewhat exaggerated regret for lost opportunities, and Charles Darwin felt that at Cambridge his "time was wasted, as far as his academical studies were concerned, as completely as at Edinburgh and at school." But this must not be taken too literally. He seems to have passed his University examinations with ease, and a letter recording his joy at getting through the "Little-Go" shows that he at any rate took them seriously. In his third year he records that he worked with some earnestness for his final degree of B.A., brushing up his classics, algebra, and Euclid, which later gave him much pleasure as it had at school.

In those days Paley's *Evidences of Christianity*, as well as his *Moral Philosophy*, were essentials for the B.A. Degree, and Darwin prepared the subject matter of these works in a very thorough manner. The logic of the *Evidences* gave him, he says—

> "as much delight as did Euclid. The careful study of these works, without attempting to learn any part by rote, was the only part

of the academical course which, as I then felt, and as I still believe, was the least use to me in the education of my mind. I did not at that time trouble myself about Paley's premisses, and taking these on trust I was charmed and convinced by the long line of argumentation."

He passed the final examination with success, and indeed gained a good place amongst those who were candidates for the Ordinary Degree. In later years Darwin was not quite sure what place he had taken in his final examination, his memory fluctuating between fifth, tenth, and twelfth. As a matter of fact, a reference to the archives of the University shows that he was placed tenth in the οἱ πολλοὶ, a not uncreditable position out of a class list of 178 successful candidates. In that year the whole number of the Honours candidates was but 86.

Apparently Darwin's experiences at Edinburgh had given him a distaste for lectures, and it is unfortunate that this distaste kept him away from the teaching of Sedgwick. He attended, however, the botanical lectures of Henslow, which were then crowded with students as well as with senior members of the University, and he revelled in the excursions which Henslow used to conduct, on foot or in coaches, or down the river in barges, "or to some more distant place, as to Gamlingay, to see the wild lily of the valley and to catch on the heath the rare natterjack." He was in fact known to the senior members of the University as "the man who walks with

Henslow," and the man who walked with Henslow did not spend three years at Cambridge wholly in vain.

On coming into residence Darwin kept for a couple of terms over the shop of Bacon the tobacconist,—Calverley's Bacon—at that time in Sidney Street. For the rest of his time in Cambridge he had a pleasant panelled set of rooms—my "most snug and comfortable rooms," as he calls them—on the south side of the first court of Christ's, formerly occupied, according to tradition, by Paley, and since Darwin's time by the present Dean of Westminster and successive College deans.

Darwin, as has been said, came up after Christmas. Among those of his contemporaries at Christ's, who had joined the previous October, was A. T. Holroyd, who, a few years later, in 1836, journeyed up the Nile and crossed the desert to Khartum. He penetrated up the Blue Nile to Sennaar, and again across the desert to the White Nile and Kordofan. Later he explored the Syrian desert, and "Holroyd's tracks" were common on maps of the period. He afterwards went to New Zealand and Australia, where he practised at the Sydney bar. He was elected to Parliament in 1863, and became Minister of Works. There was also Charles Davidson, a distinguished conveyancer, and G. H. Moore, a Roman Catholic, of Moore Hall, County Mayo, which county he represented in Parliament for many years. He was a leader with C. Gavan Duffy in the tenant-right movement, and a distinguished and popular man. Amongst the men who came up two terms after Darwin

was the Hon. M. A. Harris, son of Baron Harris of Seringapatam and Mysore, who for a time served in the East India Civil Service; the Reverend W. Fitzwilliam Wharton, Rector of Barmingham, Yorkshire; William Aubrey de Vere Beauclerk, ninth Duke of St Albans; and James Hildyard, one of six brothers who were all Fellows of various Colleges. The last-named was a sound scholar, and edited two plays of Plautus. He became Rector of Ingoldsby, and was the author of *Ingoldsby Letters.*

Amongst his friends was Whitley, Senior Wrangler in 1830, who inoculated him with a taste for pictures and good engravings, and Darwin records with pleasure his frequent visits to the "Fitzwilliam Gallery," and thinks that his taste for pictures and engravings must have been "fairly good; for I certainly admired the best pictures." His friend J. M. Herbert introduced him to a musical set, and, in spite of his want of ear, he acquired a strong taste for music, "and used very often to time his walks so as to hear on week-days the anthem at King's College Chapel." He says, "This gave me infinite pleasure, so that my backbone would sometimes shiver." Amongst other absorbing pursuits was that of collecting insects, especially beetles. He was first interested in entomology by his cousin W. Darwin Fox, of Christ's, who had kindred tastes, and with whom he frequently corresponded—in fact, most of the letters written from Christ's College that remain were addressed to him.

After he had passed his final examination Darwin had still to keep one term in order to

proceed to his degree, which he received on April 26, 1831, and it was during this term and the subsequent May term when he was still in residence, that, unvexed by the prospect of examinations, Henslow persuaded him to begin the study of geology. There must have been something unusual about the student, for he seems to have made friends with men much older than himself, and some of them, one would imagine, not very approachable. He records how he used to walk home at night with Dr Whewell; and rejoices in his friendship with Leonard Jenyns. He became the friend of Adam Sedgwick, and in August, 1831, he accompanied him on a geological survey in North Wales. It was on returning from this trip that he found a letter from Henslow informing him that Captain Fitzroy was willing to give up part of his cabin to any young man who would volunteer without pay to act as naturalist on the classical voyage of the *Beagle*. Captain Fitzroy was going out to survey the southern coast of Tierra del Fuego and to visit some of the South Sea Islands, returning by the Indian Archipelago.

We have seen how Darwin had been influenced by the works of Paley; and it is interesting to record that when, owing to the cramped space in a brig of ten guns, Darwin was restricted to a single volume of general reading he selected the writings of a third great Christ's man, John Milton.

Captain Fitzroy, like Mrs R. Wilfer, was a "disciple of Lavater," and took exception to the shape of Darwin's nose. "He doubted whether any one with my nose could possess

sufficient energy and determination for the voyage." But on acquaintance his doubts soon vanished, and the captain and his naturalist became close friends.

I fear time hardly permits a detailed account of the voyage of the *Beagle*. As far as Darwin is concerned it took place at what is perhaps the period of life when the mind is most original. Many of the great creative ideas of thought seem to me to be engendered between the age of twenty and thirty years, and although much may be added later the foundation of man's life work is usually laid then. Darwin, as he records, "worked to the utmost during the voyage from the mere pleasure of investigation and from" his "strong desire to add a few facts to the great mass of facts in Natural Science."

He returned to England in October 1836 and two months later, on December 13, Darwin settled again in Cambridge, but only for three months. He took lodgings in Fitzwilliam Street—which unlovely collection of lodging-houses deserves at least some tablet to record the fact—and spent his time in unpacking and distributing the collections which he had made on his South American voyage. He was apparently a good deal in College, and was evidently made a "Member of the Room," for his name occurs frequently in the Combination Room wine book. This book, which dates back to pre-Napoleonic times, is one of the few records the College retains of the presence of the great naturalist.

His relations to Christ's were always of the most cordial kind, and it has ever been a sub-

ject of regret to the governing body that their new statutes did not pass through Parliament in time for them to confer the only honour they could confer upon Darwin, that of an honorary Fellowship.

Whatever feeling Darwin had about the education that he received at Cambridge he had a real love for the place, to which he sent all but one of his sons; and it is good to read the following lines in his autobiography:— "Upon the whole, the three years I spent at Cambridge were the most joyful of my happy life."

Early in the year 1839 Darwin married his cousin Emma Wedgwood, and for nearly four years they kept house in Upper Gower Street. The sustained toil and the discomforts of the ship had injured Darwin's health, and he and his wife led a life of "extreme quietness." During this period, he states, "I did less scientific work, though I worked as hard as I possibly could, than during any other equal length of time in my life. This was owing to frequently recurring unwellness and to one long and serious illness." His health indeed prevented his regular attendance at scientific and other gatherings which are among the few attractions London can offer over the country, and in 1842 he removed to the secluded Kentish village of Down. The chief attraction of the place was its quietness, "its chief merit," as Darwin writes, "is its extreme rurality." The house stands a quarter of a mile from the village, whose peaceful charm has been but little altered in the last sixty-seven years.

Here for forty years Darwin lived and

laboured, in spite of ill-health which often laid him aside for weeks, his daily task always confined to a very few hours of work. I do not propose to follow further the details of this happy life, but one event, and that a well known one, I must briefly refer to. Darwin's work was so catholic, its bulk so great and its effect so stimulating, that few have realized how vast was the output of scientific work which, though often an invalid, he gave to the world. The extent of the work has been perhaps a little over-shadowed by the immense importance of that great generalization known as Natural Selection. Sir Wm. Thiselton-Dyer has reminded us that Darwin lies beside Newton in Westminster Abbey, and he adds "It is the singular fortune of an illustrious University that of two of her sons, one should have introduced a rational order into the organic and the other into the inorganic world."

Last year was celebrated the Jubilee of the reading of a Paper at the Linnean Society entitled "On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection." This was the joint production of Charles Darwin and of Alfred Russell Wallace, and was laid before the Society by Sir Joseph Hooker and Sir Charles Lyell. The history of this Paper is well known, but it is so creditable to both these high-minded and honourable men that I may briefly repeat it, and in doing so I cannot do better than use the noble words[1] of Wallace:—

[1] The Darwin-Wallace Celebration. The Linnean Society, London, 1908, pp. 5—7.

"The *one fact*," said Wallace, "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 a 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."

It is a remarkable fact that both naturalists owed their inspiration to the same source. Both had read the *Essay on Population* written by a modest clergyman named Malthus, a book which on its appearance was met with a storm of execration; both saw in it the demonstration of that "struggle for existence" which sur-

rounds us on all sides, and both (and they alone of all the readers of Malthus) saw that the necessary consequence of this struggle for existence was that the fittest alone survive. This conception, "an essentially new creative thought," as Helmholtz described it, explained the method of that evolution which since the time of the Greeks has been at the back of men's mind. It thus rendered the fact of evolution acceptable and even inevitable in the minds of all intelligent thinkers and brought about changes in our attitude to the organic world and indeed in our whole relation to life greater perhaps than have ever been produced by any previous thought of man.

It has been somewhat shallowly said, said in fact on the day of the centenary of Darwin's birth, that "we are upon very unsafe ground when we speculate upon the manner in which organic evolution has proceeded without knowing in the least what was the variable organic basis from which the whole process started." Such statements show a certain misconception, not confined to the layman, as to the scope and limitations of scientific theories in general, and to the theory of organic evolution in particular. The idea that it is fruitless to speculate about the evolution of species without determining the origin of life is based on an erroneous conception of the true nature of scientific thought and of the methods of scientific procedure. For Science, the world of natural phenomena is a complex of procedure going on in time, and the sole function of Natural Science is to construct systematic schemes forming conceptual descriptions of actually ob-

served processes. Of ultimate origins Natural Science has no knowledge and can give no account. The question whether living matter is continuous or not with what we call non-living matter is certainly one to which an attempted answer falls within the scope of scientific method. If however the final answer should be in the affirmative we should then know that all matter is living, but we should be no nearer to the attainment of a notion of the origin of life. No body of scientific doctrine succeeds in describing in terms of laws of succession more than some limited set of stages of a natural process; the whole process—if indeed it can be regarded as a whole—must for ever be beyond the reach of scientific grasp. The earliest stage to which Science has succeeded in tracing back any part of a sequence of phenomena itself constitutes a new problem for Science and that without end. There is always an earlier stage and to an earliest we can never attain. The questions of origins concern the theologian, the metaphysician, perhaps the poet. The fact that Darwin did not concern himself with questions as to the origin of life nor with the apparent discontinuity between living and non-living matter in no way diminishes the value of his work. The broad philosophic mind of the great Master of inductive method saw too fully the nature of the task he had set before him to hamper himself with irrelevant views as to origins.

No well instructed person imagines that Darwin spoke either the first or the last word about organic evolution. His ideas as to the precise mode of evolution may be, and are

being, modified as time goes on. This is the fate of all scientific theories; none are stationary, none are final. The development of Science is a continuous process of evolution, like the world of phenomena itself. It has however some few landmarks which stand out exceptional and prominent. None of these is greater or will be more enduring in the history of thought than the theory associated with the name of Charles Darwin.

I cannot attempt further to weigh or estimate the influence and the far-reaching import of the work which all the world has been weighing and estimating during this year, the Centenary of his birth, and the Jubilee of the *Origin of Species*. I cannot, to my intense regret, give you any personal recollections of Darwin, for though I think I once saw him in the streets of Cambridge, I have to my sorrow never been absolutely sure that this was so.

But in reading his writings and his son's most admirable Life one attains a very vivid impression of the man. One of his dominant characteristics was simplicity, simplicity and directness. In his style he was terse, but he managed to write so that even the most abstruse problems became clear to the public. The fascination of the story he had to tell was enhanced by the direct way in which he told it.

One more characteristic. Darwin's views excited at the time intense opposition and in many quarters intense hatred. They were criticised from every point of view and seldom has a writer been more violently attacked and abused. Now what seems to me so wonderful

in Darwin was that—at any rate as far as we can know—he took both criticism and abuse with mild serenity. What he wanted to do was to find the truth, and he carefully considered any criticism and if it helped him to his goal he thanked the critic and used his new facts. He never wasted time in replying to those who fulminated against him, he passed them by and went on with his search.

It is a somewhat remarkable fact that whilst the works of Darwin stimulated an immense amount of research in Biology, this research did not at first take the line he himself had traced. With some exceptions the leading zoological work of the end of the last century took the form of embryology, morphology and palaeontology; and such subjects as cell-lineage, "Entwickelungsmechanik"; the minute structure of protoplasm, life-histories, teratology, have occupied the minds of those who interest themselves in the problems of life. Along all these lines of research man has been seeking for the solution of that secret of nature which at the bottom of his heart he knows he will never find, and yet the pursuit of which is his one abiding interest. Had Frank Balfour lived we should, I think, have sooner returned to the broader lines of research as practised by Darwin, for it was Balfour's intention to turn himself to the physiology—using the term in its widest sense—of the lower animals. Towards the end of the nineteenth century, stimulated by Galton, Weldon began those series of measurements and observations which have culminated in the establishment under the guidance of his friend and fellow-worker,

Karl Pearson, of a great school of Eugenics and Statistics in London. With the beginning of the twentieth century came the rediscovery of the neglected facts recorded by Gregoire Mendel, Abbot of Brünn, some years before, and with that rediscovery an immediate and enormous outburst of enthusiasm and of work. Mendel had placed a new instrument in the hand of the breeder, an instrument which, when he has learnt to use it, will give him a power over all domesticated animals and cultivated crops undreamt of before. We are getting a new insight into the workings of Heredity and we are acquiring a new conception of the individual. The few years which have elapsed since men's attention was redirected to the principles first enunciated by the Abbot of Brünn have seen a great School of Genetics arise at Cambridge under the stimulating energy of Bateson, and an immense amount of work has also been done in France, Holland, Austria, and especially in the United States. As the work has advanced new ideas have arisen and earlier formed ideas have had to be abandoned; this must be so with every advancing Science. But it has now become clear that mutations occur, and occur especially in cultivated species; and that mutations breed true seems now to be established. In wild species also they undoubtedly occur, but whether they are as common in wild as in cultivated species remains to be seen. If they are not, in my opinion a most profitable line of research would be to endeavour to determine what factor exists in cultivation which stimulates mutation.

To what extent Darwin's writings would

have been modified had Mendel's work come into his hands we can never know. He carefully considered the question of mutation, or as they called it then, saltation, and as time went on, he attached less and less importance to these variations as factors in the origin of species. Ray Lankester has recently reminded us that Darwin's disciple and expounder Huxley "clung to a little heresy of his own as to the occurrence of evolution by saltatory variation" and there must have been frequent and prolonged discussion on the point. That "little heresy" has now become the orthodoxy of a number of eager and thoughtful workers who are at times rather aggressive in their attacks on the supporters of the old creed. "That mutations occur and exist is obvious to every one, but that they are of frequent occurrence under purely natural conditions is," Sir William Thiselton-Dyer thinks, "unsupported by evidence." So delicate is the adjustment between an organism and its natural surroundings that it seems likely that a sudden, large and wide mutation would lead to the extinction of the mutating individual. As far as I can understand the matter in dispute, Darwin and his followers held that evolution had proceeded by small steps for which we may accept de Vries' term fluctuations, whilst the Mutationists hold that it has advanced by large ones, or mutations. But it is acknowledged that mutations are not all of the same magnitude, some, *e.g.* albinism, brachydactyly in man, dwarf habit or glabrousness in plants may be large, others, *e.g.* certain differences in shade of colour or in size, are insignificant,

and indeed Punnett has suggested that under the head of fluctuating variation we are dealing with two distinct phenomena. He holds that "some of the so-called fluctuations are in reality mutations, whilst others are due to environmental influence." He thinks the evidence that these latter are transmitted is slender, and later states that "Evolution takes place through the action of selection on these mutations. Where there are no mutations there can be no evolution." The disagreement about the way in which Evolution has proceeded has perhaps arisen from a misunderstanding as to the nature of the two kinds of variation described respectively as Mutations and Fluctuations. Mutations are variations arising in the germ-cells and due to causes of which we are wholly ignorant; fluctuations are variations arising in the body or "soma" owing to the action of external conditions. The former are undoubtedly inherited, the latter are very probably not. But since mutations (using the word in this sense) may be small and may *appear* similar in character to fluctuations, it is not always possible to separate the two things by inspection alone. The whole matter is well illustrated by the work of Johannsen on beans. He found that while the beans borne by any one plant vary largely in size, yet if a large and a small bean from the same plant are sown, the mean size and variability of the beans on the plants so produced will be the same. The differences in size are presumably due to differences of condition and are not inherited. But if two beans are sown, one from a plant with beans of large average size, and one from a bean

of small average size, the bean plant whose parent had the high average will bear larger beans than the one from the parent with small average beans. The faculty of producing a high or low mean size is congenital, is a mutation in the sense used above, and is inherited. It is no doubt unfortunate that the word mutation has been used in several different senses, for it seems to have led to most regrettable confusion and misunderstanding.

As I have said in such a year, and in my position, I ought perhaps to have devoted the whole of this address to the more philosophical side of our subject, but in truth I am no philosopher, and I can only say as Mr Oliver Edwards "an old fellow-collegian" of Dr Johnson's said to the "great lexicographer" when they met after nearly half a century of separation: "I have tried too in my time to be a philosopher; but I don't know how, cheerfulness was always breaking in."

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