SCIENCE

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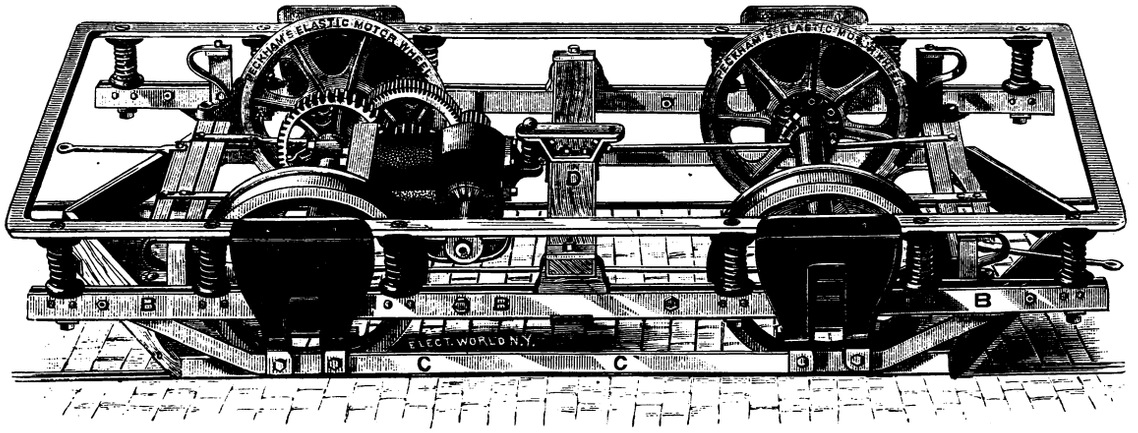
AN IMPROVED TRUCK FOR ELECTRIC CARS.

THE improved motor-truck for electric cars shown in the illustration on this page is designed to prevent, or at least to greatly lessen, the oscillating motions of cars with short wheel-base, such as all four-wheeled street-cars must of necessity be. It is also intended to strengthen the ends of car-bodies by providing additional support nearer the ends of the car than is possible with the usual truck.

The main double side-bars, marked *B* in the engraving, support, by means of the twelve springs shown, the upper frame upon which the car-body rests. The side bars are in turn supported by the cantilever trusses *C*, which are suspended from the journal-boxes by malleable iron yokes, to which the side-bars are securely fastened. The electric motor is suspended by a bolt and spring from the hanger on the cross-bar *D*. The hanger is arranged to support either one or two motors. A part of the side-bar *B* is detachable, so that it may be unbolted and taken off when it is necessary to remove the armature for repairs. No other part of the truck need be disturbed when repairs to the motor are needed.



THE PECKHAM CANTILEVER MOTOR-TRUCK FOR ELECTRIC CARS.

These trucks are equipped with compound lever brakes of great strength and simplicity, which, in quickness of action, are claimed to be much superior to the brakes generally used on car-trucks.

A peculiar feature of these trucks is that they are equipped with elastic wheels, the parts of which they are composed being interchangeable, so that worn or damaged parts may be readily and cheaply replaced. The wheels have malleable iron hubs, which are forced on the axles by hydraulic presses at a pressure of thirty-five tons to the square inch, so that there is no possibility of their ever working loose. The wheel webs can be removed and replaced by any ordinary workman, without the aid of special machinery, and without removing the motors from the axles. Tubular rubber cushions are inserted between the hub and the web, supporting the axles and motors, and relieving them from shocks, and lessening the tendency to crystallization of the iron. The journal-boxes are dust-tight and self-lubricating, and have been in use on various roads a sufficient length of time to demonstrate their efficiency. The axles are made of fibrous wrought steel, and are provided with enlarged bearings and screw threaded collars.

These cantilever trucks, which are made by the Peckham Car Wheel Company of this city, are now in actual use on many electric street-railways in this country, and the companies using them are well pleased with their many points of superiority over trucks not specially made for motor service.

THE INFLUENCE OF LEARNED INSTITUTIONS UPON THE PROGRESS OF MODERN SOCIETY.[1]

IT is sometimes urged, as a criticism upon institutions of higher education, that many men of intellectual eminence, subjected to their training, have acknowledged small obligation to it. One recalls, as an example of this, the grotesque picture of the University of Edinburgh, drawn by the satirical humor of Carlyle in "Sartor Resartus:" "Had you, anywhere in Crim Tartary, walled in a small enclosure; furnished it with a small, ill-chosen library; and then turned loose into it eleven hundred Christian striplings, to tumble about as they listed, from three to seven years; certain persons under the title of professors being stationed at the gates, to declare aloud that it was a university, and exact considerable admission fees, — you had, not indeed in mechanical structure, yet in spirit and result, some imperfect resemblance of our High Seminary." Mr. Darwin has furnished us a more recent instance, declaring, that, during the three years which he spent at Cambridge, his "time was wasted, as far as the academical studies were concerned," — "sadly wasted, and worse than wasted." It is not difficult to adduce unflattering estimates like these in considerable number from men distinguished both in letters and in science. Literary genius has been particularly impatient of academic methods. Acquaintance with the thought of the past, indispensable to those who would enlarge the area of exact knowledge, is less necessary to production in pure literature;

[1] Address delivered on the fourteenth anniversary of the Johns Hopkins University, by Professor E. H. Griffin, dean of the college faculty, Feb. 22, 1890.

and accordingly some of the greatest masters in this department stand outside of all scholastic association, while others, who have passed through the ordinary discipline, have failed to discern its advantage. It is in no small degree disappointing to note the relation in which so many of our English poets have stood toward the established educational system. They are, no doubt, a "genus irritable," somewhat likely to re-act against methods intended for the ordinary mind. Yet we do not like to add to Shakspeare, Pope, Burns, Scott, Keats, and the many others who accomplished their work without aid from learned institutions, so many critical and dissatisfied recipients of that aid: such as Shelley, prematurely dismissed from academic privileges; Byron, Goldsmith, Swift, who perhaps deserved to be; Southey, who declared that of all the months of his life those passed at Oxford were the most unprofitable, — "All I learned was a little swimming and a little boating;" Wordsworth, who showed his contempt for the ceremony of graduation by devoting the days preceding the final examinations to the reading of "Clarissa Harlowe;" even Milton, the most learned of our poets, whose discontent with his alma mater led him to speak of Cambridge, in his "Reason of Church Government," in this wise, "As in the time of her better health, and mine own younger judgment, I never greatly admired her, so now much less."

Nor is it the more strictly imaginative departments of literature alone that have been largely non-academical in their spirit. The fragment of autobiography in which Gibbon has given us so vivid a picture of his intellectual life comments with unsparing severity upon the learned body intrusted with his education: "To the University of Oxford I acknowledge no obligation: and she will as cheerfully renounce me for a son as I am willing to disclaim her for a mother." His great contemporary, Hume, owed so little to scholastic influences that the bare fact of his residence as a student is with some difficulty established. Adam Smith devotes a well-known passage of the "Wealth of Nations" to a consideration of public endowments of education from a point of view sufficiently indicated in remarks like these: "The discipline of colleges and universities is in general contrived, not for the benefit of the students, but for the interest, or more properly speaking for the ease, of the masters. . . . Those parts of education for the teaching of which there are no public institutions are generally the best taught." The low esteem in which Locke held the curriculum of his day is stated, expressly or by implication, in each of his writings on education. Francis Bacon criticised the learned foundations of his time on historical grounds in the "Advancement of Learning," and on grounds of theory in his "Novum Organum."

It is needless to multiply instances of this revolt of individual genius from the ideas and methods embodied in institutions of education. It seems necessary to admit that the academic discipline has not been very successful in dealing with the highest order of minds. Yet, obviously, there are various things that may be said in reply to such an allegation. It does not follow, because the work of a great man seems to himself or to others to have been uninfluenced by his early education, that it really was so. We sometimes forget the source of impulses that have been of great consequence to us; and it is not difficult to show, in the case of some distinguished critics of the educational system, that their obligations to it are much greater than they suppose. All human things have periods of relative decline and inferiorit , which it is not just to treat as representative. Some of the s verest strictures proceed from men who happened upon evil days, and in such cases the exceptional character of the time should be taken account of. During the eighteenth century, for example, the English universities were unproductive. Many of the professors treated their positions as sinecures, and gave no instruction. The story goes that one of the non-resident professors, subjected to the cruel hardship of a journey four times a year for the drawing of his salary, who had made various attempts to induce the authorities to forward the stipend, at last discovered a statute which obliged them to do so, and thus succeeded in absolving himself from the solitary function which he had ever been known to discharge. It is no wonder that the indignant comments of the author of the "Wealth of Nations" were provoked by an administration of a public trust under which such abuses were possible. So far as there is any incompatibility between provision for the original and creative mind, and due consideration for persons of inferior endowment, it may with some reason be maintained that the latter is the more important duty. Genius can take care of itself; it will not suffer its path to be too narrowly marked out: it is the man of average powers who needs instruction and direction. Society may be better served by an educational regimen adapted to the great mass of those subjected to it than by one higher in intellectual quality, but narrower in the range of its application. We must not allow too great weight to the fact that so many distinguished names can be cited in criticism of methods of education. Such criticisms are often unfair as to the matter of fact, withholding acknowledgments that ought to be rendered. Just as applied to a particular time, they are often unjust as general propositions. The distinction which ought always to be kept in view between the ordinary mind, for which systems of instruction are largely designed, and the exceptional mind, which is in great degree a law unto itself, they often disregard.

I have thought that it might be suitable to the occasion which brings us together, if, instead of discussing a theme of more specific character, which might not be of interest to us all, I were to remind you, through a few illustrations, how potent and effective the influence of learned institutions has been upon the progress of modern society. The conception of scholarly life as remote from practical things is sufficiently common to make it well sometimes to enter protest against it; and however little influenced we may be by derogatory estimates, such as have been referred to, an occasional resurvey of salient facts of academic history cannot be without value. One who considers how hard it is to name an important movement of thought or life, since society emerged from the middle ages, in which institutions of higher education have not been a discernible factor, will understand how honorable and dignified is the learned tradition which we have inherited. "I have felt," said Frederick D. Maurice, "the close connection between the learning of the scholar and the life of the world." The realization of this, as a personal consciousness, is one of the most ennobling and invigorating experiences of which one is capable; the perception of it, merely as a fact observed in history, is by no means unimportant.

In June, 1888, the University of Bologna celebrated the eight hundredth anniversary of its founding. Unless the succession of teachers said to be traceable at Athens, from Plato down to the suppression of Pagan philosophy by Justinian, be admitted as an exception, this is the longest existence attained by any such institution in the civilized world. This length of time takes us back to that early awakening of the intellect of Europe which has been happily termed the "Roman Renaissance." Various influences contributed to make this period of the twelfth and thirteenth centuries one of new life, — Mohammedan civilization, acting through the Crusades and the Saracen conquests, awakening an interest in physical science, bestowing upon western Europe important portions of the philosophy of Aristotle; the commercial enterprise of the busy Italian cities, creating wealth, introducing refined tastes and habits, developing political relations and ideals before unknown; the resuscitation of ancient philosophy, under the direction of the Church, expressing itself in the speculative and dogmatic movement known as scholasticism. The early universities were the product of these pregnant influences. In their origin they were essentially popular; not established by bounty of king or patron, but rising, without preconcerted plan, in response to recognized needs, around the persons of famous teachers.

The most characteristic of the intellectual tendencies of the age was the scholastic philosophy, and it was only natural that the newly founded schools should for a long period of time be mainly devoted to its promulgation. Mr. Hallam, writing scarcely more than fifty years ago, declared that he knew of only one Englishman, since the revival of letters, who had

"penetrated into the wilderness of scholasticism." When one remembers that Thomas Aquinas is the accredited exponent of the theology of the Roman Catholic Church, this seems hardly creditable to English scholarship; nor is it to our credit that the only idea which so many persons have of these philosophers and theologians of the middle ages is derived from the grotesque and silly discussions in which they are popularly represented as delighting. But the dispute as to the nature of universals, which has been the special occasion of the cheap ridicule visited upon them, is not a mere word-play. Its historical genesis and its intellectual affiliation are in the concepts of Socrates, the ideas of Plato, the forms of Aristotle. However alien in spirit and form to the Greek philosophy, scholasticism is its continuation, and nominalism and realism are only the mediæval way of expressing the antithesis of sense and reason, phenomena and noumena, the empirical and the ideal, which, under one name or another, appears in every age of human thought. That this antithesis should have taken a theological form was only natural under the circumstances then existing: in the absence of a knowledge of nature, there was little else to philosophize about, except the data furnished by the Scriptures. It is easy, no doubt, to blame the scholastic thinkers because they did not adopt the inductive method as expounded by modern authorities; but we all know that men must be judged by the standards of their time, and it is certain, that, in its best period, scholasticism was immensely stimulating and influential. We cannot easily understand how these dry and subtle abstractions of logic and metaphysics could have been so interesting; but we know that the old curriculum, inherited from the declining days of the empire,—the trivium and quadrivium, — was abandoned on all sides for this new instrument of discipline and culture; that admiring pupils flocked in vast numbers to listen to masters like Abelard and Scotus; that even the street brawls of the students turned on the issues between the nominalists and the realists. One can have little of the historic spirit who supposes that these great results were accomplished by what Erasmus contemptuously described as "quibblings about notions, and relations, and formalitations, and quiddities, and haecceities." This mediæval philosophy and theology was a genuine expression of the human mind, as good a theory of the universe as the times made possible.

The number of eminent men who taught in the schools of England, France, and Germany during the predominance of scholasticism was by no means small. Such men as Albertus Magnus, Thomas Aquinas, Duns Scotus, William of Occam, would command respect in any age of the world. The greatest of them all according to modern standards, Roger Bacon, we can hardly regard as a product of the spirit of his time so much as a protest against it; and we find in his case, as in that of others, that powerful influences in behalf of intellectual and spiritual freedom proceeded from schools of scholastic learning. Few movements in English history have taken deeper hold upon the masses of society than that of Wycliffe, the centre of whose activity was at Oxford. At the reforming councils of Constance and Basle the deputies from the universities were conspicuously independent; John Huss was supported by the influence and enthusiasm of the University of Prague. Thus in this age anticipations of a new era of human thought appeared. It is to the honor of the early universities of Europe that they were produced by this first intellectual awakening of the modern world, and that they so effectively contributed to it.

The great defect of the intellectual life of the middle ages was that it had not at its command sufficient material of knowledge. In keenness and subtlety, and in constructive ability, the mediæval thinkers have perhaps never been surpassed; but a far wider range of facts was necessary, that these powers might be profitably employed. The revival of ancient learning, therefore, which, beginning at least a century earlier, spread so rapidly throughout Europe after the middle of the fifteenth century, was a natural and indispensable step in the development of thought. It restored the continuity of history; it made antiquity and classic culture again objects of knowledge.

The relation of schools of learning to this eager study of the past was modified by a variety of circumstances. In Italy, where the passion for classical studies was earliest and most intense, private patrons played the most prominent part in the movement. The collection and transcription of manuscripts, the formation of libraries, the encouragement of learned men, — these services were more munificently rendered by powerful families like the Medicis, by Popes like Nicholas V. and Leo X., by the academies which sprang up in all the leading cities, than by the universities. Of them — in Italy and in every other country—the scholastic philosophy had possession. It is not strange that everywhere it declined to yield its ground. Within limits, the resistance to new methods and new materials of thought, of which the history of education furnishes so many examples, may be admitted as reasonable. Institutions stand in historical relations to the past and to the future, and must act in view of these, making sure that a given change is wholesome before sanctioning it. But the conservative impulse has ordinarily been in excess: habit and sentiment and vested interest have made change more difficult than the public good would dictate. In particular, effete and outworn disciplines have always offered bitter resistance to competitors. The phase of scholasticism which had become prevalent in the fifteenth century combined a strenuous assertion of orthodoxy with fundamental scepticism. The nominalism of William of Occam denying objective validity to general notions, making them mere words or names not answering to reality, carried with it, of course, the consequence that reasonings founded upon general terms are invalid; that no conclusions can be reached by rational argument; that no tenets of theology or philosophy are rationally demonstrable; that faith and the authority of the Church are the foundations of belief. We cannot wonder that a mode of thought so suicidal, which renounced all natural and verified knowledge, should have recognized an irreconcilable opposition between itself and a broadly human and rational movement like the revival of learning.

It must be remembered, also, that humanism passed into various extravagances which might well awaken the alarm of those who adhered to the ancient faith. Even so ardent a friend of the new learning as Erasmus dreaded the results of its importation into the north. "One scruple still besets my mind," he said, "lest under the cloak of revived literature Paganism should strive to raise its head." How largely a refined and sceptical Epicureanism pervaded Italian society at the time of the classical revival, the art and literature of the period abundantly testify. The cynical frankness with which even high ecclesiastics avowed their unbelief is something startling. The theoretical preference of Paganism to Christianity was not uncommon. "Christianity," said Machiavelli, "teaches men to support evils, and not to do great deeds." It must be admitted that the opposition of the academic adherents of scholasticism was not wholly without excuse.

It would, however, be a mistake to suppose, that, even where the traditional influences were strongest, schools of learning were without share in this decisive and critical movement of human thought. The opposition of the existing authorities was in some cases avoided through the expedient of founding colleges. Thus through the institution by Francis I., in 1531, of the Royal College of Three Languages, the Univers ty of Paris, a stronghold of the old dialecticians, became an important centre of Greek and Hebrew scholarship. This expedient was much employed by the patrons of the new learning in England. The preponderance of the colleges in the English university system is largely due to the fact that so many sprang into being, or into a more vigorous life, at this time, as instruments of the new culture. Nowhere was the classical revival more effectively promoted than in the English universities. There are few chapters of literary history more fascinating than that which, beginning, let us say, with the gift of classical books at Oxford by Shakspeare's "good Duke Humphrey" about 1435, and ending with the death of Sir Thomas More in 1535, should indicate the leading events and personages of this century of intellectual revolution. The prevalence of Greek scholarship at Oxford and Cambridge is often attributed to the influence of

Erasmus; but there is little doubt that, upon his first visit, he found there attainments quite equal to his own. The encomium of Erasmus upon his English friends has been often quoted: "When I listen to my friend Colet, I fancy I am listening to Plato himself. Who but must admire Grocyn, who is nothing short of a complete encyclopædia of knowledge? Did ever any one possess such taste, so acute, polished, and searching, as Linacre? Has nature ever produced a mind gentler, sweeter, or more richly gifted than that of Thomas More?" The bantering compliment which Erasmus paid More illustrates the delightful intellectual sympathy which united this remarkable body of men to one another. He entitled his famous work, composed at More's house, the "Praise of Folly;" the Latin words containing a play upon his host's name, *Encomium Moriæ*. The thoroughness with which the new culture took possession of the centres of English education is indicated in the literature produced in the succeeding generation. The Elizabethan dramatists were nearly all, except Shakspeare, university bred: they often use their classical knowledge with indifferent judgment and taste, but they make it a prominent element in their work. Shakspeare's classical allusions need not be explained by denying his identity: intercourse with his university trained compeers sufficiently accounts for them. Much of the interest of this early group of scholars was centred in the elucidation of the Scriptures. Colet lectured at Oxford on the Epistles of St. Paul: Erasmus worked at Cambridge on his edition of the Greek text of the New Testament. The practical aims and the moral earnestness of the English revival of letters distinguished it from that of Italy, from which it took its origin, and rendered it influential upon the higher life of the nation.

The leaders of German humanism were, if possible, more interesting in personal traits than their English co-laborers. Agricola, Reuchlin, Ulrich von Hutten, Melancthon,—these names suggest a variety of character and achievement peculiarly attractive. The development, however, of the movement in Germany was cut short by the advent of the Reformation. This had been foreseen by Erasmus, who had from the first looked with little sympathy upon Luther. A typical man of letters, his chief concern was for literature, the interests of which he would not jeopardize by theological disputes. But the extent to which the classical revival had leavened the thought of the universities may be seen in the fact that the Reformation derived from them its chief impulse. This great movement of faith and conduct was pre-eminently academical in its character. It was not in origin a popular revolution, but a learned one: the study of Greek, pursued for the sake of scriptural interpretation rather than of merely elegant accomplishment, was its inspiration. Whatever view one may take of the German Reformation, it must be conceded that institutions of learning have rarely acted upon society with greater effect than did universities like that of Wittenburg, which first encouraged humane studies, and then used them as instruments of social change.

In 1612, Descartes completed his studies at the Jesuit School of La Flêche. The account which he gives us of his education shows how largely the classical learning had then been accepted by the historical successors of its old scholastic adversaries. If we take the fall of Constantinople as an approximate date for the beginning of the movement, and consider that the Jesuit ideas of education were fairly in operation by the beginning of the seventeenth century, a period of about one hundred and fifty years would seem to have been occupied in winning recognition for the new learning. The magnitude of the interests involved in this momentous intellectual change may explain its slow accomplishment.

The term ordinarily applied to the intellectual awakening of the fifteenth and sixteenth centuries accurately describes its character. It was a renaissance, a revival of the past. It is evident, that, unaccompanied by any other influence, this reinvigoration of the sentiments and ideas of antiquity was an inadequate impulse and basis of civilization. No age can afford to content itself with what has already been. It is difficult to overestimate the importance, as an element in the formation of modern society, of the new studies, which, after the force of the renaissance was in a measure expended, attracted the best thought of the time. "The fifteenth century," it has been said, "restored the broken links of time; the seventeenth unveiled space. The former had shown to man his place in history; the latter was to assign him his place in nature."

The great age of physical discovery, beginnnig about the middle of the sixteenth century, but falling mainly in the seventeenth, was distinguished above all preceding eras by independence of the past. No generation of thinkers has ever appeared which derived so little from its predecessors as that which, acting concurrently in each of the leading countries of Europe, laid the foundations of modern science. It is significant that so many of the great men of that epoch interested themselves about the question of method. Bacon wrote a new Organum, discussing the laws under which the object is to be known, as the Organum of Aristotle had discussed the laws under which the subject thinks. The first important work of Descartes was the "Discourse on Method," reversing the procedure of Bacon, and seeking the knowledge of effects through their causes. Pascal's fragment on method is well known. Spinoza, Leibnitz, Hobbes, Locke, — their common characteristic is that they begin with first principles, and manifest an almost unprecedented degree of intellectual independence. It would hardly be expected that an era so self-reliant and so original would have much concern with the traditions and institutions of previous learning. Yet the investigation of nature which created physical science in the seventeenth century founded itself at first upon what had been done in the past. Copernicus evolved his system after an exhaustive study of the various astronomical systems of the ancients. All the discoverers who co-operated in giving this new direction to men's thoughts were trained in schools of education; most of them filled professor's chairs. It is an interesting fact that so many who have contributed to scientific thought have been teachers. This was noticeably the case at the originative epoch of the seventeenth century: Galileo was a professor at Pisa and Padua, Kepler at Prague, Torricelli at the Florentine Academy, Newton at Cambridge. The founders of modern science were indebted to the universities of their day for the equipment of knowledge, without which, novel as were their methods and results, they could not have done their work. Nor, since their time, have contributions to knowledge in this department been often made by men who have not enjoyed the advantage of regular education. A man of letters may dispense with this: it is not necessary that he be widely familiar with the productions of the past. A man of science must know what has been accomplished by his predecessors: the subjects with which he deals have a rigorous continuity of development. Eminent inventors have often been imperfectly educated; but the originating thought, which makes invention possible, comes from a well-furnished mind. Of course, this is more and more the case as experimental methods are developed. The perfecting and multiplication of mechanical aids to investigation, the founding of laboratories and museums and libraries, tend to concentrate activity at points where these facilities are furnished, and thus make the service of learned institutions increasingly indispensable. As the philosophical and theological element in modern thought goes back to the universities of the twelfth and thirteenth centuries, which were produced by it; and as the humanistic and classical tradition finds its origin largely in the learned schools of the renaissance,—so the scientific factor is, even more distinctly, academic in its history. Since the study of nature requires acquisitions and facilities which cannot be commanded by the isolated individual, and must always demand associated and organized endeavor, we see how enormous is the indebtedness of the industrial and commercial civilization of the modern world to institutions which it sometimes thoughtlessly considers unpractical.

In consideration of the sacrifices and sufferings of the citizens of Leyden during that memorable siege whose heroic and picturesque incidents have been made familiar to us by Motley, they were offered by the states of the Netherlands their choice

between immunity from taxation and the establishment of a university. With a foresight which has been rarely paralleled, they chose the latter, and the University of Leyden was accordingly founded in 1575. To this seat of learning, during the years immediately following, came, as teachers and students, a remarkable body of men. One of the earliest professors was Lipsius, an industrious and prolific scholar, for the honor of whose adhesion Protestants and Roman Catholics contended, the latter finally prevailing. To make good this defection, Joseph Scaliger was called, descended from the princely house of Verona, whose tomb all travellers remember, possessed of a wonderful memory, such as, in these days when memory is a lost art, seems scarcely credible, but with still better title to remembrance in the fact that he was the first to form the conception of the science of historical criticism. His conjecture that the Chronicle of Eusebius must originally have consisted of two books, and his conjectural restoration of the lost one, subsequently confirmed in the main by its discovery, must rank as one of the most noteworthy triumphs of historical imagination. Salmasius was another of the teachers at Leyden, in reply to whom Milton composed his "Defense of the People of England;" whose abusive personalities toward his antagonist are equalled only by those of that antagonist toward him; in regard to which, however, it must be admitted that Milton was the aggressor, since, desiring to render his opponent ridiculous, Milton describes him, in graceful allusion to the supposed ascendency of Madame Salmasius over her husband, as "an eternally speaking ass, ridden by a woman;" to which polite characterization the Dutch scholar retorts with various amiable epithets, such as "puppy," "silly coxcomb," "unclean beast." Such, couched in irreproachable and sonorous Latin, are some of the pleasant compliments which the controversial ethics of that day did not condemn. Grotius was another of the famous men produced at Leyden, a philosophical jurist of Christian temper and of varied learning, often spoken of as the founder of the modern science of the law of nations. Arminius was a student at Leyden, whose name survives in polemical theology, the seriousness of whose departures from Calvinistic orthodoxy would not, I fear, be altogether appreciated, were I to recount them in this place. These and many other distinguished men gave the University of Leyden European celebrity. "In the Batavian Netherlands," says Sir William Hamilton, "when Leyden was founded, erudition was at a lower ebb than in most other countries; and a generation had hardly passed away when the Dutch scholars of every profession were the most numerous and learned in the world." The burghers had made a good bargain; the fame of their city was carried all over Europe by the fame of its university; they got good return for the taxes of which they were not relieved. We may perhaps think of a city of our day, known far and near through the work of its university, and may possibly regret, that, in the matter of the taxes, the parallel fails to be complete.

Equally signal examples of the influence of learned institutions upon the general welfare of the communities in which they are, might be easily multiplied. In 1807, when Fichte delivered his "Addresses to the German People," his voice often drowned by the trumpets of the French troops, setting forth his idea of a common education as the basis of a common nationality, the political condition and prospects of Germany seemed well-nigh hopeless. The humiliations suffered at the hands of Napoleon were not so discouraging as the fact that these did not seem to rouse a united national spirit. The brilliant literary production which marked these years of disaster seemed to show that the intellectual activity of the people was without relation to their political life. We can now see the far-sighted wisdom of the declaration of Frederick William III., in accordance with which the University of Berlin was founded, that the State must repair its outward losses through the development of its spiritual energies. The connection between the educational and the political history of Germany during the present century, no one can overlook: it was the intellectual and moral conditions created by the work of its universities which contributed in no small degree to make the united and triumphant empire possible. We sometimes regret the multiplication of colleges in our own country; but, whatever evils have attended it, we must not forget that every one of these institutions has been a centre of enlightening and civilizing power.

It is remarkable how many movements which have become popular and widespread have originated in select circles of men gathered in academic relations. What was it which restored to Christianity its influence upon the English nation, after it had been so far lost that Bishop Butler declared, in 1736, "It is come, I know not how, to be taken for granted by many persons that Christianity is not so much as a subject of inquiry, but that it is now at length discovered to be fictitious"? The distinguished apologetic writers of the period contributed little to this result. It was the little company of Oxford students, contemptuously stigmatized as "Methodists," who wrought this moral and social transformation. Reformations in religion have ordinarily proceeded from institutions of learning, but reformations of all sorts are very likely to have this origin. The reason is because the element of ideality is more largely present in such communities than anywhere else, because things are judged in the light of principles more dispassionately and disinterestedly by minds engaged in the pursuit of truth than by persons absorbed in the ordinary pursuits and rivalries of life. The most hopeful appeal in behalf of any interest of human progress is to those who are for the time removed from immediate connection with the existing order, whose enthusiasms are fresh, unselfish, and responsive. One can hardly conceive an atmosphere more congenial to all high inspirations than that which pervades those select circles of young men not rarely gathered in our institutions of education.

Let me recur, in conclusion, to the expressions of criticism and discontent of which I spoke at the beginning, in order briefly to raise the question whether these are likely to be as sharply urged hereafter against present methods as they now are against those which have preceded. There are, as it seems to me, many reasons for believing that the educational work of our time is indefinitely better than any in the past.

The various intellectual interests are harmonized with one another to a greater degree than at any previous time. Scholarly activity is not predominantly determined in any one direction. The legitimacy of all spheres of knowledge is admitted. No one of any authority constitutes himself the partisan of one discipline as against another. Specialization, no doubt, tends to narrowness of view; but this tendency is counteracted by a profounder realization of the unity of knowledge, leading us to understand that every thing in some sort involves and leads to every thing else. Provision is thus made for all minds to an extent impossible under a narrower conception of the scope and relations of learning. The undogmatic candor with which knowledge is imparted is in favorable contrast to the political and ecclesiastical prejudices and prescriptions which have so often impaired the freedom and impartiality, if not the integrity, of academic teaching. That peculiar sentiment, inadequately described in the words "love of truth," whose ethical value is attested by the laborious, self-denying lives so often produced by it, has never been more fully developed among scholars and teachers than it is to-day. The historic method, whose abuse, as leading to intellectual indifferentism, is acutely indicated by Mr. John Morley, — "In the last century men asked of a belief or story, Is it true? We now ask, How did men come to take it for true?"—in its real spirit and in its chief influence, is singularly humane and practical, since it leads us to consider every department of knowledge in its relation to the life of society and the welfare of mankind, and blends in happy and admirable combination the scientific and the philanthropic temper. It may surely be claimed that never in the history of educational institutions have they approached so nearly as now the standard of duty and service indicated by Cardinal Newman: "If a practical end must be assigned to a university course, I say it is that of training good members of society. Its art is the art of social life, and its end is fitness for the world." That aspiring and

ingenuous minds, subjected to the influences which control the schools of learning in our day, will revolt from them with the keen dissatisfaction and bitter sense of injury and loss which so many have felt in the past, it does not seem possible to believe.

President Gilman delivered an address, on the occasion of this anniversary five years ago, upon a subject closely akin to that which has now been presented. His opening words I will quote: "To be concerned in the establishment and development of a university is one of the noblest and most important tasks ever imposed on a community or on a set of men. It is an undertaking which calls for the exercise of the utmost care, for combination, co-operation, liberality, inquiry, patience, reticence, exertion, and never-ceasing watchfulness. It involves perplexities, delays, risks. Mistakes cannot possibly be avoided; heavy responsibility is never absent." This statement, in no wise exaggerating the arduous and responsible nature of the task, may remind us how large a measure of honor and gratitude is due to those who have co-operated in the founding and upbuilding of this university, and especially to him, of whom in his absence we may speak more freely, to whose energy and wisdom and self-devotion the success of these years is, by common consent, pre-eminently to be ascribed.

NOTES AND NEWS.

WALLED up in the cellars of a brewery at Burton-on-Trent, there was discovered not long ago some beer which had been brewed in the year 1798. It resembled sherry more than it did a malt liquor, and was in good condition.

—The American Society of Mechanical Engineers have purchased a commodious building at 12 East 31st Street, this city, for permanent headquarters. Part of the building will be occupied by the Institute of Electrical Engineers, and the libraries of both societies will be merged into one.

—Late reports from the engineers at work on the Nicaragua Canal indicate that the preliminary harbor improvements at Greytown are going ahead successfully and rapidly. Senator Warner Miller has been elected president of the construction company, succeeding Mr. A. C. Cheney, who is now vice-president.

—A special train on the Philadelphia and Reading and the Central Railroad of New Jersey, on March 10, made the run between Philadelphia and New York, a distance of ninety miles, in eighty-five minutes. This is at the average rate of 63.53 miles per hour. At times the train is said to have exceeded eighty-five miles per hour.

—The American Tunnel Construction Company have contracted to construct a tunnel under the East River, from New York to Brooklyn, work to begin as soon as the consent of the local authorities shall have been secured. Meanwhile the tunnel under the Hudson, which has passed into the hands of English capitalists, is making slow progress.

—M. D. Bellet contributes to the *Compte Rendu*, 1889, No. 14, a note on some tables furnished by the director of the McGill Observatory, Montreal, to Gen. Greely. The observations extend over fifty years, from 1839 to 1888 inclusive, and form an exhaustive exposition of the climatic conditions of the country. During those years the variations of the seasons have been confined within very narrow limits. The last frosts have occurred at the beginning of May. The earliest spring was that of 1878, when the last frost was on April 2, and the latest was in 1856, in which year the thermometer fell to freezing-point on May 21. The frost, except in 1867 and 1874, always returned before November, the latest recorded being on the 5th of that month, and the earliest on Sept. 15 in the year 1859. In 1860 snow fell on Sept. 29, the only occasion when it fell during that month. Its latest appearance was in 1846, on Nov. 28. In 1839 snow ceased to fall in March, an event which did not happen again until 1889. The latest snow recorded fell on May 27, 1871. Snow fell during this month in only nineteen years out of the fifty. The mean temperature at Montreal during the seven years 1851 to 1856 inclusive was 41.56° F., the maximum 100.1° F., and the minimum 36° F. During the fourteen years ending in 1888, the mean was 41.58° F., though the last year the mean was only 39.83° F. The mean rainfall for 1851 to 1857 was 43.004 inches, and for the last fourteen years only 27.2 inches; but the figures for the months of July and August, 1888, are the largest recorded. The annual fall of snow for the years 1851 to 1857 was 95.76 inches; for the fourteen years ending in 1889, 125.8 inches.

—The construction of railways was commenced in Japan about twenty years ago; and now 579 miles of line are in working order, of which 497 are in Hondo, and the remainder in Yezo. Some of these lines, according to *Compte Rendu*, 1889, No. 14, belong to the state, others to the Japanese Railway Company. The former run from Tokio to Yokohama; from Yokohama to Kodzu; from Kobe, through Ozaka and Kioto, to Otsu on Lake Biwa; from Handa, through Nagoya and Nagahama, to Tsuruga on the west coast of the island; from Takasaki to Yokokawa; and from Naoyetsu to Sikiyama. The company's lines run from Tokio to Sendai, and from Tokio to Takasaki and Mayebashi. In Yezo there are only two state lines, — the one from Otaru to Sapporo, and thence to the coal-mines of Horonai; the other connecting the sulphur-mines of Kushiroko with the river of the same name. Besides the above-mentioned lines, there are in course of construction a line connecting Kodzu and Nagoya, with a branch to the naval station Yokosuka; another from Yokokawa through Nagano to Sikiyama; a branch from the Sendai line to Utsunomiya and Mito; and a line from Koyama to Kiryu, through Tochigi, Sano, and Tatebayashi. Lastly, numerous lines are projected, of which one from Sendai to Aomori, at the northern extremity of Hondo, is among the chief.

—Sir J. H. Drummond-Hay believes that Marocco might export a large quantity of agricultural produce under a just and prudent government, says the London *Chamber of Commerce Journal*. The soil is very fertile, particularly in the southern provinces, and produces wheat, barley, maize, and other grains, cotton, oil, fruits, cattle, etc. The people are strong and intelligent, and the climate more temperate than in southern Spain. But the inhabitants do not care to waste their labor in producing more than suffices for their maintenance, when any surplus there may be is taken from them by the tax-collectors, and any show of wealth attracts the unpleasant attentions of the government officials. The prohibitions and duties on exports also exercise a prejudicial influence on agriculture, as was proved in the case of maize. Sir John Drummond-Hay succeeded in getting the prohibition on the exportation of that grain removed by the convention of 1856. The first year one vessel only was laden with maize, but in subsequent years one hundred vessels were annually laden with it, and a large quantity of fresh land was brought under cultivation. Yet, in spite of the fanaticism of the Sultan's advisers and the unsettled state of the country, trade does to some extent increase. In the years 1875-85 the value of the imports averaged £1,033,918 annually, of which about three-fourths represented British goods. The imports at Tangier in 1887 amounted to £748,000, about £62,000 more than in the previous year.

—M. V. Turquand presented last year a statistical album to the Paris Geographical Society (*Compte Rendu*, 1889, No. 14). It contained, among others, six maps showing the geographical distributions of the different nationalities in France. There are 80,000 Spaniards living in France, most of them in the Basse-Pyrénées and Pyrénées Orientales. It is curious that there are hardly any in Ariège. The Swiss, who also number 80,000, occupy chiefly the basins of the Loire and of the Upper Rhone and Sâone. The Italians are spread over the country from the Maritime Alps to Paris, but are most numerous in the departments of the Alpes-Maritimes, Var, and Bouches-du-Rhône. In the first-mentioned they form one-twentieth per cent of the population. The total number of Belgians in France is nearly 500,000: they dwell in the northern half of the basin of the Seine. Lastly, the Germans are found principally along the