

MITCHELL (T.D.)

best respects of the author

A CURSORY VIEW

OF THE

HISTORY OF CHEMICAL SCIENCE,

AND SOME OF ITS

MORE IMPORTANT USES TO THE PHYSICIAN:

BEING

AN INTRODUCTORY,

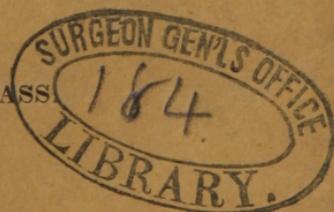
TO THE

COURSE OF LECTURES, FOR THE SESSION 1837-8.

BY THOMAS D. MITCHELL, M. D.

*Professor of Chemistry and Pharmacy, in the Medical Department
of Transylvania University.*

PUBLISHED BY THE MEDICAL CLASS



Lexington:

Finnell & Zimmerman, Printers—Observer & Reporter Office.

1837.

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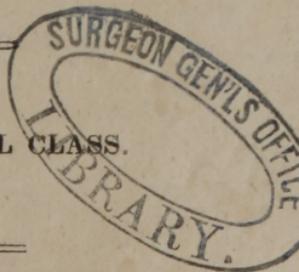
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Professor THOMAS D. MITCHELL,

Sir:—Having been appointed a committee to express to you the wish of the Medical Class, we have the honor to request, for publication, a copy of the excellent and instructive Introductory Address, delivered by you on the 11th inst., before the citizens of Lexington and the Gentlemen of the Class.

With great respect, your ob't. serv'ts,

J. P. W. S. COMPHER,
N. J. W. WORTHAM,
DAVID WALKER,

Committee.

Lexington, 13th November, 1837.

CHEMICAL LABORATORY, LEXINGTON, }
November 14, 1837. }

To Messrs. COMPHER,
WORTHAM and } *Committee, &c.*
WALKER,

Gentlemen:—In reply to your note of yesterday, requesting, in behalf of the Medical Class, a copy of my Introductory Lecture for publication, allow me to say, that were I to indulge my own feelings, I would prefer that the address might have no greater publicity than it has already enjoyed. If, however, it will afford to the respectable and intelligent gentlemen whom you represent, any gratification to give it a more extensive circulation through the medium of the press, the manuscript is at your service.

I am, gentlemen, very respectfully, yours, &c.

THOS. D. MITCHELL.

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THE UNIVERSITY OF CHICAGO
CHICAGO, ILLINOIS

TO THE HONORABLE SENATE OF THE UNIVERSITY OF CHICAGO
FROM THE FACULTY OF THE DIVISION OF THE PHYSICAL SCIENCES

RESOLUTION

WHEREAS, the Faculty of the Division of the Physical Sciences has the honor to acknowledge the receipt of a communication from the Honorable Senate of the University of Chicago, dated the 15th day of May, 1920, in relation to the proposed reorganization of the Faculty of the Division of the Physical Sciences, and has thereupon resolved to advise the Senate of its views thereon; and

WHEREAS, the Faculty of the Division of the Physical Sciences has the honor to acknowledge the receipt of a communication from the Honorable Senate of the University of Chicago, dated the 15th day of May, 1920, in relation to the proposed reorganization of the Faculty of the Division of the Physical Sciences, and has thereupon resolved to advise the Senate of its views thereon;

Resolved, That the Faculty of the Division of the Physical Sciences do hereby advise the Senate of the University of Chicago that it is in favor of the proposed reorganization of the Faculty of the Division of the Physical Sciences, and that it has no objection to the proposed reorganization of the Faculty of the Division of the Physical Sciences.

ADOPTED BY THE FACULTY OF THE DIVISION OF THE PHYSICAL SCIENCES
AT A MEETING HELD AT CHICAGO, ILLINOIS, ON THE 15TH DAY OF MAY, 1920.

WALTER DILLIARD, Secretary

INTRODUCTORY DISCOURSE.

If the spirits of the venerable men, who laid the foundations of medical science in the United States of America, might be permitted to revisit the land of their nativity, and to cast an admiring look for one moment over this large and respectable assembly, what think you would be their emotions? Doubtless they would call to mind the early effort of their youthful ardor in the cause of science, when but a few feint sparks could be collected together, the feeble glimmerings which were destined to glow and send out light and heat to every portion of the land. They would revert to the long forgotten days of gloom and discouragement, when the flickering taper seemed ready to go out in total darkness, and cover with the sable mantle of oblivious night all their brightest prospects. How would the contrast cover them with amazement, to behold in the far wilderness, where but lately the red man was lord and proprietor of all, this large assembly of young men, gathered from almost every section of our country, for the special purpose of gaining medical knowledge. How imposing, sublime and overpowering the spectacle! Their bosoms swelling with ecstatic joy, their fondest wishes more than gratified, their happiest anticipations outstripped in the exuberance of the reality, well might they wonder and gaze and wonder still at the onward immeasurable flights of science, as they retraced their way back to the dwelling place of departed spirits.

Two thirds of a century have not yet elapsed since the first medical school in America had even a nominal existence.* Of its trials,

*The idea of establishing a medical school in Philadelphia had its origin with Dr. William Shippen and Dr. John Morgan. This was in the year 1762. Those two gentlemen were the first duly appointed Professors in America. In 1768, Dr. Adam Kuhn and Dr. Thomas Bond were added to their number. The latter individual gave his introductory address in the Pennsylvania Hospital on the 3d day of December, 1766, a copy of which may be seen in the fourth volume of the North American Medical and Surgical Journal. On the first day of August, 1769, the organization of the school was completed, by the appointment of Dr. Benjamin Rush to the chair of chemistry. The faculty then stood as follows:

Dr. John Morgan, Professor of Theory and Practice.

Dr. Thomas Bond, Professor of Clinical Medicine.

Dr. Wm. Shippen, Professor of Anatomy, Surgery and Midwifery.

Dr. Adam Kuhn, Professor of Materia Medica.

Dr. Benjamin Rush, Professor of Chemistry.

There are now not less than thirty medical schools in actual operation in the United States; and we have recently heard of several similar institutions, for which charters have been procured, and which will probably, for a season at any rate, have a "local habitation and a name." The facts stated in this note, are gathered from a pamphlet recently sent forth by the University of Pennsylvania. The author of the present address is named in that pamphlet as one of the graduates for 1812; but the residence and title of Thesis are omitted. This defect is general for the graduates of that year, and arose from neglect of the Dean. The omissions in the present case should be filled with *Pennsylvania*, and *Acidification and Combustion*.

its difficulties, its struggles into life, the historian has furnished a faithful, but melancholy tale. In despite of opposition and strife, it raised its drooping head; and by feeble advances at first, and with more rapid strides in later times, it has at length fixed itself upon a basis that laughs at opposition and puts the shafts of malice at defiance. Had the noble spirits who first embarked in the enterprise grown weary and retreated from the conflict, who will venture to say, that this stately temple of science had yet been erected, or this intelligent assembly congregated within its walls?

The first class of graduates, in this country, numbered but ten individuals,* with two of whom, young as the speaker is, he had the honor of a personal acquaintance. The last member of that class has long since paid the debt of nature, and since the day on which he received the degree of Doctor of Medicine, scarce seventy years have rolled by, while from this school alone, more than seventy graduates are annually added to the profession.† In view of these facts, will it be deemed visionary and romantic, to look forward to a period within the present century, when, far beyond the Rocky Mountain range, hundreds yet unborn shall come from hamlets, towns, and cities to sit at the feet of some who now hear me, to learn the principles of Medical Science? If we may calculate, for the wonders locked in the storehouse of futurity, by the almost incredible results of the past, such a conjecture is perfectly reasonable, and the realization of it, altogether within the limits of probability. The triumphal car of improvement rolls onward with a celerity vieing with the electric flash and the rush of thought, and none can predict so strange and amazing an advance in the various departments of our profession, as that you may not witness it, and in the consummation of which, you may not be the happy participants.

*The names of the class are as follows, the two especially referred to, being in italics:

John Archer, from the State of Delaware.	
Benjamin Cowell, Bucks county, Pennsylvania.	
<i>Samuel Duffield,</i>	} Philadelphia.
Jonathan Potts,	
<i>Jonathan Elmer,</i> Cumberland county, New Jersey.	
Humphrey Fullerton, Lancaster county, Pennsylvania.	
David Jackson, Chester county,	do
John Lawrence, East New Jersey.	
James Tilton, Kent county, Delaware.	
Nicholas Way, Wilmington,	do

These persons were graduated June 21st, 1786, and at the expiration of half a century, the list of graduates in the University of Pennsylvania, (which is only a continuation of the first school) amounted to 3040, of these, more than 50 have been or now are Professors in the parent and other Medical Schools. Three of the number are now in the Faculty of Transylvania.

†The Medical School of Lexington commenced its operations in the year 1819. Its classes have numbered 3570 pupils, of whom 943 have received the honors of the Doctorate. Not less than five of the graduates of Transylvania have been, or now are teachers in it, and other Medical Schools.

You live, gentlemen, in a most important period of your country's history; and you have repaired hither on a noble errand. You have come to identify yourselves with some of the greatest, the best of men the world has ever known. Glorious association! may the bright constellation of worthies that encircles it, stimulate you in the search of knowledge, virtue and happiness. You have indeed bade adieu to home and friends, the sweets and comforts, the sympathies and endearments of the family fire-side, to make a temporary abode with strangers. Not to bend the knee at the senseless shrine of an imaginary Deity have you made the pilgrimage hither: But you have come in the name of humanity, of science and truth to learn the heaven-born art of soothing human woes, and chasing away the sorrows flesh is heir to. You have come to taste of the pure and limpid streams of science, to drink full draughts of the river of knowledge, that you may have in you a well of water, never failing, ever fresh and life invigorating. For such attainments, who would not risk a little self-denial? Our profession plants itself upon the principle, fundamental and unalterable, that man was made for nobler ends than the gratification of self. It scorns to be pent up in a narrow circle, and claims humanity as its province, the wide world as its empire. But we forget not that you, like ourselves, are but men. We desire to sympathise with every emotion of your bosoms, for we too have known and felt the pains and pleasures that appertain to a course of medical studies, and have shared in all the sorrows and the joys that cluster around the days and nights, the months and years of pupilage. Our feelings like our interests are kindred in their nature, and it becomes us therefore to realize and rejoice in the identity that subsists between us. Whatever be the nature and extent of the gradations among us, our object is the same. Be it our mutual effort therefore, to make our intercourse pleasant and profitable, so that in the close of the session upon which we have now entered, you may be able to survey the past with delight, and find nothing in the retrospect that may presage a blemish or a stain in your future history.

The week appropriated to introductory lectures, has every where been regarded as a kind of holiday season, in which the mind is best pleased with topics that have only a general interest, and do not partake of the abstruse and recondite parts of science. It is on this account that teachers in Medical Schools, not unfrequently depart from the prescribed limits of their course of lectures, to make up an Introductory address, of miscellaneous and desultory matter. Such compositions are not destitute of utility, either in respect of the teachers or the pupils, and more especially are they acceptable to the numerous

and intelligent citizens, that are wont to honor such occasions with their presence.

It may perhaps excite the surprise of some, to hear that no part of duty is so perplexing to the Professor, as his Introductory lecture. He is, of course, expected to make a show, at least, of preparing something new for the season as it recurs, and in nine cases out of ten, the task is postponed to the eleventh hour. Then, perhaps, the subject is not selected, and if amid the pressure of other business, he produces, at length, an essay that does not please himself, and will probably be styled by some of his auditory, "a very indifferent affair," who need wonder?

Do not imagine, Gentlemen, that these remarks are offered by way of excuse for the meagre effort now about to be made, to gain your patient attention for a few minutes. I learned many years ago, that if a work be really good, it needs no apology, but that if it be defective, a thousand apologies cannot make it better.

You have come hither to acquire useful and necessary information on the several departments of medical science; and we are placed here to impart the very instruction you are seeking. It is natural, therefore, that you should expect to hear from each of your teachers, during the present week, something that may have a useful bearing on the profession of your choice, and that may inspire you with more exalted views of its magnitude and responsibility.

It is by no means a matter of astonishment, that a full survey of all the ground over which the faithful student is compelled to travel in a course of lectures, should have led to the conclusion, that four months are not sufficient for the prosecution of the task. But it is a source of wonder, that any student who has formed a due estimate of the enterprise in which he has embarked, could so forget the greatness of the undertaking, as to spend, in idle and frivolous amusement, any portion of the time that should be devoted to study. You have before you seven distinct objects, or medical elements, that go to make up the vast compound, denominated the *Science of Medicine*, and which cannot be mastered by any of you, even with tolerable accuracy, unless a due regard be paid to each of its component parts. To neglect either, is to mar the beauty of the whole. The mason who fails to dig deep and get a solid foundation for either of the corners of his edifice, puts the whole fabric in danger, hazards his reputation as a mechanic, and wrongs his employer. You profess to be erecting a noble structure, resting on seven pillars for its foundation and support. See to it, gentlemen, that the stones of those pillars are well fitted together, and closely cemented by careful and incessant study.

It is my design on the present occasion, to sketch very briefly the progress of Chemical Science, and in addition thereto, to name some of the advantages connected with its study.

I need not stop to tell you, that Chemistry is a branch of Natural Science, a part of that great system of talent and effort, which has been long exerted to ascertain the properties and laws of simple and compound matter. We learn very little if any thing of the nature of Chemistry, from the supposed derivation of the word, for that is still a matter of dispute. Some have endeavored to trace its origin to a Greek and others to an Arabian word, but the meaning of neither is adequate to throw any useful light on the present acceptation of the term. By some persons, Chemistry has been employed in a sense equivalent to the present meaning of Natural Philosophy; and this is said to be the manner of its use among the Egyptians. With that people, science was for a long time regarded as the sacred property of the *magi*, or wise men, who were exceedingly careful to conceal their knowledge from the populace. For this reason, Plutarch supposed that the study of Nature was the same with Chemistry, a word that he regarded as synonymous with *secret science*. Whatever may have been the actual extent of Egyptian knowledge, touching the arcana of Nature, in general, and however far they may have been removed from any just claim to an acquaintance with Scientific principles, it cannot be denied that they were in the possession of many of the most important facts on which the science of Chemistry is based. We look in vain, however, for the true origin of the name of our science, to the Egyptians or to any other people, in the expectation of deriving any real advantage from the discovery. For the science itself, some have claimed a higher antiquity than evidence is able to support. They have travelled back to years beyond the flood, and have ventured to trace its rise in the antedeluvian world. But it is not an easy matter to establish a point, so doubtful as this, by satisfactory proof. Tubal Cain may have wrought in brass and iron, a thousand times, and others may have imitated his example, but that does not establish the fact of his acquaintance with Chemical laws and Chemical phenomena. As well might we invest the red men of the forest, our own aborigines, with all the importance of a character for chemical philosophy, by reason of the coloring matters which observation and frequent use taught them to apply to various purposes in domestic economy, and which Nature freely yielded to their untiring researches. Tubal Cain for aught we know, had some acquaintance with zinc and copper, and he may have melted them into brass, just as any man, in the present day, unacquainted with scientific principles, might fuse any of the metallic products of Nature. We con-

clude, therefore, that to attempt to ferret out some traces of Chemistry in the infancy of society, on no better grounds, evinces rather a love for things and days of yore, than for truth and propriety.

The Israelites acquired from the Egyptians a large amount of knowledge, especially in respect of the art of working metals, and of dying red, blue, purple and scarlet. The Phenicians most probably had some acquaintance with the manufacture of glass, of perfumes, imitations of the precious stones, and the like, and their stock of knowledge descended to the Carthagenians and Greeks, and thence to the Romans. The two latter people, but especially the Greeks, seem to have possessed very limited knowledge of any chemical operations, or of any branch of analytical science. And Plato, doubtless, had allusion to this fact, when he made an Egyptian priest say to Solon, "*You Greeks will be always children, for you have neither the antiquity of knowledge, nor the knowledge of antiquity.*" We may perhaps, in part, explain the cause of the Grecian and Roman ignorance of nature, at that particular epoch, by a reference to their religious delusions; for not one of them would have dared to take water from a fountain or a river to decompose it, by the agency of fire. They would have regarded it as a most sacrilegious act, incurring the unutterable wrath of the divinity that protected the stream. The high priest would have execrated the daring aggressor, and an indignant populace would have satiated their vengeance with his blood.

The Egyptians too were idolaters, but their minds were less encumbered by superstitions, than were other nations, and hence they would not succumb to that intellectual bondage which prevented some from looking into the secrets of nature. The elder Pliny ranks the Egyptians, first, in the knowledge of the sciences; and Democritus who flourished 500 years before the Christian era, gained so large a stock of Chemical knowledge in Egypt, as induced Pliny to regard him in the light of a super-human being; and yet this classic and venerable land has transmitted to us scarce a vestige of his discoveries. Our surprise at this fact, however, may well be dissipated by the recollection of the sad catastrophe, that consigned to ashes the celebrated Alexandrine library, and lost to the world, the untold intellectual and scientific treasures of the East.

Exiled at length from Egypt, Greece and Rome, Chemistry found an Asylum in Arabia, and there appeared under the name of *alchemy*. When we reflect on the zeal which the lovers of Nature evinced in that once illustrious region, and contrast it with the intellectual desolations that are now every where to be seen, we are forcibly impressed with the similarity of fate that Christianity realized in the same portion of the globe. Who would credit the fact, if history did not

fully establish it, that in lands where philosophy and religion flourished and diffused their influence for ages before the sound of the one or the voice of the other had been heard on this continent, superstition, idolatry and ignorance have since exerted an uncontrolled dominion? Such, however, are the inscrutable ways of Providence, and it becomes us to bow where we cannot explain.

The days of alchemy present a most striking contrast with the condition of the science of Chemistry in the times in which we live. The alchemists were most indefatigable and laborious in their researches, but they were so confined in their investigations, that the application of science to them seems to be a kind of misnomer. Their principal aim, was the conversion of all metals into gold, and it had the mark of self-aggrandisement stamped upon it. They professed to believe, universally, that all metallic bodies contained or could be changed into this precious substance, and they toiled, almost without intermission, to give reality to their fancies. They imagined that some highly favored substance might be discovered, through whose instrumentality, this operation might certainly be effected, and to this desideratum, they gave the name of *the Philosophers' Stone*. They were governed from first to last by the most sordid considerations; the love of wealth was their inspiring Deity, and no sacrifice of time or labor was deemed too great, for the successful prosecution of the visionary enterprise. They even banded themselves together under the pledge of inviolable secrecy, alleging that some terrible judgment would fall upon him who should reveal the principles which guided them. Hence they kept themselves for the most part secluded, and invented mysterious characters, by the use of which, newly initiated members might have free intercourse with them, without risk of revealing the secret.

Foolish and delusive as were all the artifices of the alchemists, we find that there were a few of their number, distinguished for talents and learning. Albert the Great, a German who lived in the 12th century, wrote a work upon alchemy, in which were minutely detailed the processes, then in use. This treatise is said to have been written in a clear and perspicuous style, evincing a familiar acquaintance with many of the phenomena of Nature and products of art. Astonished at the extent of his knowledge, his own countrymen accused him of the crime of magic, and cast him into a prison. One of his pupils, by name Aquinius, in imitation of his teacher, published an additional work on Alchemy, and it is there that the word *al-gam* has its origin. But his system was so entirely mixed with astrological notions, as to make it of very little value.

The most judicious and intelligent of the alchemists, was furnished by England, in the person of Roger Bacon. In his treatise on the wonderful powers of art and nature, he denounced as idle and ridiculous, the belief in magic, charms and necromancy, and he boldly taught that a principal cause of the prevailing superstition, was the sad ignorance of natural phenomena. The *camera obscura*, the *telescope* and *gun powder* were familiar to him; and although he was careful to conceal his operations from the deluded multitude, he was accused of magic and cruelly incarcerated.

Somewhere about the period of which we are speaking, alcohol and oil of turpentine were employed in the practice of medicine. This circumstance proves, that chemical processes were then practised; and it is moreover certain, that several treatises, accompanied with plates descriptive of the apparatus in use, were published about the same time. Experiments were made, even at that early period, on human blood and other animal matters, and something was known of the art of enamelling, and coloring glass, precious stones, &c.

The first individual who made a systematic effort to apply chemistry to medicine, was Basil Valentine, a German monk, who taught that all substances were composed of salt, sulphur and mercury. He published a book, entitled *The Triumphal Chariot of Antimony*, in which he detailed his experiments with that metal, in such a manner as to excite a general interest among the physicians of England. Indeed, the name of this metal is said to have originated from its fatal operation, under his administration, in the cases of several monks; hence the reputed derivation, *anti* against and *monos* a monk.

In addition to the infatuation of the alchemists that has already been noticed, we next advert to a delusion no less preposterous, viz: that their vain philosophy was able to furnish a *panacea*, or universal remedy. Some of them imagined that the philosophers' stone, by whose instrumentality the baser metals were all to be changed into gold, could exert its talismanic influence in closing the grave forever, by making man immortal on the earth. The leader in this master piece of absurdity and folly was Paracelsus, a native of Switzerland. He ventured so far as to boast that he had actually discovered an elixir, whose virtues could prolong life *ad infinitum*, and thus reverse the law of heaven, which says to man, "dust thou art and to dust shalt thou return." But vain and delusive were his hopes; false and worthless his declarations. At the early age of 48, in manhood's prime, as if to overwhelm with shame his weak and stupid followers, the grim messenger laid prostrate in the grave, the impious Paracelsus.

Thus foiled in all its efforts, after having given birth to nearly five thousand volumes, the alchemistic system fast crumbled into ruins;

and chemistry, with at least some pretensions to the character of a science, like the fabled Phoenix, rose from its ashes. Among the most prominent symptoms of reformation, was the attempt of Beecher to prove that the earths were not simple bodies, but combinations of elements, and in his efforts to establish Chemistry on the true basis of analysis, he performed many experiments, which have been highly advantageous to succeeding operators. Stahl, the author of the celebrated doctrine of Phlogiston, was one of his pupils, and was the first philosopher who offered any thing like a satisfactory solution of the process of combustion. He taught, that Phlogiston formed a part of all combustible bodies, and that its separation constituted fire, or was indispensable to the development of the burning process. The celebrated Thenard, one of the ablest chemists of modern times, has observed of Stahl, that his theory of combustion, however erroneous, has so many important results connected with it, as to be justly ranked among the grandest discoveries in the science. He was called, by reason of the boldness of his investigations, the noble and sublime Stahl. He was the first philosopher who promulged any clear ideas of chemical affinity, and he made some suggestions on the theory of double elective attraction. About the same time, many learned men were embarked in chemical investigations, and the science received large additions, of greater or less value, from the discoveries of Boyle, Glauber, Lemery and others.

Long since the days in which Alchemy flourished, the cause of science has been retarded by the determined adherence of men to systems, for system sake. Thus, the love for what was once known and admired as the Phlogistic system of Stahl, led to false interpretations of facts, and to the prolongation of the reign of a most delusive theory. This system is now every where abandoned, and yet a writer of considerable notoriety thus spoke concerning it, in the year 1788:—“A modern sect of French philosophers, called *Antiphlogistians*, have endeavored to blow up this first pillar of chemical theory, (alluding to phlogiston;) but in vain—it stands upon the firm basis of demonstration and it will stand forever.” And again: “I have mentioned,” says the writer, “a new sect of philosophers, called *antiphlogistians*. The reader may perhaps be anxious to know something of their origin and creed.” He then goes on to enumerate five points, maintained by this sect, all of which, excepting one, are now universally admitted to be founded in facts, that cannot be controverted. Yet the writer observes further concerning this new sect: “It was born in France and there let it die. It has been considered in other nations, only to be ridiculed.”

*Berkenhout.

The true reason of the failure of former systems of Chemistry, and of the success of those of modern times, is to be found in the fact, that in the one case, experiment was made subservient to theory, while in the other, the most splendid speculations are cheerfully sacrificed on the altar of experiment and observation.

Chemistry can be perfected only by the correct investigation of Nature and the laws that govern matter, and on no other principle, can it be called, with propriety, a science. This was the foundation of the philosophy of Lavoisier, and his cotemporaries in France, of Sir Humphrey Davy in England, and of Berzelius in Sweden. And though in its future applications, many things that are now regarded as settled facts may be exploded, it is the only solid basis on which the science can ultimately stand, as a perfect, beautiful and harmonious whole.

Notwithstanding all that may be said of the progressive movements of Chemistry to the time of Stahl and which have cursorily passed before us in review, it is impossible for any one in the present day, to read with satisfaction the details of chemical processes, as they are related in the early annals of our science. The whole is clouded with mysticism and obscurity; it resembles, not a little, the fashionable style of letter-writing, which is so completely hieroglyphical in its character, as to cause immense trouble in decyphering it, and after the task has been accomplished, it not unfrequently happens, that we have little or nothing that is valuable, as a compensation for our toil and time. The first individual who made an attempt to obviate this difficulty, and so to remove one of the impediments to the progress of science, was the renowned Bœrhaave, whose name, as you are aware, is identified with the profession of medicine. This celebrated philosopher published a work on Chemistry in the year 1732, containing a more ample collection of experiments and more precise directions for repeating them, than any that had been previously offered to the world. But resplendent as were the talents of Bœrhaave, and untiring as was his zeal, the science, even in his hands, was full of imperfection. It was tinctured with the errors, the false reasoning and the vague analogies of Alchemy; and a revolutionary spirit was requisite to stand forth and stem the torrent of superstition and delusion, to scrutinize the laws of Nature, reckless of existing systems, and prepared to meet the frowns of their authors. Such a man was Bergmann, and Chemistry even now ranks him among her most illustrious sons. He arranged the well known tables of elective attraction, and published many original and valuable papers, on various topics. He was a native of the same country that gave birth to that distinguished cultivator of natural science, Linnæus, and they

moved onward in their appropriate spheres, with harmony and success. On a particular occasion, Bergmann sent to Linnæus an account of his experiments and observations, which so much delighted the latter, that he forwarded the communication to the academy of Stockholm, adding the emphatic note of approbation, "*vidi et obstupui*," "I have seen and have been astonished."

Scheele, the pupil and friend of Bergmann, enriched Chemistry with new and important facts, and by reason of the peculiarly philosophic bent of his mind in all his investigations, one of the most distinguished Chemists of modern times, has styled him the *Newton* of Chemistry. You will observe, as we travel through the course of lectures on which we have now entered, how largely the science is indebted to this indefatigable man, whose discoveries were so frequent and important, that even their dates are recorded in almost every book of our science. In his day, the true spirit of science began to spread in all directions, and England and France became active competitors for scientific fame. Black and Cavendish and Priestley, in England, gave a mighty impulse to the work of discovery and roused to vigorous effort, hundreds of their country men. To them belongs the discovery of carbonic acid gas, of Pneumatic Chemistry in general, of hydrogen and oxygen gases, and also the credit of greatly improving and simplifying the utensils of the operative Chemist.

Nor were the French Chemists silent spectators of these events. They were engaged at the very same time, in the noble business of investigating Nature's secret laws, and of unfolding the hidden properties of matter. So simultaneous were the movements of these philosophers, with those of their competitors in England, that it is impossible to decide the merit of some important discoveries, made at nearly the same time, in two different countries. It was at this memorable juncture, that the inimitable Lavoisier was astonishing France with his transcendent powers, and laying the foundation of a fame, that will never be forgotten while the retort and furnace constitute essential parts of the Chemist's furniture. His genius could not be cramped by the dogmas of predecessors, and bursting away from the bands of authority, his aspiring mind grasped a field of inquiry, large as nature, and various as matter itself. His *Elements of Chemistry* afford full and satisfactory evidence, that their author was no ordinary man; but rather one of those rare productions of nature, which for a while astonish by their overpowering lustre, and then suddenly vanishing away, leave behind them a void, that the lapse of years can scarcely fill. His treatise bears the deep impress of originality; and no student who will read it with care and contrast it with the crude es-

says of by-gone centuries, can fail to perceive, that its author was the sun and the soul of his system. It will teach him most clearly the distinction between the art that Chemistry *was*, and the Science that it came to be, when touched with the magic wand of Lavoisier. In the ancient chemical writings, he will find little else than a crude assemblage of barbarous terms and disjointed facts; while in the treatise to which I have referred, he cannot fail to discover a system of principles, a chain of laws, whose application to the facts of Chemistry, infuses life and interest and intelligence through the whole. To Lavoisier we are indebted, chiefly, for the system of Nomenclature which is now universally employed. The terms previously in use, were unmeaning and discordant, and conveyed no satisfactory idea of the composition of any article whatever. The revolution that was effected, consisted mainly in the substitution of names that set forth, with sufficient clearness, the nature of the substance spoken of. Thus you read, in the old books, of the *sal mirabile* or the wonderful salt, Glauber's salt, &c. and it is not possible to form a correct notion of the composition of the substance. But the modern name, Sulphate of Soda, indicating the presence of Sulphuric Acid and Soda, gives you at once, the nature of the compound, so far as its constituents are concerned.

Associated with Lavoisier, were Fourcroy, Berthollet, Guyton de Morveau, Chaptal and many other eminent Chemists, who have obtained a high degree of celebrity, on account of their zealous efforts to promote the interests of their favorite science. More recently, however, very important advances have been realised, as the result of the concurrent labors of Sir Humphrey Davy, Murray, Thompson, Brande and Berzelius, in England, Scotland and Sweden, and of Vauquelin, Gay Lussac, Thenard and Pelletier in France. The most brilliant success has been displayed in their numerous analyses and giant decompositions, in virtue of which, some highly interesting simple substances were brought to light, upon which the eye of man never gazed before. Though last, not least, our own beloved country claims a share in the meed of praise, awarded to the cultivators of science. Her Franklin dared to grasp the vivid lightning, at whose flash the world had stood in awe, since time began its round; and the philosopher of America taught mankind how to guard against the ravages of this mighty and terrific agent. Woodhouse and Hare and Perkins and Silliman, with a host of less experienced Chemists, have been ardent and often successful in the field of investigation and discovery; and at this moment, the rudiments of chemical science are taught in hundreds of our academies, seminaries and ordinary schools, and the time has arrived, when all our systems of education must

bow to its influence. The day has gone by, never to return, when the proud and disdainful germ of aristocracy shall dare to inquire, "who reads an American book, or hears of an American discovery in science?" Our sons, if not their fathers, may live to witness the time, when our inventive genius and powers of research shall fix us upon the loftiest summit of the temple of science; and the descendants of *Franklin*, as well as the posterity of Washington, shall every where exult at the mention of their birth place, and the world do honor to the American name.

If the hasty glance that has been taken of the progressive movements of Chemistry from the dark ages of the world to the enlightened era in which we live, be substantially correct, I ask the student of Medicine, in what estimation it becomes him, to regard the momentous subject? Among the names that I have caused to pass in review before you on this occasion, are some that have been the crown and glory of our profession; and let me for a moment point you to the brightest spot on the history of American medicine, and tell you that Rush and Wistar, in the early part of their career, were teachers of the science of Chemistry, in the school that has been so resplendent by reason of their instructions on the Theory and Practice of Medicine and Anatomy.

So general is the study of our science by all classes of community, who have no direct relation to the learned professions, that a necessity is imposed on medical men, to become versed in its principles and acquainted with its leading facts. You are liable to be interrogated in every evening circle, of which you may form a part, touching some trifling or more important circumstance, the solution of which demands a knowledge of chemical laws; and it not unfrequently happens, that the physician is selected from the group, as the expounder of the mystery. How painfully awkward and embarrassing must be the situation of the young man, fresh from the temple of medicine, and perhaps with the misplaced honors of the doctorate in his pocket, who is appealed to on such an occasion in vain, and whose deficiency is supplied by the voluntary response of some humble artisan or tradesman! Most ardently do I desire, that none who now hear me, may ever find themselves in such a dilemma. But it is not only in the associations with your own sex, that such exigences may arise, to test the depth of your scientific attainments. Remember, that the day light of chemical philosophy has burst with effulgence upon the female mind,* and that in your future intercourse with so-

*The first person who gave a regular course of Chemical Lectures to a class of females in the United States of America, so far as I know, was my worthy preceptor, Joseph Parrish, M. D. of the city of Philadelphia. This was probably in the year 1808. In the year 1809, I assisted him in a similar effort. Since that period, female classes for the study of Chemistry have been very numerous.

ciety, you may be subjected to the catechetical inquiries of the fair sex, touching phenomena that admit of no proper explanation, apart from the light that our science has cast upon them. What student of medicine, by carelessness and neglect while in attendance on the lectures to be given in this school, will expose himself to the merited sarcasm of the intelligent female who has far outstripped him in the study of the science, and who will delight, it may be, in detecting and displaying his ignorance! Will any of my audience consent to make the disastrous and disgraceful experiment? I trust not.

But what if nobody but the physician studied the science of Chemistry; should that circumstance lessen its value in the estimation of the young candidate for medical honors? Does not a knowledge of its principles, more than all other sciences, lead us to examine and understand the phenomena of nature, and to form an acquaintance, often useful and always interesting, with the things around us! Suppose that none but professed chemists among medical men were able to overturn the fallacy of the ancients, that air, fire, earth, and water were elements, and the only elements, would that be an adequate reason to exonerate students of medicine in after times, from exploring the rich mine of science, and becoming acquainted with the characteristic properties of the fifty elements that are now distinctly marked and familiar to the Chemist? Would it not rather seem to be a motive, too strong to be resisted, for perseverance in the delightful task of contemplating the works of nature, and surveying the wisdom of nature's God?

The physician, independently of his special avocation, has many opportunities, by reason of general information, of conferring benefits on his fellow men. He is usually regarded as a source of intelligence on very many points, that have no direct relation to the practice of medicine, and may therefore frequently further his interests as a professional man, if no better motive operated, by the information he may be able to impart.

It is difficult to name a branch of human industry, that has not been more or less improved by Chemistry, and physicians, either in private life, or in the capacity of public teachers, have often contributed to this result. The present condition of the steam engine, is to be ascribed, in a great degree, to the influence of our science. The celebrated Watt, whose name is identified with steam machinery, in its highest state of perfection, repeatedly acknowledged, that his first ideas of a useful kind, on the subject that has given him an imperishable fame, were acquired during his attendance on the Chemical lectures of Dr. Black. That able teacher explained the doctrine of latent heat and the expansibility of steam, in so lucid a manner,

as to excite a new train of reflections in the mind of Watt, which ultimately gave birth to his noble discoveries.

Possessed of a tolerable share of chemical knowledge, you may make yourselves highly useful in the promotion of almost every species of manufacture, or in giving advice to the agriculturalist, or in matters of general interest, involving the health or comfort of the neighborhood, in which your lot may be cast. And should it be expedient to abandon the profession of medicine, for a different occupation, you may be able to apply the chemical knowledge you possess, to the furtherance of your welfare in a new avocation, and so reap a rich reward for the labor bestowed upon the patient studies of early life. There are not a few physicians in our country, whose acquaintance with Chemistry led them to embark in various kinds of manufacture, with great success, from which they would have been deterred, if a cultivation of chemical studies had not qualified them for the novel sphere.

It is a maxim, every where received by intelligent men, that too much learning cannot be acquired. No individual can foresee the circumstances in which he may be placed, by the vicissitudes of 10, 15 or 20 years; and it has often happened, that knowledge gained in youth, merely in the course of a fashionable education, but without any special design, has been made the means of subsistence to a whole family. Even admitting therefore what some have ignorantly asserted, that a man may be a good physician and even excel in his profession, without an acquaintance with Chemistry, still it would be wise in every student of medicine, to cultivate this branch of science, assiduously, on account of its important bearing on all the occupations of life.

Do any object to my plea in behalf of chemical science, that its principles are so difficult of comprehension, that you shrink with instinctive horror from the task? Are its terms so barbarous and unmeaning, its facts so boundless and astounding, that if at all disposed to show it due respect, you think it wise to pay your homage at a distance, to stand in awe, far off, as if the monster wore a lion's skin? Gentlemen, 'tis the nettle's feeble touch that wounds and irritates; the manly grasp can crush it into atoms, nor leave a sting behind. Effort must be made, or nothing will be accomplished. Shall I point you to the cloud capt pyramids of the East, the work of ages, monuments of vanity and pride, built to astound and not to bless the world? Does magnitude appal and ever during greatness dim your vision, by their overpowering lustre? Go to the ant; hold converse with the bee, and learn a lesson from the smallest works of God.

But I am not at liberty to omit the consideration of the influence of our science, to enlighten the mind, in respect of the Providential arrangement of the material universe. The atheist, "in wondering mazes lost," and bewildered by the fog that his fanaticism has engendered, will tell you that all that we see, and feel and are, spring from what he is pleased to call, chance. It avails not to marshal before him the thousand proofs of intelligence and design, as they stand erect, in grandeur and sublimity, to rebuke his folly. He is enslaved by his system, and you cannot convince him of his error.

But when the student of Chemistry approaches the subject, in the light of the *Doctrine of Definite Proportions*, and beholds the proofs, varied and almost numberless, of the combination of bodies in fixed and unalterable quantities, he feels assured, that chance has no share in this. He learns that every drop of water, whether at the North or at the South pole, at the Eastern or Western extremity of the globe, is made up of precisely the same component parts, in quality and quantity, without a fraction of difference. He ascertains that it is impossible to combine the elements of water, so as to produce that fluid, in any other than the natural proportions, and he recoils from the sentiment, that chance has ordered it thus. He finds that every element in creation is stamped as with the seal of divinity with its appropriate, and unalterable combining number, and the fact of intelligent design so confronts him at every step, that he could not, if he would, ascribe such order and arrangement, to the capriciousness of accident. And while he beholds such proofs of the handy work of Deity in inanimate matter, he recognises the same power and skill and benignant supervision, throughout the wide domain of Nature.

Need I tell you, in addition to what has been already advanced, that Chemistry will greatly facilitate the discharge of your duties, as professional men? I trust that you have learned enough on this point, to be satisfied, that the practitioner who is ignorant of our science, must be perplexed and embarrassed on many occasions, in which the well instructed physician will realise no difficulty. It is now a well established truth, that several very important diseases can be understood and correctly treated, only, by calling in the aid of chemical science. And in the art of prescribing and of preparing medicinal compounds, who does not know, that the man who is ignorant of Chemistry, can scarcely avoid the perpetration of fatal mistakes? And let me ask you, gentlemen, whether he is qualified, in your estimation, to judge of the poisonous or salutary quality of a medicine, prepared by chemical process, or to make an examination of matters ejected from the stomach and suspected of having a poisonous quality, who has throughout his course, disregarded the principles and facts

of Chemistry? But I beg you, to follow such a physician to the Court of Justice, whither he has been summoned to testify, touching the guilt or innocence of a prisoner charged with the commission of murder, by the agency of a mineral poison. He may perhaps have glanced hastily at a manual on the mode of detecting poisonous matters, and in the self complacency of his ignorance, may fancy that he is prepared to meet the perplexing query and keen eye of the advocate. But at every step of the examination, he is covered with confusion, and his utter want of acquaintance with the subject is obvious to the Court, the jury and the spectators. The youngest member of the bar, it may be, has travelled over the whole ground, and perceives that the witness knows not whereof he testifies. Verily, he must be a sorry limb of the law, who with half an effort, could not overwhelm the practitioner, destitute of a sufficient acquaintance with Chemistry to meet the proper interrogations. In mercy to the public, the sooner such limbs are lopped from both professions, the better.

Do not allow yourselves, gentlemen, to be deceived with the idle calculation, that these things are superfluous matters, the drapery of the profession, and that your leisure moments will suffice to give the subject a passing thought, and furnish you for any emergency. As well might the farmer abandon the experience of ages, and trust to the spring-sowing for his wheat crop. Success is not impossible in either case; but remember, gentlemen, that in every lottery, the blanks far outnumber the prizes.

A physician may read over and over again the best work extant on the operation, antidotes and tests of poisons; yea, he may commit every word of Christison's admirable volume to memory; yea, more, he may be able to recite it backwards at midnight, and enter the hall of justice, not doubting that he can pass the ordeal of a crooked examination. But I tell you, that unless made master of the principles of Chemistry in the period of pupillage, he will encounter the coming storm, with no better success than awaits the gallant ship, as she ploughs the mountain wave, with all sail set, and no ballast on board. His character will be shipwrecked, the profession of medicine dishonored. Who will risk such a catastrophe? Who will not rather lay a good foundation while opportunity is present, and the charms of science woo to its embrace.

And, what shall I say more to stimulate you in the uphill path of science? The health and happiness of unborn millions may yet be committed to your care, and a responsibility may rest upon you that language cannot describe. Friends and relatives are gazing upon your destiny in fond anticipation, and many a bosom is now swelling

with [the prospective glory and honor, that fancy has painted as the portion that awaits you. Let not, I pray you, these pleasing hopes be disappointed. Let them not prove to be the vagrant reveries of a distempered brain, the airy visions of the midnight dream. It is for you to make them substantial, glorious realities. Will you not do it?

In the prosecution of the duty assigned me in this exalted seat of medical science, I pledge to you all that untiring zeal and perseverance, which my subject is calculated to inspire. And may I not claim at your hands, that patient attention and spirit of inquiry, so indispensable to the successful study of a most interesting department of knowledge. Be it your fixed, unalterable aim to improve every hour to the best advantage; and I risk nothing in the declaration, that although you cannot all rise to an equality with a Black, a Cullen, or a Davy, you may become great and good in the judgment of society, and exert such an influence on the profession of your choice, as shall crown you with honor while living, and embalm your memory for the good of posterity.

And now, gentlemen, as you are destined to mingle freely with each other, throughout the season upon which we have entered, allow me, in the most friendly manner, to express the hope, that no unkind feeling may mar your social intercourse, nor blight your harmony. Cherish no other strife than that which shall urge you onward with an irresistible impetus, to win the loftiest honors of the profession. Where is the young man, who will content himself with the almost imperceptible progress, that must ultimately land him far in the rear of some, whose native talent is decidedly inferior? To drag at the tail of a profession, requires no effort; but alas! how many occupy that position! Let me entreat you, gentlemen, to keep before you the highest, noblest, purest standard. The more elevated the mark at which you aim, the more certain and glorious the prize. Resolve to be something in the world. Determine that the profession shall be the better and not the worse, by the addition of your name to its roll. And above all, be it your settled purpose, to have a place among the acknowledged friends of virtue, religion, and good order; and so contribute your humble aid in transmitting to distant posterity, the inestimable blessing we enjoy. And when the record of the present time shall go down to another age, may it appear, that the faithful historian has enrolled among the benefactors of the world, some of the intelligent youth who are now within the sound of my voice. Your Country claims your service, and will not fail to reward your fidelity.

