

are as follows: "On the Condensation of Carbonic, Sulphurous and Chloro-chromic Acid Gases;" "On Staurotide;" "On Siderographite;" "Number of Indigenous Plants of New York State;" "On West Point Minerals," &c., &c.

His more important and valuable contributions are the following: "Catalogue of Plants to be found in a radius of thirty miles around New York," published in 1819; "Flora of the Northern and Middle States," 1824; "Flora of the State of New York," 2 vols., 1843-44; "Appendix to Dr. John Lindley's Introduction to Botany," 1831. He also edited, with Dr. Asa Gray, "The Flora of North America." His more important and valuable papers are to be found in the Smithsonian Contributions, and in the various government, railway and other explorations.

Dr. Torrey was an honored member of this Society. By his gentle manner and pleasing conversation, he endeared himself to us all. He had a magnetism which drew and a sympathy which touched all hearts. Associated with De Witt Clinton, Albert Gallatin, Samuel L. Mitchell and Gulian C. Verplank in the early history of the Society, he has indelibly impressed himself upon the scientific thought of the American people. He has opened mines of thought and influence which can be wrought in all time to come. Let us cherish his memory and emulate his example.

One of the greatest lights of this century is Charles Robert Darwin. I cannot hope in the limited space allotted me to do more than allude to the great work of this foremost man of science of this or any other age. Born, February 12, 1809, and dying, April 19, 1882, he finished his renowned scientific career in one of the most remarkable periods of human history. It is difficult to know which to praise most in this great biologist, his methods or their results. He was eminent in observing the habits of plants and animals and their relations to each other. He studied the variations of species under domestication and in a state of nature. He studied hybridity and the effects of hereditary and growth force. He did little in comparative anatomy and scarcely anything in embryology. His method was the inductive. He relied upon facts and not upon theoretical speculations. In 1859 appeared his

great work on "The Origin of Species." The theory may be thus stated :

Every kind of animal and plant tends to increase in numbers in a geometrical progression.

Every kind of animal and plant transmits a general likeness, with individual differences, to its offspring.

Every individual may present minute variations of any kind and in any direction.

Past time has been practically infinite.

Every individual has to endure a very severe struggle for existence, owing to the tendency to geometrical increase of all kinds of animals and plants, while the total animal and vegetable population (man and his agency excepted), remains almost stationary.

Thus, every variation of a kind tending to save the life of the individual possessing it, or to enable it more surely to propagate its kind, will in the long run be preserved, and will transmit its favorable peculiarity to some of its offspring, which peculiarity will thus become intensified till it reaches the maximum degree of utility. On the other hand, individuals presenting unfavorable peculiarities will be destroyed. The action of this law of Natural Selection may be represented by the expression, "Survival of the fittest."

This conception of Mr. Darwin's is perhaps the most interesting theory, in relation to Natural Science, which has been promulgated during the present century. In a remarkable manner it groups together a vast and varied series of biological facts, and even paradoxes, which it appears more or less clearly to explain. By this theory of "Natural Selection," light is thrown on the more singular facts relating to the geographical distribution of animals and plants; on the resemblance between the past and present inhabitants of different parts of the earth's surface.

His second great work, on "The Descent of Man," appeared in 1871. I have not time to speak of this work as I would like. It produced a profound sensation among scholars. It was looked upon as positively infidel in its teaching, and was condemned by the clergy. It presented evolution in a new phase. It was said to

teach that man, in the process of evolution, came directly from the monkey. Mr. Darwin was caricatured. Pictures of him, with caudal attachment, were put upon the market. But time has vindicated the reputation of the great scientist. Prejudice has yielded to admiration. The clergy are of one accord in their readiness to do him honor. His remains were buried in the great mausoleum of Westminster Abbey. His pall-bearers were, James R. Lowell, the Duke of Argyle, Lord Derby, Professor Huxley, Sir Joseph Hooker, Sir John Lubbock, Alfred R. Wallace, Mr. Spottiswood, President of the Royal Society, and Canon Farrar.

The English Church has shown great wisdom in thus honoring this distinguished scientist. By giving his bones a resting place in the most renowned of English sepulchres, they have removed a strong and growing prejudice from the minds of that large and influential class of scientific men who are doubtless the leading thinkers and workers of this generation. It was politic to recognize this class of men. The church needs the vitalizing forces of thought and action that are outside of itself, to redeem it from a species of monasticism which is sure to spring up in a life of seclusiveness from the world. By this act of the church, the interests of science and religion are conserved. The priest at the altar and the scientist in his painstaking investigations, alike honor the cause of truth.

This was once true of the Roman Catholic Church. If any man became distinguished in science, arts or letters, he was canonized at death, and admitted into fellowship with the saints. So long as this was done the church maintained its supremacy; but when it became non-sympathetic and persecuting, it lost its power.

The *English Medical Press and Circular* says: "There is but one appropriate resting-place for the greatest naturalist in the world—the founder of the modern school of biology, the most illustrious scientific *savant* of the century—and that place is amidst those who are, by right, regarded as the creators of our intellectual superiority—in the national fane at Westminster."

"He was," said Canon Prothero, at Westminster Abbey, "the greatest man of science of his day; but was so entirely a stranger to

intellectual pride and arrogance, that he stated, with the utmost modesty, opinions, of the truth of which he was himself convinced, but which, he was aware, could not be universally agreeable and acceptable. Surely, in such a man, lived that charity which is the very essence of the true spirit of Christ."

Canon Liddon, in his sermon at St Paul's, observed, "that when Professor Darwin's books on the Origin of Species and on the Descent of Man appeared, they were largely regarded by religious men as containing a theory necessarily hostile to religion. A closer study had greatly modified any such impression. It is sure that, whether the creative activity of God is manifested through catastrophes, as the phrase goes, or in progressive evolution, it is still His creative activity, and the really great questions beyond remain untouched. The evolutionary process, supposing it to exist, must have had a beginning: who began it? It must have had material to work with: who furnished it? It is itself a law or system of laws: who enacted them? Even supposing that the theory represents absolute truth, and is not merely a provisional way of looking at things incidental to the present state of knowledge, these great questions are just as little to be decided by physical science now as they were when Moses wrote the Pentateuch; but there are apparently three important gaps in the evolutionary sequence, which it is well to bear in mind. There is the great gap between the highest animal instinct and the reflective self-measuring, self-analyzing thought of man. There is the greater gap between life and the most organized matter. There is the greatest gap of all between matter and nothing. At these three points, as far as we can see, the Creative Will must have intervened otherwise than by the way of evolution out of existing materials—to create mind, to create life, to create matter. But, beyond all question, it is our business to respect in science, as in other things, every clearly ascertained report of the senses; for every such report represents a fact, and a fact is sacred as having its place in the Temple of Universal Truth."

The *Observer* says: "We may be asked, of course, what it is, after all, that Darwin has done? He has not invented an electric

light, or a vacuum break, or thrown a viaduct across a valley, or tunnelled under a strait, or discovered some marvellous method by which to convert brewers' refuse into bread. He has done nothing for which he could have taken out a patent, or have started a joint stock company with limited liability. But he has lived from the first in an air higher than that where money is made, and professional chairs are given away. And living thus, purely, simply and honestly, he has left his mark indelibly upon human thought; the history of human thought being, for each and for all of us, the history of the universe. Peerages and decorations are conferred upon men who successfully conduct negotiations in the sugar trade, or wage war, with the Martini-Henry rifle, against naked savages. Darwin enjoyed no such distinction. Certainly he never coveted it. He was never made commissioner of anything. His whole life was one continual worship of truth for its own sake. He was incapable of jealousy, ambition or self-seeking, and—though he himself knew it not—*the moral lesson of his life is perhaps even more valuable than is the grand discovery which he has stamped on the world's history.*"

Sir. Charles Lyell, in his *Antiquity of Man*, quotes a saying of Professor Agassiz, that whenever a new and striking fact is brought to light in science, people first say "it is not true," then it is contrary to religion, and lastly, "that everybody knew it before." If a sermon delivered in St. Paul's by Canon Liddon may be accepted as evidence, the theory of evolution has passed through the two first stages of Agassiz' process, and is already on its way to the third. From the extracts from his sermon, it will be seen that the eloquent Canon accepts Darwinian theories only with reservations. His remarkable words only need to be carried to their legitimate issue, to indicate the basis on which the long-looked-for reconciliation between science and religion will be possible.

The following extracts from Continental papers may not be out of place:

The *Gaulois* remarks "that Darwin will remain one of the greatest glories of science. No other man has, during the second half of this century, exercised a more decisive and fruitful

influence on the progress of natural science. No one else has so much honored science by the nobility of his character, by the primitive simplicity of his life and by his deep and sincere love of truth."

The *France* observes: "Darwin's work has not been merely the exposition of a system; but, as it were, the production of an epic—the greatest power of the genesis of the universe, one of the grandest that ever proceeded from a human brain—an epic magnificent in its proportions, logical in its deductions and superb in its form. Darwin deserves not only a place by the side of Leibnitz, Bacon, or Decartes, but is worthy to rank with Homer."

The *Cologne Gazette* says: "He was a man of science, who made a mark upon his times in a manner unparalleled by any of his contemporaries. He compelled every branch of science to acknowledge his revolutionizing discoveries. The completion of his gigantic system will give abundant occupation to the remotest generations; but the memory of the founder of this prodigious scientific structure will remain imperishable to all time."

We cannot more fitly close this sketch than by quoting from an article in *Nature*, by Prof. Huxley:

"In France, in Germany, in Austro-Hungary, in Italy, in the United States, writers of all shades of opinion, for once unanimous, have paid a willing tribute to the worth of our great countryman, ignored in life by the official representatives of the kingdom, but laid in death among his peers in Westminster Abbey by the will of the nation.

"It is no secret that, outside that domestic group, there are many to whom Mr. Darwin's death is a wholly irreparable loss. And this not merely because of his wonderfully genial, simple and generous nature, his cheerful and animated conversation and the infinite variety and accuracy of his information, but because the more one knew of him the more he seemed the incorporated ideal of a man of science. Acute as were his reasoning powers, vast as was his knowledge, marvelous as was his tenacious industry, under physical difficulties which would have converted nine men out of ten into aimless invalids, it was not these qualities, great as they were, which impressed those who were admitted to his intimacy

with involuntary veneration, but a certain intense and almost passionate honesty, by which all his thoughts and actions were irradiated as by a central fire.

“It was this rarest and greatest of endowments which kept his vivid imagination and great speculative powers within due bounds; which compelled him to undertake the prodigious labors of original investigation of reading, upon which his published works are based; which made him accept criticisms and suggestions from anybody and everybody, not only without impatience, but with expressions of gratitude sometimes almost comically in excess of their value; which led him to allow neither himself nor others to be deceived by phrases, and to spare neither time nor pains in order to obtain clear and distinct ideas upon every topic with which he occupied himself.

“One could not converse with Darwin without being reminded of Socrates. There was the same desire to find someone wiser than himself; the same belief in the sovereignty of reason; the same ready humor; the same sympathetic interest in all the ways and works of men. But instead of turning away from the problems of nature as hopelessly insoluble, our modern philosopher devoted his whole life to attacking them in the spirit of Heraclitus and of Democritus, with results which are as the substance of which their speculations were anticipating shadows.

“None have fought better and none have been more fortunate than Charles Darwin. He found a great truth, trodden under foot, reviled by bigots and ridiculed by all the world; he lived long enough to see it, chiefly by his own efforts, inseparably incorporated with the common thoughts of men, and only hated and feared by those who would ridicule, but dare not. What shall a man desire more than this? Once more the image of Socrates rises unbidden, and the noble peroration of the *Apology* rings in our ears as if it were Charles Darwin's farewell: ‘The hour of departure has come, and we go our ways—I to die and you to live. Which is the better, God only knows.’

The following is the translation of a letter written by the late Charles Darwin in answer to an inquiry from a young student at

Jena, in whom the study of Darwin's books had raised religious doubts:

“SIR—I am very busy, and am an old man in delicate health, and have not time to answer your questions fully, even assuming that they are capable of being answered at all. Science and Christ have nothing to do with each other, except in as far as the habit of scientific investigation makes a man cautious about accepting any proofs. As far as I am concerned, I do not believe that any revelation has ever been made. With regard to a future life, every one must draw his own conclusions from vague and contradictory probabilities. Wishing you well, I remain, your obedient servant,

“Down, June 5th, 1879.

CHARLES DARWIN.”

Mr. Darwin was not regarded as a Christian; but he had the greatest respect for all that was good in Christianity, and was great enough to acknowledge it. This is the way in which he answered some shallow critics of foreign missionaries: “They forget, or will not remember, that human sacrifices, and the power of an idolatrous priesthood; a system of profligacy unparalleled in any other part of the world; infanticide, a consequence of that system; bloody wars, where the conquerors spared neither women nor children—that all these have been abolished; and that dishonesty, intemperance and licentiousness have been greatly reduced by the introduction of Christianity. In a voyager to forget these things is base ingratitude; for should he chance to be at the point of shipwreck on some unknown coast, he will most devoutly pray that the lesson of the missionary may have extended thus far.”

It will perhaps be objected that the theory of descent has already been sufficiently established by Darwin. It is true that his newly-discovered principle of selection is of the very greatest importance, since it solves the riddle as to how that which is useful can arise in a purely mechanical way. Nor can the transforming influence of direct action, as upheld by Lamarck, be called in question, although its extent cannot as yet be estimated with any certainty. The *secondary* modifications which Darwin



regards as the consequence of a change in some other organ, must also be conceded. But are these three factors actually competent to explain the complete transformation of one species into another? Can they transform more than single characters or groups of characters? Can we consider them as the sole causes of the regular phenomena of the development of the races of animals and plants? Is there not perhaps an unknown force underlying these numberless developmental series as the true motor power—a “developmental force,” urging species to vary in certain directions, and thus calling into existence the chief types and subtypes of the animal and vegetable kingdoms?

The theory of selection by no means leads, as is always assumed, to the denial of a teleological Universal Cause and to materialism. Mechanism and teleology do not exclude one another; they are rather in mutual agreement. Without teleology there could be no mechanism, but only a confusion of crude forces; and without mechanism there could be no teleology, for how could the latter otherwise effect its purpose?

Von Hartmann correctly says: “The most complete mechanism conceivable is likewise the most completely conceivable teleology.” We may thus represent the phenomenal universe as such a completely conceivable mechanism. With this conception vanish all apprehensions that the new views would cause man to lose the best he possesses—morality and purely human spiritual culture.

Let us take our stand boldly on the ground of new knowledge and accept the direct consequences thereof, and we shall not be obliged to give up either morality or the comforting conviction of being part of an harmonious world, as a necessary member capable of development and perfection.

Any other mode of interference by a directive teleological power in the processes of the universe than by the appointment of the forces producing them, is, however, at least to the naturalist, inadmissible. We are still far removed from completely understanding the mechanism by means of which the organic world is evoked; we still find ourselves at the very beginning of knowledge.