SPECULATION IN SCIENCE.[1]

By Prof. J. LAWRENCE SMITH.

I NOW pass to the second part of my discourse. It is in reference to the methods of modern science—the caution to be observed in pursuing it, if we do not wish to pervert its end by too confident assertions and deductions.

It is a very common attempt, nowadays, for scientists to transcend the limits of their legitimate studies, and in doing this they run into speculations apparently the most unphilosophical, wild, and absurd; quitting the true basis of inductive philosophy, and building up the most curious theories on little else than assertion; speculating upon the merest analogy; adopting the curious views of some metaphysicians, as Edward von Hartmann; striving to work out speculative results by the inductive method of natural science.

And such an example as this is of great value to the reflective mind, teaching caution, and demonstrating the fact that, while the rules by which we are guided in scientific research are far in advance of those of ancient days, we must not conclude that they are perfect by any means. In our modern method of investigation how many conspicuous examples of deception we have had in pursuing even the best method of investigation! Take, for instance, the science of geology, from the time of Werner to the present day. While we always thought we had the true interpretation of the structural phenomena of the globe, as we progressed from year to year, yet how vastly different are our interpretations of the present day from what they were in the time of Werner! In chemistry, the same thing is true. How clearly were all things explained to the chemist of the last century by Phlogiston, which, in the present century, receive no credence, and chemical phenomena are now viewed in an entirely different light!

Lavoisier, in the latter part of the last century, elucidated the phenomena of respiration and the production of animal heat by one of the most beautiful theories, based, to all appearances, upon well-observed facts; yet, at the present day, more delicate observations, and the discovery of the want of balance between the inhaled oxygen and exhaled carbonic acid, subverted that beautiful theory, and we are left entirely without one. It is true we have collated a number of facts in regard to respiration, molecular changes in the tissues, etc., all of which are recognized as having something to do with animal heat; still it is acknowledged that we are incapable of giving any concrete expression to the phenomena of respiration and animal heat as Lavoisier did eighty or ninety years ago.

[1] Abstract of the address before the American Association for the Advancement of Science, at its late meeting in Portland, Me., by the retiring president.

Electricity is the same now as it has ever been, yet it was once spoken of as a fluid, then as a force, now as an energy readily convertible into caloric or mechanical energy; and in what light it will be considered fifty years hence no one can predict.

Now, what I desire to enforce here is, that amid all these changes and revolutions of theories, so called, it is simply man, the interpreter, that has erred, and not Nature; her laws are the same; we simply have not been able to read them correctly, and perhaps never will be.

What, it may be asked, are we to do, then? Must we cease theorizing? Not at all. The lesson to be learned from this is to be more modest in our generalizations; to generalize as far as our carefully-made-out facts will permit us, and no further; check the imagination, and let it not run riot and shipwreck us upon some metaphysical quicksand.

The fact is, it becomes a question whether there is such a thing as pure theory in science. No true scientific theory deserves the name that is not based on verified hypothesis; in fact, it is but a concise interpretation of the deductions of scientific facts. Dumas has well said that theories are like crutches, the strength of them is, to be tested by attempting to walk with them. And I might further add, that very often scientists, who are without sure-footed facts to carry them along, take to these crutches.

It is common to speak of the theory of gravitation, when there is nothing purely hypothetical in connection with the manner in which it was studied; in it we only see a clear generalization of observed laws which govern the mutual attraction of bodies. If at any time Newton did assume an hypothesis, it was only for the purpose of facilitating his calculations: "Newton's passage from the falling of an apple to the falling of a moon was at the outset a leap of the imagination;" but it was this hypothesis, verified by mathematics, which gave to the so-called theory of gravitation its present status.

In regard to light, we are in the habit of connecting with it a pure hypothesis, viz., the impressions of light being produced by emission from luminous bodies, or by the undulation of an all-pervading, attenuated medium; and these hypotheses are to be regarded as probable so long as the phenomena of light are explained by them, and no longer. The failure to explain one single well-observed fact is sufficient to cast doubt upon or subvert any pure hypothesis, as has been the case with the emission theory of light, and may be the fate of the undulatory theory, which, however, up to the present time, serves in all cases.

It is not my object to criticise the speculations of any one or more of the modern scientists who have carried their investigations into the world of the imagination; in fact, it could not be done in a discourse so limited as this, and one only intended as a prologue to the

present meeting. But, in order to illustrate this subject of method more fully, I will refer to Darwin, whose name has become synonymous with progressive development and natural selection, which we had thought had died out with Lamarck fifty years ago. In Darwin we have one of those philosophers whose great knowledge of animal and vegetable life is only transcended by his imagination. In fact, he is to be regarded more as a metaphysician with a highly-wrought imagination than as a scientist, although a man having a most wonderful knowledge of the facts of natural history. In England and America we find scientific men of the profoundest intellects differing completely in regard to his logic, analogies, and deductions; and in Germany and France the same thing—in the former of these countries some speculators saying that "his theory is our starting-point," and in France many of her best scientific men not ranking the labors of Darwin with those of pure science. Darwin takes up the law of life, and runs it into progressive development. In doing this, he seems to me to increase the embarrassment which surrounds us on looking into the mysteries of creation. He is not satisfied to leave the laws of life where he finds them, or to pursue their study by logical and inductive reasoning. His method of reasoning will not allow him to remain at rest; he must be moving onward in his unification of the universe. He started with the lower order of animals, and brought them through their various stages of progressive development until he supposed he had touched the confines of man; he then seems to have recoiled, and hesitated to pass the boundary which separated man from the lower order of animals; but he saw that all his previous logic was bad if he stopped there, so man was made from the ape (with which no one can find fault, if the descent be legitimate). This stubborn logic pushes him still further, and he must find some connecting link between that most remarkable property of the human face called expression; so his ingenuity has given us a very curious and readable treatise on that subject. Yet still another step must be taken in this linking together man and the lower order of animals; it is in connection with language; and before long it is not unreasonable to expect another production from that most wonderful and ingenious intellect on the connection between the language of man and the brute creation.

Let us see for a moment what this reasoning from analogy would lead us to. The chemist has as much right to revel in the imaginary formation of sodium from potassium, or iodine and bromine from chlorine, by a process of development, and call it science, as for the naturalist to revel in many of his wild speculations, or for the physicist who studies the stellar space to imagine it permeated by mind as well as light—mind such as has formed the poet, the statesman, or the philosopher. Yet any chemist who would quit his method of investigation, of marking every foot of his advance by some indelible imprint, and go back to the speculations of Albertus Magnus, Roger

Bacon, and other alchemists of former ages, would soon be dropped from the list of chemists and ranked with dreamers and speculators.

What I have said is, in my humble opinion, warranted by the departure Darwin and others have made from true science in their purely speculative studies; and neither he nor any other searcher after truth expects to hazard great and startling opinions without at the same time courting and desiring criticism; yet dissension from his views in no way proves him wrong—it only shows how his ideas impress the minds of other men. And just here let me contrast the daring of Darwin with the position assumed by one of the great French naturalists of the present day, Prof. Quatrefages, in a recent discourse of his on the physical character of the human race. In referring to the question of the first origin of man, he says distinctly that, in his opinion, it is one that belongs not to science; these questions are treated by theologians and philosophers: "Neither here nor at the Museum am I, nor do I wish to be, either a theologian or a philosopher. I am simply a man of science; and it is in the name of comparative physiology, of botanical and zoological geography, of geology and paleontology, in the name of the laws which govern man as well as animals and plants, that I have always spoken." And, studying man as a scientist, he goes on to say: "It is established that man has two grand faculties, of which we find not even a trace among animals. He alone has the moral sentiment of good and evil; he alone believes in a future existence succeeding this natural life; he alone believes in beings superior to himself, that he has never seen, and that are capable of influencing his life for good or evil; in other words, man alone is endowed with morality and religion." Our own distinguished naturalist and associate, Prof. Agassiz, reverts to this theory of evolution in the same positive manner, and with such earnestness and warmth as to call forth severe editorial criticisms, by his speaking of it as a "mere mine of assertions," and the "danger of stretching inferences from a few observations to a wide field;" and he is called upon to collect "real observations to disprove the evolution hypothesis." I would here remark, in defence of my distinguished friend, that scientific investigation will assume a curious phase when its votaries are required to occupy time in looking up facts, and seriously attempting to disprove any and every hypothesis based upon proof, some of it not even rising to the dignity of circumstantial evidence.

I now come to the last point to which I wish to call the attention of the members of the Association in the pursuit of their investigations, and the speculations that these give rise to in their minds. Reference has already been made to the tendency of quitting the physical to revel in the metaphysical, which, however, is not peculiar to this age, for it belonged as well to the times of Plato and Aristotle as it does to ours. More special reference will be made here to the proclivity of the present epoch among philosophers and theologians to be

parading science and religion side by side, talking of reconciling science and religion, as if they have ever been unreconciled. Scientists and theologians may have quarrelled, but never science and religion. At dinners they are toasted in the same breath, and calls made on clergymen to respond, who, for fear of giving offence, or lacking the fire and firmness of St. Paul, utter a vast amount of platitudes about the beauty of science and the truth of religion, trembling in their shoes all the time, fearing that science falsely so called may take away their professional calling, instead of uttering in a voice of thunder, like the Boanerges of the Gospel, that the "world by wisdom knew not God." And it never will. Our religion is made so plain by the light of faith that the wayfaring man, though a fool, cannot err therein.

No, gentlemen, I firmly believe that there is less connection between science and religion than there is between jurisprudence and astronomy, and the sooner this is understood the better it will be for both. Religion is based upon revelations as given to us in a book, the contents of which are never changed, and of which there have been no revised or corrected editions since it was first given, except so far as man has interpolated; a book more or less perfectly understood by mankind, but clear and unequivocal in all essential points concerning the relation of man to his Creator; a book that affords practical directions, but no theory; a book of facts, and not of arguments; a book that has been damaged more by theologians than by all the pantheists and atheists that have ever lived and turned their invectives against it—and no one source of mischief on the part of theologians is greater than that of admitting the profound mystery of many parts of it, and almost in the next breath attempting some sort of explanation of these mysteries. The book is just what Richard Whately says it is, viz., "Not the philosophy of the human mind, nor yet the philosophy of the divine nature in itself, but (that which is properly religion) the relation and connection of the two beings—what God is to us, what he has done and will do for us, and what we are to be in regard to him." . . . Let us stick to science, pure, unadulterated science, and leave to religion things which pertain to it; for science and religion are like two mighty rivers flowing toward the same ocean, and, before reaching it, they will meet and mingle their pure streams, and flow together into that vast ocean of truth which encircles the throne of the great Author of all truth, whether pertaining to science or to religion. And I will here, in defence of science, assert that there is a greater proportion of its votaries who now revere and honor religion in its broadest sense, as understood by the Christian world, than that of any other of the learned secular pursuits.

But, before concluding, I cannot refrain from referring to one great event in the history of American science during the past year, as it will doubtless mark an epoch in the development of science in this country. I refer to the noble gift of a noble foreigner to encourage

the poor but worthy student of pure science in this country. It is needless for me to insist on the estimation in which Prof. John Tyndall is held among us. We know him to be a man whose heart is as large as his head, both contributing to the cause of science. We regard him as one of the ablest physicists of the time, and one of the most level-headed philosophers that England has ever produced—a man whose intellect is as symmetrical as the circle, with its every point equidistant from the centre. We have been the recipient of former endowments from that land which, we thank God, was our mother-country, for from it we have drawn our language, our liberty, our laws, our literature, our science, and our energy, and without whose wealth our material development would not be what it is at the present day. Count Rumford, the founder of the Royal Society of London, in earlier years endowed a scientific chair in one of our larger universities, and Smithson transferred his fortune to our shores to promote the diffusion of science. Now, while these are noble gifts, yet Count Rumford was giving to his own countrymen—for he was an American—and they were posthumous gifts from men of large fortune. But the one I now refer to was from a man who ranks not with the wealthy, and he laid his offering upon the altar of science in this country with his own hands; and it has been both consecrated and blest by noble words from his own lips; all of which makes the gift a rich treasure to American science; and I think we can assure him that, as the same Anglo-Saxon blood flows in our veins as does in his (tempered, 'tis true, with the Celtic, Teutonic, Latin, etc.), he may expect much from the American student in pure science as the offspring of his gift and his example.

THE GLACIERS AND THEIR INVESTIGATORS.

By Prof. JOHN TYNDALL.

SOON after my return from America, I learned with great concern that a little book of mine, published prior to my departure, had given grave offence to some of the friends and relatives of the late Principal Forbes; and I was specially grieved when informed that the chastisement considered due to this offence was to be administered by gentlemen between whom and myself I had hoped mutual respect and amity would forever reign. We had, it is true, met in conflict on another field; but hostilities had honorably ceased, old wounds had, to all appearance, been healed, and I had no misgiving as to the permanence of the peace established between us.

The genesis of the book referred to is this: At Christmas, 1871, it fell to my lot to give the brief course of "Juvenile Lectures" to which

EDITOR'S TABLE.

AMERICAN SCIENTIFIC ASSOCIATION—PRESIDENT SMITH'S ADDRESS.

THE twenty-second meeting of the American Association for the Advancement of Science, which commenced at Portland, Me., August 20th, was fairly attended by the members, and presented very good results in the way of scientific work. In estimating its contributions, we must not overlook the fact that, while the numbers of those in this country who are at liberty to pursue original investigations untrammelled, is not large, on the other hand we have two national associations, through which the moderate amount of original research that takes place is published to the world. While the American Association was the only organization of national scope for the publication of new scientific results, its papers were creditable both in number and quality, and it compared favorably with its prototype, the British Association for the Advancement of Science. But, when, a few years ago, a considerable number of its ablest members joined in the organization of the National Academy of Sciences, having substantially the same object in view as the American Association, but exclusive in its membership, and under government patronage, the necessary effect was greatly to weaken the older organization. The National Academy meets twice a year, and draws closely upon the original work of its associates. If, therefore, the numbers in attendance upon the Association and the grade of scientific contributions might seem to indicate a decline in American science, the circumstances here referred to will sufficiently qualify the conclusion.

The address of the retiring president, J. Lawrence Smith, while containing many excellent suggestions, was not conformed to the better type of such productions. It is the custom of the eminent scientific men who are honored with the office but once in their lives to devote the occasion, either to a general review of recent scientific work, or to some special subject with which they are most familiar, and upon which they can speak with the force of authority. Dr. Smith has been favorably known in the world of science as a chemist who has made valuable contributions in its inorganic department. The great activity in chemical inquiries at the present time, and the important transition through which chemical theory is now passing, would certainly have afforded the president a most pertinent and instructive theme, but he preferred to employ the occasion in considering certain aspects of science that are now prominent in public attention, and upon which the scientific world is in much disagreement. The leading feature of the address was an attack on the Darwinians, and this portion of it we publish; and, as the question is thus reopened officially, it becomes a proper subject of comment.

The predecessor of President Smith, Dr. Asa Gray, of Harvard College, had followed the better usage of presiding officers in his address at Dubuque last year, and discussed some of the larger problems of botany in the light of the derivation theory. The most eminent of American botanists, an old and untiring student of the subject, a man of philosophic grasp, and with a candor and sincerity of conviction that commanded the highest respect, after long and thorough study of the question, Prof. Gray did not hesitate to give the weight of his authority to that view of the origin and diversities of

living forms of which Mr. Darwin is now the leading representative. And although in the field of biology large numbers of its most eminent students, who are of all men most competent to decide upon it, have accepted that doctrine as representing the truth of Nature more perfectly than any other, and as of immense value in their researches into the laws of life, yet Dr. Smith, as our readers will see, denounces it as a groundless hypothesis due to a riotous imagination, and, in the language of Agassiz, a "mere mire of assertions." His declarations have called forth the applause of the press—always so candid, and intelligent, and independent, on such matters—who seize the occasion to preach new sermons on the "vagaries of science," and declare that they "take sides with the angels against the monkeys," and are "with the Creator against Darwin."

The course of the president was not commended even by his own party. Dr. Newberry, an eminent student of biology and geology, is reported as having spoken in the following decided way: "Prof. Newberry, after a handsome allusion to the retiring president, Prof. J. Lawrence Smith, protested against the opposition to the development theory as expounded in that gentleman's address. Prof. Newberry said he was not himself a Darwinian, but he recognized the value of the evolution theory in science. You cannot measure its value as you can the work of an astronomer, measured by definite ratios of space and time; but he considered the hypothesis one of the most important contributions ever made to a knowledge of Nature. Most men and women are partisans, and some are willing to suppose that the hypothesis is sufficient to account for all the phenomena of the animal kingdom, while, on the other hand, there are those who see in it nothing but failure and deficiency. Let us assume a judicial position, and allow the tests of time and truth to settle the questions involved. Go, however, in whatever direction the facts may lead, and throw prejudice to the winds. Recollect that all truth is consistent with itself."

Dr. Smith can hardly be said to have argued the question of Darwinism. He gave us his own opinion of it, and quoted, to sustain it, two distinguished authorities in natural history. But he gave the influence of his name and position to the charge that it transcends the legitimate limits of inductive inquiry, and is only a wild and absurd speculation. While the technical and difficult questions of natural history by which the truth or falsity of the doctrine must be determined are beyond the reach of unscientific readers, and belong to the biologists to decide, the question here raised as to whether the investigation, as conducted, is legitimately scientific or not, is one of which all intelligent persons ought to be capable of forming a judgment. We have repeatedly considered this point in the pages of THE POPULAR SCIENCE MONTHLY, and have endeavored to show that the present attitude of the doctrine of evolution is precisely the attitude which all the great established theories and laws of science had to take at their first promulgation. It is familiar to all who know any thing of the progress of science, that astronomy and geology, in their early stages, passed through precisely the same ordeal that biology is passing through now; their leading doctrines were reprobated as false science, and the wild dreams of distempered imaginations. Let us now take another case, in the department of pure physics, and see how scientific history repeats itself:

The undulatory theory of light is now a firmly established principle in physics. Dr. Smith says that "the failure to explain one single well-observed fact is sufficient to cast doubt upon, or subvert, any pure hypothesis,"

and, he adds, in reference to the undulatory theory, that, "up to the present time, it serves in all cases." In order that this theory, now so perfect, should be adopted, it had, of course, to be first propounded. The conception of an ethereal medium to explain the phenomena of light was suggested by Huyghens and Euler, but they did not experimentally demonstrate it, and their authority was overborne by that of Newton, who maintained the emission or corpuscular theory. The true founder of the undulatory hypothesis of light was Dr. Thomas Young, Professor of Natural Philosophy in the Royal Institution of Great Britain, and whom Prof. Tyndall regards as the greatest physicist who has appeared since Newton. Dr. Young is thus estimated by the German Helmholtz: "His was one of the most profound minds that the world has ever seen; but he had the misfortune to be in advance of his age. He excited the wonder of his contemporaries, who, however, were unable to follow him to the heights at which his daring intellect was accustomed to soar. His most important ideas lay, therefore, buried and forgotten in the folios of the Royal Society, until a new generation gradually and painfully made the same discoveries, and proved the exactness of his assertions, and the truth of his demonstrations."

Now, in this case, there was no monkey in the question, and no capital of public prejudice that could be made available in the discussion, to repress obnoxious opinions. The hypothesis was certainly innocent enough, and its truth or falsehood was a matter of simple determination by experiment. Dr. Young made the experiments which established it—the Royal Society recognized the value of the experiments, and, in 1801, assigned to their author the distinguished honor of delivering the Bakerian lecture, in which his experiments were described, and their conclusions demonstrated. Yet, with the Royal Society to back him, and with his views capable of proof before all men, Dr. Young was crushed, and that by outside influences appealing to the public, on the ground that his hypothesis was spurious science—mere wild absurdity of the imagination.

We ask attention to the similarity of the present ground of attack upon Darwin, and the ground of attack upon Dr. Young three-quarters of a century ago. Dr. Smith prefaces his strictures upon Darwinism with the following declaration: "It is a very common attempt nowadays for scientists to transcend the limits of their legitimate studies, and, in doing this, they run into speculations apparently the most unphilosophical, wild, and absurd; quitting the true basis of inductive philosophy, and building up the most curious theories on little else than assertion."

Henry Brougham, afterward Lord-Chancellor of England, writing in the second number of the *Edinburgh Review* concerning Young's Bakerian lecture, said: "We have of late observed in the physical world a most unaccountable predilection for vague hypotheses daily gaining ground; and we are mortified to see that the Royal Society, forgetful of those improvements in science to which it owes its origin, and neglecting the precepts of its most illustrious members, is now, by the publication of such papers, giving the countenance of its highest authority to dangerous relaxations in the principles of physical logic. We wish to raise our feeble voice against innovations that can have no other effect than to check the progress of science, and renew all those wild phantoms of the imagination which Bacon and Newton put to flight from her temple. . . . Has the Royal Society degraded its publications into bulletins of new and fashionable theories for the ladies of the Royal Institution? *Proh pudor!*[1] Let the professor continue to amuse his audience with an endless variety of

[1] For shame!

such harmless trifles, but, in the name of science, let them not find admittance into that venerable repository which contains the works of Newton and Boyle. . . . The making of an hypothesis is not the discovery of a truth. It is a mere sporting with the subject; it is a sham-fight which may amuse in the moment of idleness and relaxation, but will neither gain victories over prejudice and error, nor extend the empire of science. A mere theory is in truth destitute of merit of every kind, except that of a warm and misguided imagination." Dr. Young's theory "teaches no truth, reconciles no contradictions, arranges no anomalous facts, suggests no new experiments, and leads to no new inquiries. It has not even the pitiful merit of affording an agreeable play to the fancy. It is infinitely more useless, and less ingenious, than the Indian theory of the elephant and tortoise. It may be ranked in the same class with that stupid invention of metaphysical theology. . . . We cannot conclude our review of these articles without entreating for a moment the attention of that illustrious body which has admitted of late years so many paltry and unsubstantial papers into its transactions. . . . We implore the council, if they will deign to cast their eyes upon our humble page, to prevent a degradation of the institution which has so long held the first rank among scientific bodies."

For the second time Dr. Young was selected by the Royal Society to give the Bakerian lecture, and he again chose for its subject "Experiments and Calculations relative to Physical Optics," and again the *Edinburgh Review* came down upon him as follows: "The paper which stands first is another Bakerian lecture, containing more fancies, more blunders, more unfounded hypotheses, more gratuitous fictions, all upon the same field on which Newton trode, and all from the fertile yet fruitless brain of the same eternal Dr. Young." The reviewer thus winds up the controversy: "We now dismiss, for the present, the feeble lucubrations of this author, in which we have searched without success for some traces of learning, acuteness, and ingenuity, that might compensate his evident deficiency in the powers of solid thinking, calm and patient investigation, and successful development of the laws of Nature, by steady and modest observation of her operations. We came to the examination with no other prejudice than the very allowable prepossession against vague hypothesis, by which all true lovers of science have for above a century and a half been swayed. We pursued it, both on the present and on a former occasion, without any feelings except those of regret at the abuse of that time and opportunity which no greater share of talents than Dr. Young's are sufficient to render fruitful by mere diligence and moderation. From us, however, he cannot claim any portion of respect, until he shall alter his mode of proceeding, or change the subject of his lucubrations; and we feel ourselves more particularly called upon to express our disapprobation, because, as distinction has been unwarily bestowed on his labors by the most illustrious of scientific bodies, it is the more necessary that a free protest should be recorded before the more humble tribunals of literature."

The reader will perceive that this strain is not unfamiliar. Young was denounced as Darwin is now denounced, professedly in the interest of science; but the pretext was as false then as it is now. In the former case the *animus* of the assault was mere personal spite: Brougham's inordinate vanity having been wounded by some very moderate criticisms of Dr. Young upon his mathematical works. But a man who did not understand the subject, appealing to a

tribunal which knew nothing about it, against wild speculations degrading to science, was able to depreciate and suppress for a quarter of a century one of the most solid and perfect theories of natural phenomena that modern research has produced. And, strange as it may seem, the work was effectually done; for, although Young made a masterly reply, but a single copy was sold, and, as Tyndall remarks, "for twenty years this man of genius was quenched—hidden from the appreciative intellect of his countrymen — deemed, in fact, a dreamer through the vigorous sarcasm of a writer who had then possession of the public ear."

Happily, the time is past when the investigators of Nature can be thus crushed out; but still the old tactics are imitated, and not without evil effect for the time. The men of science, to whom the question belongs, are not left to pursue it in peace. The press and the pulpit, with such scientific help as it is not difficult to get, stir up such a clamor of popular opprobrium that biological students who hold to evolution as the fact and law of Nature, and guide their researches by its light, do not choose to have it publicly known that they are adherents of the doctrine. We are behind England in fair and tolerant treatment of the Darwinian question, but may expect the same improvement in this respect that Huxley tells us has taken place with the English. In a recent article he remarks: "The gradual lapse of time has now separated us by more than a decade from the date of the publication of the 'Origin of Species;' and whatever may be thought or said about Mr. Darwin's doctrines, or the manner in which he has propounded them, this much is certain, that, in a dozen years, the 'Origin of Species' has worked as complete a revolution in biological science as the 'Principia' did in astronomy—and it has done so, because, in the words of Helmholtz, it contains 'an essentially new creative thought.' And, as time has slipped by, a happy change has come over Mr. Darwin's critics. The mixture of ignorance and insolence which, at first, characterized a large proportion of the attacks with which he was assailed, is no longer the sad distinction of anti-Darwinian criticism. Instead of abusive nonsense, which merely discredited its writers, we read essays, which are, at worst, more or less intelligent and appreciative; while, sometimes, like that which appeared in the *North British Review* for 1867, they have a real and permanent value."

THE EDUCATIONAL CONVENTION AT ELMIRA.

The national educational association recently held at Elmira, N. Y., was of unusual interest, and evinced a marked progress in the public method of dealing with educational subjects. We have for some years refrained from attendance upon teachers' conventions, having been wearied with the narrow technical range and pedantic pettiness of the discussions. But the recent meeting showed that educators are beginning to outgrow their old professional limitations, and to consider the various questions that come before them in the light of broad principles, and in the spirit of radical and rational improvement. Many men of ability, presidents of leading colleges, eminent professors, principals of high-schools, and State and city superintendents, were present, contributing valuable papers, and giving strength and character to the debates which followed them.

President McCosh delivered an able address on the higher education, and maintained that the national Government should not give the balance of its lands to the agricultural colleges, nor yet to other collegiate institutions, but should appropriate them for the benefit of high-schools and academies through-

out the country. Dr. McCosh thus stated his main position:

"I don't propose that any portion of this $90,000,000 should be given to colleges. We cannot aid all, and to select a few would be injurious. In regard to elementary education, the Northern, the Middle, and the Western States, are able and willing to do their duty. I venture to propose that in these the unappropriated lands be devoted to the encouragement of secondary schools. Let each State obtain its share, and the money handed over to it under certain rigid rules and restrictions to prevent the abuse of the public money. In particular, to secure that upper schools be endowed only where needed, I suggest that money be allocated only when a district, or, it may be, a combination of two or more districts, has raised a certain portion, say one-half, of the necessary funds. By this means the money may be made to stimulate the erection of high-schools all over America. These schools would aid colleges far more powerfully than a direct grant to them, as, in fact, the grand difficulty which colleges have to contend against arises from there being so few schools fitted to prepare young men for them with their rising standard of excellence. But I plead for these schools, not merely as a means of feeding colleges, but as competent to give a high education in varied branches, literary and scientific, to a far greater number who do not go on to any thing higher. These schools, like the elementary schools, should be open to all children, of the poor as well as the rich. They should be set up, like the German gymnasium, in convenient localities, so that all the population may have access to them. They should embrace every useful branch suited to young men and women under sixteen and eighteen years of age—English composition, English language, history, classics, modern language, and elementary science. The best scholars in our primary schools would be drafted up to these higher schools, and thus the young talent of the country would be turned to good account, while the teachers in the common schools would be encouraged by seeing their best pupils advance."

The discussion that followed this speech brought out difficulties which the doctor had not considered, and, in fact, opened the way to the most vital problem of American education. The colleges of the country represent the old scholastic culture which took its shape at a period when popular education was not thought of, and culture was confined to the professional classes. These institutions are not holding their own at the present time. Their students are falling off, for the reason that there is a decline in the academies by which the colleges are fed; that is, as Dr. McCosh says, "the grand difficulty which colleges have to contend against arises from there being so few schools fitted to prepare young men for them."

But the cause of the decline of the academies is the rivalry of the newly-instituted high-schools, and these are the outgrowth and now an essential part of the common-school system. The modern idea of universal education has become organized in such a way as to antagonize the old college system. The common schools are not constructed upon the scholastic pattern; they aim to give to all a useful practical education, that shall be available in the common work of life. It was found that they did not go far enough in this direction for the wants of many, and so high-schools were organized in which the pupils of the common schools might graduate into the working world with a better preparation than the lower schools can furnish. It was stated in the discussion that but one in fifteen hundred of the population passes through college, while it is left for the common and high schools to educate the rest of the people. As the old academies disappear, therefore, the colleges seek to get control of the high-schools, to be used as feeders for themselves; and this, of course, necessitates a high-school curriculum fitted to prepare young men for college. This is the point at which the two systems are unconformable, and is to be the point of conflict in the future. What shall be the course of study in the high-schools? Shall it be a sequel to the common schools, or a prelude to the colleges, for these are different

things? Already in some of them we have two distinct systems of education. A principal of one of these institutions in the West said to the writer: "We are working under the disadvantages of a double curriculum. We have a scheme of studies, scientific and practical, drawn with reference to the larger number of our pupils who come from the common schools, and who close their studies with us. We take them through an English course, with mathematics, book-keeping, political economy, physics, chemistry, botany, and physiology. And we have also a classical course for a small number of students who are preparing for college. But the exactions of Latin and Greek are so great upon these that they get hardly a smattering of the subjects pursued by the other students." The tactics of Dr. McCosh were admirable. To keep the proceeds of the public lands from going to the agricultural colleges and scientific institutions, he is willing to resign all claim upon them for the benefit of the classical colleges; at the same time, if the money is expended for the extension of high-schools, as the doctor says, "these schools would aid colleges far more powerfully than a direct grant to them." Yet, as long as the two systems of education remain so diverse that the regular high-school graduation is not accepted as preparation for college, there will be conflict for the control of these establishments. Only as the college curriculum becomes more broad, modern, and scientific, and the classical studies are restricted to the special classes who have need of them, can American education become harmonized in its elements and unified in its system.

The report of President Eliot, of Harvard, on a national university, was a strong document. We publish the last portion of it, which deals with the main question, and ask attention to the high grounds on which he bases his demand for the non-interference of government with the system of higher education. His paper started a warm debate on the broad and important question of the proper relations of government to the work of instruction, and, of course, his views met with vigorous opposition. It was maintained that there is no break in the logic by which government action is prescribed; and that, admitting the propriety of state action in primary education, there is no halting-place until the government takes charge of the entire school machinery of the country. And such is the overshadowing influence of politics, and so profound the superstition regarding government omnipotence, that this view found its urgent advocates, who seem blind to the consequences that are certain to follow when the people shirk the responsibilities of attending directly to the education of the young, and shoulder it off upon a mass of politicians holding the offices of government. The friends of state education certainly pressed their case to its extreme conclusions. Government contributes money to support common schools, and appoints officers to regulate them; therefore let it appropriate $20,000,000 to establish a national university at Washington, with $1,000,000 a year to be divided among the congressional appointees, who will hold the professorships. Dr. McCosh suggested that recent congressional experiences were hardly calculated to inspire confidence in the action of that body, and asked what guarantee we should have against a university ring and systematic educational jobbing; and it was objected by others that the class of men who congregate in the capital, and the whole spirit of the place, would make it more unfit than any other in the country for such an institution. Prof. Richards, of Washington, came to the rescue of the reputation of his town, and asked, em-

phatically, "Where do its knaves and rascals come from? *We* do not make them; you send them to us from all parts of the nation." But the argument was not helped by the retort, for it is quite immaterial whether Washington breeds its scoundrels or imports them. If our republican system is one that sifts out its most venal and unscrupulous intriguers and sharpers, and gathers them into one place, it is questionable whether that place had better not be avoided as the seat of a great model university—especially if said intriguers and sharpers are to have the management of it.

ELECTIVE STUDIES AT HARVARD.

In an instructive article upon this subject, the *Nation* says: "There was a vague but very general impression, a few years ago, that, if the elective system were introduced into the older American colleges, the practical sciences, as they are called, especially physics, chemistry, and natural history, would crowd out the study of the ancient languages. There was also a feeling that the obvious utility of the modern languages, and particularly of French and of German, would help to throw the "dead languages" into the background. A great many enthusiasts fancied that the good time a-coming was at hand, when books would be thrown aside, and all intellectual activity would be narrowed down to the study of physical Nature; and so much noise has been made about the natural sciences that a great many people undoubtedly think this is the principal if not the only subject taught where an elective system prevails."

To submit this matter to a test, and "ascertain what it is that the mass of students feel the need of most and flock to most when the choice is left entirely to themselves," the *Nation* overhauls the university catalogue of Harvard for 1872–'73, and presents the statistics which bear upon the subject. The "elections" of subjects of study or choices of the students are shown in a succession of tables, the last of which divides the college studies into "disciplinary" and "practical," and exhibits the results as follows:

DISCIPLINARY STUDIES.	
Ancient languages	100
History	37
Mathematics	21
Philosophy	15
Political science	12
	185
PRACTICAL STUDIES.	
Modern languages	80
Physics and chemistry	37
Natural history	28
	145

"By this arrangement the disciplinary studies preponderate over the practical in the ratio of 185:145 or 100:78."

Upon this the *Nation* proceeds to remark: "The figures show conclusively that, in spite of the crusade which has been carried on against the ancient languages, they are still full of vitality, still a power, still a popular study, and, in fact, the greatest interest in the little college world. As our inquiry is purely numerical and statistical, we do not ask why the students make the selections they do. Doubtless, the reasons are not very obvious; still, one fact is plain, that they are not guided wholly by utilitarian views."

Now, if the *Nation* had looked a little into the "why" of this matter, we are sure it would have found the reasons for this state of things obvious enough, and, although it might have somewhat qualified its conclusion, it would have made the statement more valuable. The number of votes cast at an election is usually an expression of public opinion, but, if in any case there happen to have been military interference and dictation, the numerical report of ballots cast, if taken alone, would be misleading. We are told that