JONES

PHILOSOPHICAL PRINCIPLES OF EDUCATION AND THIER SCIENTIFIC APPLICATION TO THE DEVELOPMENT AND PERFECTION OF MEDICAL SCIENCE

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DEVELOPMENT AND PERFECTION OF MEDICAL SCIENCE.

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Philosophical Principles of Education and Their Scientific Application to the Development and Perfection of Medical Science.

Fellows of the Louisiana State Medical Society:—It is impossible to look round upon this assemblage of learned and skilful physicians, intelligent citizens, and fair ladies who have honored us with their presence without the wish to say something worthy of the occasion.

Whilst I feel that I am personally but little fitted for the task intrusted to me, I am on the other hand strengthened by the knowledge that the desire of doing good will stand with you in the place of oratorical display.

Upon the present occasion we desire to consider, as far as the brief space of time at our command will allow, a subject of great importance to students, instructors, professors and practitioners of medicine; namely:

THE PHILOSOPHICAL PRINCIPLES OF EDUCATION AND THEIR SCIENTIFIC APPLICATION TO THE DEVELOPMENT AND PERFECTION OF MEDICAL SCIENCE.

No subject is of greater importance to the citizens of this great republic than education. The strength and progress of this republic depends upon the virtue and wisdom of the entire people who control its destinies, and it is the solemn duty of each generation to transmit to its successor not only the forms of good government, but also a thorough system of education, by which the citizens shall be wise enough to protect their liberties, preserve their institutions, and develop their material resources and be capable, by their virtues and their valor, at all times to defend the republic from internal and external enemies.

We need no labored arguments to establish the pre-eminent importance of education, and of the discussion of the principles of education. Who will deny that the stability of our government, the preservation of our civil and religious liberties, of our national honor and independence, and the maintenance and advancement of our position amongst the nations of the earth, by the advancement of science, the development of our resources, and the diffusion of knowledge, has depended, and will always depend, upon the moral and intellectual education of the people? Who will deny that the intellectual, moral and political development and progress of every nation, past or present, demonstrates the importance of a correct system of education?

The Importance of This Inquiry Demonstrated by The General Results of Education in Ancient Greece.

The physical perfection, the strength and valor of the Spartan race were due to the system of culture inaugurated by Lycurgus, the fundamental principle of which was that all children belong immediately to the State. The intellectual superiority of the Athenians was due not so much to differences of race, soil, geographical position or of surrounding circumstances, as to the extent and freedom of their system of education, and to the example, teachings and writings of such men as Solon, Socrates, Plato and Aristotle.

The great fundamental principles of education were more generally understood, and more ardently practised by the Athenians than by the moderns: and to this day, the splendid achievements of the great sculptors, orators and philosophers of Athens stand unequalled. Who amongst the ancients or moderns formed, by his unaided powers, the highest conception of the divine omniscience, justice, and foresight, and of the dignity and immortality of the soul? Who amongst the ancients or moderns battled most ardently against corruption, error, superstition and sophistry? Was it not Socrates, the Athenian, who, after his splendid exertions in the pursuit of truth, and in the cause of education (exertions which resulted in the development and education of such men as Xenophon, Plato and Æschines), would accept no reward but that of a pure mind? Where do we find in ancient or modern times a purer and nobler life, a healthier body and soul, than that of Plato, the Athenian, the pupil of Socrates, whose works remain to this day the great models of Athenian genius, elegance and urbanity, and whose philosophy has been the admiration of all ages? Whose intellect towers head and shoulders above all modern and ancient philosophers? Is it not the intellect of Aristotle, the pupil of Plato, who stands second to none of the distinguished sages of the past or present, in brilliancy of genius, strength of intellect and philosophic depth and acumen?

Power of Education over National Life.

What preserves inviolate the arbitrary divisions of society and tyrannical religious and civil usages of the Hindoos, notwithstanding the bloody conquests and iron rule of British arms? Why have the Hindoos for two thousand years followed the same beaten track without advancement or retrogression either in arts, religion, politics or society? The education of the people is arbitrary, rigid and stereotyped, and as a necessary consequence, the religious, political and intellectual belief, and the whole constitution of society are arbitrary and stereotyped.

Effects of Universities upon the Science and Learning of Europe.

The end of the twelfth century was marked by the rise of *Universities*: Bologna devoted itself to law and numbered 12,000 students at the end of the twelfth century; Salerno adopted as its special province the study of medicine; and Paris was thronged with students from all parts of Europe who were anxious to devote themselves to a theology which passed by indefinite gradations into philosophy.

The thirteenth, fourteenth and fifteenth centuries witnessed the rise of universities in almost every portion of Europe.

The comparison of the condition of Europe before and after the establishment of universities of science and learning, the mental activity of England, France and Germany, demonstrate in the clearest and most unequivocal manner the importance of well-devised systems of education.

The English universities, Oxford and Cambridge, before the collegiate system had undermined and supplanted the university system, composed the strength and bloom of the nation, picked from all ranks and orders, and whilst every pulsation of the nation's life was felt in great power at the universities, the national science and learning, on the other hand, received its most vigorous impulses from these centres of ecclesiastic, political and scientific learning. So intimate was the connection of Oxford, in her palmiest days, with all parts of the little world of which she was the centre, that popular opinion looked upon the university riots as presages of civil war, and the sanction of the university was solicited for royal acts.

Within the walls of Cambridge in the seventeenth century were found two men, Bentley and Newton, who, in the promotion of classical learning, criticism and science, were the leaders not alone of England, but of all Europe; and to this day Cambridge, rendered illustrious by the great fame of Newton, and excited by the memory of his great achievements, stands pre-eminent above all the institutions of the world, for the attention which she devotes to the studies of mathematics and physics.

Men of the greatest learning and research have celebrated the power and influence of universities upon the progress of civilization and religion in Europe. Thomas Babington Macaulay says:

"The power of the Universities of Oxford and Cambridge has during many ages been great, but it was at its height during the latter part of the seventeenth century. None of the neighboring countries could boast of such splendid seats of learning. The schools of Edinburgh and Glasgow, of Leyden and Utrecht, of Louvain and Leipsic, of Padua and Bologna, seemed mean to scholars who had been educated in the magnificent foundations of Wykeham and Wolsey, of Henry the VI and Henry the VIII. Literature and science were, in the academical system of England, surrounded with pomp, armed with magistracy, and closely allied with all the most august institutions of the State. To be the chancellor of an University, was a distinction eagerly sought by the magnates of a realm. To represent an University in Parliament was a favorite object of the ambition of statesmen. Nobles and even princes were proud to receive from an University the privilege of wearing the doctoral scarlet. The curious were attracted to the Universities by ancient buildings, rich with the tracery of the middle ages, by modern buildings which exhibited the highest skill of Jones and Wren, by noble halls and chapels, by museums, by botanical gardens, and by the only great libraries which the kingdom then contained. The state which Oxford especially displayed on solemn occasions, rivalled that of sovereign princes. When her Chancellor, the venerable Duke of Ormond, seated in his embroidered mantle on his throne under the painted ceiling of the Sheldonian Theatre, surrounded by hundreds of graduates robed according to their rank, while the noblest youths of England were solemnly presented to him as candidates for academical honors, he made an appearance scarcely less regal than that which his master made in the Banqueting House of Whitehall. At the Universities had been formed the minds of all the eminent clergymen, lawyers, physicians, wits, poets, and orators of the land, and of a large proportion of the nobility and of the opulent gentry. It is also to be observed that the connection between the scholar and the school did not terminate with his residence. He often continued through life, a member of the academical body, and to vote as such at all important elections. He therefore regarded his old haunts by the Cam and the Isis, with even more than the affection which educated men ordinarily feel for the place of their education. There was no corner of England in which both Universities had not grateful and zealous sons. Any attack on the honor or interests of either Cambridge or Oxford was certain to excite the resentment of a powerful, active, and intelligent class, scattered over every county, from Northumberland to Cornwall.

The resident graduates, as a body, were perhaps not superior positively to the resident graduates of our time; but they occupied a far higher position as compared with the rest of the community. For Cambridge and Oxford were then the only two provincial towns in the kingdom in which could be found a large number of men whose understandings had been highly cultivated.

Even the capital felt great respect for the authority of the Universities, not only in questions of divinity, of natural philosophy, and of classical antiquity, but also on points in which capitals generally claim the right of deciding in the last resort. From Will's Coffee House, and from the pit of the theatre royal in Drury Lane, an appeal lay to the two great national seats of taste and learning. Plays which had been enthusiastically applauded in London were not thought out of danger till they had undergone the more severe judgment of audiences familiar with Sophocles and Terence."*

Who can estimate the influence of Erasmus in the development of the education of the Renaissance, or of Luther and Melanchthon in the wonderful intellectual and moral transformation wrought by the Reformation.

The marvelous resurrection of the mind and spirit of Europe sprang from the touch of the dead hand of an extinct civilization. Its history belongs rather to the general history of literature than to that of education.

Luther brought the school-master into the cottage and laid the foundation of the system which is the chief honor

* The History of England, by Thomas Babington Macaulay. Harper & Brothers, New York, 1852, Vol. II, pp. 210, 212.

See also: The English Universitles, by V. A. Huber. Translated by F. W. Newman, London, 1843, Vol. I, pp. 66, 69, 71, 82, 85. Vol. II, pp. 7, 12, 329. Vol. III, pp. 600, 666.

"History and Antiquities of the University of Oxford," etc., by A Wood, 5 vols. 4 to 1786, 90.

and strength of modern Germany, a system by which the child of the humblest peasant, by slow but certain gradations, receives the best education which the country can afford. The purification and widening of education went hand in hand with the purification of religion, and these claims to affection are indissolubly united in the minds of his countrymen.

Melanchthon, from his edition of school-books and his practical labors in education, earned the title of PRÆCEPTOR GERMANIÆ. Aristotle had been dethroned from his place in the schools and Melanchthon attempted to supply his place. He appreciated the importance of Greek, the terror of the obscurantists, and is the author of a Greek grammar. Melanchthon wrote elementary books in each department of the TRIVIUM, *grammar*, *dialectics* and *rhetoric*. He made some way with the study of the *Quadrivium*, and wrote *Initia Doctrinæ Physicæ*, a primer of physical science. He lectured at the University of Wittenberg, and for ten years, from 1519 to 1529, he kept a *schola privata* in his own house. Horace was his favorite classic; his pupils were taught to learn the whole of it by heart, ten lines at a time. "The tender, refined lines of his portrait show clearly the character of the painful, accurate scholar, and contrast with the burly, powerful form of the genial Luther. He died in 1560, racked with anxiety for the church which he had helped to found. If he did not carry Protestantism into the heart of the peasant, he at least made it acceptable to the intellect of the man of letters."

Even in this age of progress what can be more interesting or instructive than the views of the immortal John Milton, in his Tractate of Education, addressed to Mr. Samuel Hartleb, and probably foreshadowing a project of establishing a university in London?

The universities taught men to *think*, *to reason*.

Out of thought, and freedom of discussion, grew freedom of action.

The principles of religious and civil liberty thus engendered and fostered in the universities of England, France and Germany, led to revolutions which shattered the foul-monarchical institutions, broke the fetters of a bigoted, insolent and bloody church, and led to the establishment of governments and republics in which the civil and religious rights of all men are acknowledged and maintained.

The Present and Future Prosperity and Freedom of the United States of America Dependent Upon its System of Education.

The history of the past and present should teach us that in no country in the world is a correct system of education in all the departments of knowledge more important than in the United States.

Whilst truth does not change from age to age, the search of men after truth changes from age to age; and that nation which has thrown off the shackles of ignorance and superstition, which has gained her liberties through blood and fire, with the edge of the sword, and at the cannon's mouth, will have learned the truth, and gained her freedom and perfected her experience, by such fearful experiments, that she will be far more firmly seated in the possession of the true principles of government than nations which have passed through no such process of development.

The country which has gained her freedom after the throes of anarchy and rebellion, which has shaken off the fetters of superstition, injustice and ignorance, and indeed, passed through a fiery education, is in a very different state from a country which has been free from her birth, and in whom legislation has just commenced. The laws of the nation which has experimented and been experimented with, are the permanent expressions of the result of her experiments; whilst the laws of the nation which has neither experimented nor has been experimented with, may be the result of speculation or of abstract reason, which are not as firm and lasting as the laws of experience.

Whilst the constitution and laws of the United States of America embody the wisdom and experience of the past and present; whilst the government of the republic has been strong enough to survive the throes of a bloody and mighty civil war, which upheaved the very foundations of society, and not only broke the shackles from the arms of an inferior and servile race, but elevated four millions of slaves to the rights of citizenship; still it is morally certain that without a correct system of education, even the principles of civil and religious liberty for which our ancestors left their homes and fire-sides in the old world, and for which they fought and bled upon the western shores, will be forgotten.

Corruption in politics, drunkenness, debauchery and dishonesty in high places, the increase of crime and lawlessness, in virtue of the reckless disregard of the constitution and the most solemn civil and moral contracts, by the exercise of the pardoning power in behalf of thieves, robbers, assassins and murderers; the great power of wealth in politics and in social life; the unblushing advocacy and advancement of private interests by legislative and municipal bodies, in violation of every principle of honesty and every sentiment of patriotism, demonstrate that the education of the young men of the United States is defective.

The true mode of rescuing our common country from the evils which have destroyed former republics, is to inculcate in the family, in the private and public sohools, in the college and in the university, the great principles of morality, justice, truth and equality, which inspired the lives and governed the actions of their ancestors.

The stability of this government will depend upon the care and diligence with which its citizens study and practise the great intellectual, moral, civil and religious truths revealed by the dealings of Providence, in the rise, development, progress and decline of nations; and by the teachings of the book of Nature and of Divine Revelation. The stability of this government and the advancement of knowledge will depend upon the moral, religious, political and professional education of the people.

Control the education of a people, and you control the belief of that people: and when you control the religious and political belief of a people, you control its principles of moral, religious and political advancement. The despot knows the power of education and belief, and maintains his throne by controlling the fountains of learning and education and suppressing free speech, free discussion and the freedom of the press.

The State Responsible for the Intellectual and Moral Education of her Citizens.

The constitution of the State should not merely defend the inherent rights of man, define the police powers, proclaim the principles of justice and protect and foster agriculture, commerce, and manufactures, but it should be the highest exponent of a lofty, unspotted and incorruptible morality.

No greater crime can be committed by legislators than the inculcation, through the medium of the constitution of immoral acts and principles. The State is responsible for the diffusion of knowledge amongst the masses through the common schools, founded and maintained by the taxes collected from the people.

The State is responsible for the foundation and maintenance of universities of learning, and she has no right to delegate her institutions of learning founded by her patriotic citizens, to self-constituted guardians of the public funds and institutions, and to self-perpetuating corporations. The surrender of sacred trusts by the State tends to foster the spirit of monopoly, and leads to injustice, bigotry and nepotism.

Here in Louisiana, the problems connected with education are of the gravest character on account of the following causes:

1. Diversity in the origin and nationalities of the white population of Louisiana.

2. The existence of two distinct races, the white and the negro, in nearly equal numbers in Louisiana.

3. Deep-seated and apparently irreconcilable differences of religious belief.

4. The recognition, by the Constitution of Louisiana, of the LOTTERY as a means of gaining wealth, and of supporting charitable institutions and common schools.

This is not the occasion for the discussion of the preceding propositions, and we desire merely to enter our solemn protest against the evil influence upon the citizens of our State of all ages and condition, regardless of race, color or previous condition, by the embodiment in the Constitution of Louisiana, of a section permitting, protecting and sustaining lotteries.

Article 167 of the CONSTITUTION OF THE STATE OF LOUISIANA, adopted in convention at the city of New Orleans, July 23d, 1879, reads thus:

"Article 167."—The General Assembly shall have power to grant lottery charters or privileges; provided each charter or privilege "shall pay not less than forty thousand dollars per annum in money into the treasury of the State; and provided *further*, that all charters shall cease and expire on the 1st of January, 1895, from which time all lotteries are prohibited in the State."

"The forty thousand dollars per annum now provided by law, to be paid by the Louisiana State Lottery Company, according to the provisions of its charter, granted in the year 1868, shall belong to the Charity Hospital of New Orleans, and the charter of said company is recognized as a contract binding on the State, for the period therein specified, except its monopoly clause, which is hereby abrogated, and all laws contrary to the provisions of this article are hereby declared null and void: provided said company shall file a written renunciation of all its monopoly features in the office of the Secretary of State within 60 days after the ratification of this constitution.

"Of the additional sums raised by licenses on lotteries, the hospital of Shreveport shall receive ten thousand dollars annually, and the remaining sum shall be divided each year among the several parishes of the State, for the benefit of their schools."

Constitution of the State of Louisiana, 1879, p. 47.

For a whole generation has the form of the wanton harlot of chance been planted in the centre of the constitution of a great State; and the vice of gambling is none the less heinous, because a minute portion of the immense sums acquired by the revolutions of the "WHEEL OF FORTUNE" is devoted to the maintenance of hospitals and common schools.

Imprudent speculation, intemperance and vice fill our charitable institutions with the sick and dying, and the desire to gain wealth by speculation and the "WHEEL OF FORTUNE," rather than by honest labor and virtuous efforts converts our youth into idle vagabonds, fills our prisons and penitentiaries with defaulters, forgers, bank robbers, thieves and murderers. Is the owner of the gilded saloon, gambling and drinking hell, however high he may stand in church or State, more holy or noble than the miserable, drivelling drunkard who staggers into our hospitals or is committed to our insane asylums and prisons?

Did the African slave trade with its floods of poisonous rum, and the untold horrors of the middle passage as conducted by the merchants of the New England States in the seventeenth and eighteenth centuries, yield finally any other result than the gigantic, bloody civil war of 1861-1865, whereby the soil of the United States of America was drenched in the blood of her sons, and the entire land clad in the garb of sorrow and mourning?

Can the heart of a great State as revealed in her constitution be rotten, and her children be pure, healthy and virtuous?

What inducement is there to honest labor and virtuous endeavor, when the mother points to the gaming table and the deceitful smiles of CHANCE as the ROYAL ROAD TO WEALTH AND POSITION IN STATE AND CHURCH?

Let the work of moral education in Louisiana commence with the purification of her constitution.

Gentlemen, we are then interested in the discussion of the principles of education, not only as students of difficult and useful sciences, and practitioners of medicine, but also as citizens of a powerful and free nation, which has a high political, religious and scientific destiny to fulfil amongst the nations of the earth.

Upon the present occasion, with the limited space of time at my command, I can only give an outline of this important subject.

Nature and Ends of Education.

The word *Education* signfies drawing out, development; and the true principles of education should be based upon the knowledge of the constitution, properties, powers, and relations of the subject capable of development.

The education of man should be founded upon the knowledge of his physical, physiological, mental and moral constitution; and upon a knowledge of his relations to the universe, to his fellow-men and to his creator.

To understand the true nature and scope of education we must understand:

1st. The structure, development and relations of the material part of man.

2nd. The structure and relations of the intellect.

3rd. The structure and relations of the moral nature.

4th. The relations of the material, intellectual, and moral natures to each other, to the exterior universe, and to the Creator.

The ends of education are threefold.

1st. The development and perfection of the individual physically, intellectually and morally, for time and eternity, as an individual.

2nd. The development and perfection of the individual physically, intellectually and morally, with reference to his fellow-men.

3rd. The development and perfection of the individual physically, intellectually, socially and morally with reference to his relations to his Creator, in time and in eternity.

It is evident therefore that the true destination of education is indicated by the noblest wants and loftiest faculties of man, and that every system of education is defective, which does not comprehend man in all the varied relations of his physical, intellectual and moral natures.

In view of the mighty objects of education, it may be said with truth, that "Man cannot propose a higher or holier object for his study than education, and all that pertains to it.

According to a fine expression of Kant's, there is in every man a divinity, the ideal of a perfect man, conforming to the type according to which God fashioned him; just as in a block of Parian marble an image of a Hercules or of an Apollo would be found, if a divine artist had traced there by means of the natural veins of the marble, the contour and form of the future statue.

This statue it is the aim of education to free from the rubbish that conceals it—it is the object of our entire life to evolve its form; this inherent ideal of divinity it is the duty of education to reveal to our consciousness, and to enable us to realize it by aiding the development of all those germs and dispositions placed within us by God when he made man according to his own image, dispositions which constitute our rational nature—the true nature of the human race.

The true method of developing the physical, mental and moral constitution and faculties of man cannot be determined by any process of abstract reasoning; it must be discovered by observation, experiment, analysis and synthesis.

A true theory of education should be evolved out of the study of history, past and present; for it has taken all the past to make the present; it has required every event of the past, every work of art, every experiment, every discovery in science, in politics, in morals and in religion, to bring our race to its present state of development.

Physical Constitution and Physical Relations of Man.

The progressive study of the phenomena of the universe known to the human mind finds the last, most comprehensive and typical work in man, governed by the mechanical, astronomical, physical and chemical laws of inorganic bodies, and comprehending within himself all organic nature—composed of inorganic elements, prepared and grouped into definite compounds in the vegetable kingdom, by the combined action of the forces of matter, and of the sun under the guidance of the vital principle—endowed with a body perfect in its mechanical structure, and in the arrangement of its parts, with the size of its organs, the strength of its muscles and bones, and the vigor of its forces, constructed and arranged with exact reference to the force of gravity, the size of our globe and its relations with the sun and all other worlds in the universe; worked by forces, the resultants of the chemical changes of those substances which, in the vegetable kingdom, have been elevated into a state of force by the action of the sun; unable to create or annihilate any force, any more than to create or annihilate matter; endowed, in common with all vegetables and animals, with vital force, and arising from the same common origin, the cell, and, like plants and animals, passing through various stages of development; possessing, in common with all animals, and in contradistinction to vegetation, a nervous system, endowed with special sensibilities relating the various organs and apparatus to each other, in such a manner that, amidst an innumerable number of complicated actions, unity and harmony result, and relating the mind with the exterior world in such a manner that it is capable of obtaining a view of its own changing relations—endowed with intellectual and moral faculties capable of receiving impressions through the nervous system, and of exciting the forces by which they are surrounded, and of directing and controlling them, so as to act upon the exterior universe—formed by the *Eternal* in *His Own Image*, for purposes stretching into infinite ages, and with capacities of rejoicing forever in the warm beams of God's universal and all-vivifying love.

It is a universal law that the component parts of the universe have not in themselves the entire aim or reason of their existence—every form of matter is definitely related to every other form of matter upon the face of the globe, and the combinations of these various relations and actions and re-actions of terrestrial masses, form the essential conditions for the manifestations of the designs of the Creator. As man is composed of inorganic elements, and governed by all the laws, physical, chemical and astronomical which govern the exterior world, it follows as a necessary consequence that the peculiar constitution and relations of the inorganic elements of the crust of our globe must affect the physical and moral endowments of man.

The solid portion of the globe has been constructed for man, just as the body has been made for the soul. The material relations of the solid and fluid portions of our globe, and the distribution of the forces of the sun have exerted no small influence upon the physical and mental development of the human race.

The endless circulation of matter resulting from the combined actions of the forces of the sun, and the forces of the matter of our globe—every earthquake which, in past or present times, has fractured and dislocated the solid strata of the earth, elevated the bed of the ocean or depressed the level of the continents—every volcano which has poured forth the liquid contents of the interior of the earth—every flood which has swept over the ancient continents, has contributed more or less to the formation of a suitable soil for the maintenance of plants and animals, and the development of the human race.

The examination of the material relations of celestial and terrestrial motions, and animated beings, demonstrate that the existence of man is absolutely dependent upon the relations of the component members of the universe—that a single alteration in the chain of phenomena would destroy the existence and manifestation of the phenomena of man.

That the forces of man are resultants of the combined actions and emanations of sun and fixed stars, which keep up a never-ending circulation and change of matter upon the surface of our globe — that man cannot create or annihilate matter, that the great law of the indestructibility of force, action and reaction, applies to the phenomena of man; and, consequently, the intellectual and moral faculties are limited to the guidance and direction of the forces with which the Creator has endowed the universe—that man comprehends within himself all phenomena, astronomical, physical, chemical, physiological and psychological, and is therefore a type of the universe—that the knowledge of the structure, phenomena and relations of man includes a knowledge of science whether relating to matter or mind.

The phenomena of man are complicated and restricted, and depend for their manifestation upon the general phenomena which affect all bodies.

Relations of the Intellectual and Moral Faculties.

As the material part of man has been constructed with exact reference to the exterior universe, so the intellect of man has been constructed with exact reference to the exterior universe. The material part of man has also been constructed with exact reference to the structure of the intellectual and moral natures; it stands between the exterior world and the mind, and as a portion of the exterior world, a machine governed by the laws of exterior bodies, typical of the great mechanism of the surrounding universe, it forms a fit instrument for the manifestation of the spirit breathed into it by the Creator of the universe.

The material part of man, with its complicated machinery, appears to have been constructed with exact reference to the action of the intellectual and moral nature; it stands between the exterior world and the mind, and as a portion of the exterior world, a machine governed by the laws of exterior bodies, typical of the great mechanism of the surrounding universe, it forms a fit instrument for the manifestation of the spirit breathed into it by the Creator of the universe.

The material body of man with its complicated machinery, appears to have been constructed with exact reference to the action of the intellectual and moral nature. Thus, the complicated apparatus of the nervous system relates the mind of man through the nerves with the exterior world; and the complicated muscular apparatus obeys the volitions of the mind through the nervous system and accomplishes various mechanical actions by which matter is moulded and forces controlled and directed according to the interior ideal creations of the intellectual faculties. The forces which work the muscular locomotive system, are developed by the chemical changes of the elements of the muscular and nutritive fluids. The office of the digestive, circulatory and respiratory system is to prepare materials which will readily enter into chemical changes and thus generate the forces by which, under the guidance of the mind, the locomotive apparatus of the body may be moved and the barriers and obstacles in nature overcome, and the forces of nature controlled and directed so as to accomplish definite effects.

Classification of the Faculties of the Mind.

In whatever manner the intellect of man be regarded, whether as an indivisible, immaterial agent, or as a product or secretion of the brain, many metaphysicians have found it convenient, if not absolutely indispensable, to divide and classify its powers or faculties.

Thus, for purposes of systematic study, analysis and comparison, metaphysicians have designated:

I. The simple cognitive faculties, by which we attain the knowledge of individual objects in the concrete, as:

(1.) Sense perception, by which we know material substances in certain modes, or in the exercise of certain qualities; and,

(2.) Self-consciousness, by which we know self in certain states.

II. The retentive and reproductive powers, as

(1.) Memory, which recalls what has been before the mind in time past;

(2.) Imagination, which puts what has been before the mind in new and non-existing forms. Both of these possess an imaginary or pictorial power, which enables us to represent objects by signs.

Above the presentative and representative powers, we have:

III. The correlative faculties, discovering such relations as that,

(1.) Of whole and parts;

(2.) Of sameness and difference, in respect of such qualities as space, time, quantity and active property; and

(3.) Of cause and effect.

IV. The moral faculty, determining in regard to certain mental states that they are right or wrong.

Associated with the exercise of the powers we have:

V. The emotions, attaching us to certain objects and withdrawing us from others.

VI. The will, or operative power, choosing or rejecting among the objects presented to the mind.

It should be added that there are laws of association, determining the order of succession of the states produced by the various powers.

The object of education is to develop these faculties in their true relations with each other, and in subserviency to the great ends of being.

The mind has no direct communication with exterior bodies; its relations with the exterior world are through the nervous system, endowed with special sensibilities, and developed upon the exterior into the organs of sense.

Functions and Structure of the Brain and Nervous System.

The organs of sense are nothing more than portions of the nervous system adapted by conformation and the addition of peculiar apparatus, to receive and transmit impressions from exterior bodies.

The mind can have no other knowledge of the exterior world than that which is derived from the cognizance of the excited states, modifications or disturbances in the apparatus endowed with special sensibility, when acted on by the impressions of external bodies; and if all the organs of sense were absent, the mind would be shut up to itself, and would never acquire any knowledge of the various forms of matter and the various affections and motions of matter in the exterior world.

The brain must be regarded as a composite organ, whose parts have each some special function, and are to a certain extent independent of each other; one part is essential to vital processes, hence its destruction causes death; another part presides over the various movements of the body, hence paralysis of motion is the result of the destruction of any portion of this area; a third part enables the mind to appreciate touch, temperature and pain; a fourth region presides over sight; and in the same way, smell, hearing and taste are governed by distinct portions of the brain.

When a combined action of different parts is demanded, as in the exercise of the reason, judgment, imagination and will, the knowledge gained by means of the special senses can be contrasted and become food for thought.

The nerves have been compared to telegraphic wires, that put the brain and spinal cord in direct connection with the muscles, the spine, and the various organs and tissues; the nervous centres are therefore to be compared to the main offices of the telegraphic system, whose messages are being constantly received and dispatched.

Every message sent out is more or less the result of some message received by the nervous centres, which are constantly in receipt of afferent impulses or impressions of sight, smell, taste, hearing and touch.

As the result of the information so gained, the mind constantly sends out from the nervous centres afferent or motor impulses to the muscles.

Connection of the Mind with the Brain.

The cerebro-spinal system in man consists of three departments independent one of another, yet intimately connected.

1. The cerebrum proper.

2. The cerebellum and the apparatuses of cerebella innervation.

3. The medulla spinalis and its encephalic expansions.

In the study of the education or development and action of the mental and moral faculties we are chiefly concerned with the minute anatomy of the cerebrum proper, which consists of two lobes or hemispheres united to one another by a series of white transverse fibres, which form an anastomosis between the homogeneous regions of each lobe, so as to constitute a twin system, of which all the molecules are consonant one with another.

Each central lobe, taken alone, presents for consideration in its turn:

1. Masses of gray matter.

2. Agglomerations of white fibres.

The masses of gray matter, which are composed of many myriads of cells, and are the essentially active regions of the system, are arranged at the periphery in a thin undulatory continuous layer, which constitutes the cerebral cortex; and in the central regions in the form of two gray ganglions, coupled together, which are the gray substance of the optic thalami and corpora striata.

The white substance, essentially composed of nerve tubules in juxtaposition, occupies the spaces comprised between the cortical periphery and the central ganglia. The fibres of which it consists represent lines of union between various regions of the cortical periphery, and the regions of the central ganglia, and run like a series of electric wires stretched between two stations in two principal directions. Some directly unite the different points of the cortical periphery with the central ganglia and are lost in their mass; the others, on the contrary, have a transverse direction, they proceed from one hemisphere to the other, thus uniting the homologous regions of the brain, right and left, They therefore serve as an anastomosis and commissure between the homologous regions and are thus the agents which produce unity of action between the two cerebral hemispheres. The dense and compact network which unites all the nerve cells of the cerebral cortex one with another, is so delicate that when enlarged to 286 diameters the fibres of which it is composed become visible like single hairs in appearance and magnitude. It is evident from these facts that the cerebrum is the sum total of the cerebral convolutions united one with another; with those on the same side and with those on the other, and simultaneously with the central optic striate ganglia. We find in the cortical substance a few anatomical elements, an ultimate morphological unit, the nerve cell with its various attributes and definite configuration, its nerve fibres, connective tissue and capillaries. These small pyramidal bodies are disposed in series parallel to one another, united to one another by means of an intermediary network, and are moreover regularly stratified, thus forming layers successively piled up like the strata of the cerebral cortex. The cerebral nerve fibres enter into intimate connection with the network of cells, and are insensibly lost in the surrounding tissue. All the nerve cells have a pyramidal form; they are of unequal volume; the smaller occupy the superficial or submeningeal, the larger the deeper region; these latter are, on an average, double the size of their fellows and the transition from small to large cells is accomplished by insensible gradations, the cells of the intermediate zones in general presenting mixed characters. While all the cells are pyramidal in form, the summit of each is, so to speak, attracted towards the superficial regions, like a series of needles magnetized so as to point towards the pole so that their bases are all parallel and are directed towards the point from which the nerve fibres arise. They give off from their substance a species of very delicate, rootlet-like, hirsute fringe, which gradually spreads out and forms on all sides a surrounding network ; and as each cell presents a similar arrangement, the result is that a close union between them is produced, so that they form throughout the cerebral cortex a continuous true plexus, all the molecules of which are by some means arranged so as to vibrate in unison. By their prolongations, which form the base of the pyramid, they enter more or less directly into relation with the afferent nerve fibres, while their apices send out a filamentous prolongation, which proceeds either to be lost in the surrounding network, or to enter into contact with certain zones of cells situated above.

The number of cells in the cortical substance must be estimated at many thousands. In a space of cortical substance equal to 1 square millimeter, and of a thickness of $\frac{1}{10}$ of a millimeter, 100 to 120 nerve cells of various sizes have, on an average, been counted; if, now, we form in imagination an estimate of the ratio of this small portion of the cortical substance to the whole, we shall arrive at an estimate of many thousands.

The internal structure of the cerebral cell seems to grow more complex the deeper we proceed in the minute study of its elements. Some years ago anatomists admitted of an investing membrane and a contained substance, with a nucleus and a nucleolus in the constitution of the cell; later they discovered that its investing membrane was nothing more than the external layer of an amorphous protoplasm surrounding the nucleus of the cell, and prolonging itself externally in the form of multiple ramifications.

The structure of the cerebral cell, however, seems to be much more complicated, for that eminent anatomist, J. Luys, of Paris, has lately discovered that the substance called the protoplasm of the cerebral cell is formed by a true tissue organized in a special manner; that this tissue, consisting of very delicate fibrillæ, interlaced like the wicker-work of an osier basket, has a tendency to agglomerate towards the nucleus of the cell, which thus becomes a true point of concentration; that the nucleus itself is not homogeneous; that it is endowed with a special structure, radiated in appearance; and that, lastly, the nucleolus, considered as the final expression of the unity of the nerve cell, is in its nature divisible into secondary filaments.

It has been well said that the new means of investigation, which the scientific methods of the nineteenth century have placed within the reach of our generation, show that in the long process of evolution which extends through ages, man only arises step by step at the fragments of truth which he snatches, and that even his most persevering efforts only seem to cause the unknown to recede a few paces backward. It is strange to find that, as fast as any progress is accomplished and new discoveries registered, new problems incessantly start up; and that just as we thought we had arrived at the utmost limits of the known world, at the demonstration of elements, simple, fixed, definite, our perfected methods of study enable us to see new complexities and unexpected hardships. What will be the end of these unforeseen details which present themselves in the train of each adaptation of a new method of study to our researches into the nervous system? No one knows as yet; it seems as though the secrets of nervous organization escape from our eyes, as fast as we press further into the regions where they conceal themselves. Imagination is confounded when we thus penetrate into the world of the infinitely little, when we find the same infinite divisions of matter that so vividly impress us in the study of the siderial world; and when we thus behold the mysterious details of the organization of an anatomical element, which only reveal themselves when magnified from 700 to 800 diameters, and think that this same anatomical element repeats itself a thousand-fold throughout the whole thickness of the cerebral cortex, we cannot refrain from wonder and admiration; especially when we reflect that each of these little organs has its autonomy, its individuality, its minute organic grouping; that it is united with its fellows; that it participates in the common life; and that above all it is a silent and indefatigable worker, directly elaborating those nervous forces of the psychic activity which are incessantly expended in all directions, and in the most varied manners, according to the different calls which are made upon it and set it vibrating.

The nerve fibres which represent the bonds of union between the cortical substance and the central regions of the brain emerge from the nuclei of the plexus of cells. They all at first appear as isolated filaments, as a derivation, mediate or immediate, from the tissue proper to each cell; then by degrees, as they proceed between the ranges of cells, they enlarge, their sheath thickens, the interposed fatty substance becomes more abundant, and they are insensibly transformed from gray to white fibrils.

It would be foreign to our purpose to enter into the minute anatomy of the other elements which enter into the structure of the brain, as the *neurologia*, *lymphatics* and *capillaries*, destined for the mechanical support, and nutretion of the nervous elements, and we conclude with the repetition of the generalization, that the brain represents an immense instrument constructed of nervous elements, each gifted with its proper individuality, and yet internally connected one with another. The series of cells arranged in stratified zones, and the connections of the different strata communicating one with another, imply the idea that the nervous activities of each zone may be indefinitely evoked; that they may be associated one with another; that they may be modified in passing from one region to another, according to the nature of the intermediary cells brought into play; that, in a word, nervous actions like vibrating undulations, must propagate themselves, through one point of contact after another, following the direction of the organic substance that underlies them, either transversely or vertically from the superficial to the deep regions, and vice versa. The cerebrum considered thus in its totality is an instrument essentially *sensory-motor*.

The nervous and muscular forces must be regarded in the light of the revelations of chemical, physiological and physical sciences as similar to, if not identical, with electricity.

The doctrine of the unity and correlation of forces propounded by Mayer in 1842, not only led to the recognition of the essential unity of the so-called imponderables, namely, the chemical forces, heat, light and electricity and motion, but also slowly but surely revolutionized the theories of physiologists, and led to the reference of all chemical, physical and vital forces or processes to a single force or power, which originally appeared as light from the sun and excited in inorganic matter and living organisms, heat, mechanical motion, chemical change, electricity, and nervous and muscular force. Philosophers have announced the theory, that there is in reality but one single force, which runs through an eternally changing round in dead or inorganic, and in organic nature. As far as the knowledge of man extends, matter and force are indestructible. Force changes its form; heat is changed into motion; chemical action developes force in accordance with the amount and character of the matter altered, and in all chemical and physical changes the resulting power or force maintains a constant magnitude—animal heat is dependent upon chemical changes, and the resulting forces, heat and motion, and muscular and nervous forces, are dependent upon and are equivalent to the sum of the power of the simultaneously produced chemical processes.

The immaterial, intellectual, moral soul of man has no direct communication with the exterior world. The mind receives impressions, transmits its volitions and excites the material structures of the engine by which it is environed, through the nervous system, which is endowed with special sensibilities.

If we cut the nerve of the eye, the mind will be deprived of all luminary impressions. So also, if we cut the nerves supplying all the senses, the mind will be cut off entirely from all communication with the external world.

The impressions of exterior bodies upon the nervous system are always attended by a change of the structure of the nervous system, and all the organs of sense are excited by changes of matter. The excitement of the nervous system and transmission of the impressions are attended by a change of matter.

Every act of the mind which excites the nervous system is attended by a change of the chemical elements of the nervous system.

The intellectual and moral faculties of man work through and by the physical and chemical forces; they are distinct from matter, they are superior to matter, they excite matter to action, they direct and control the actions of matter.

The intellect of man is free to act according to its own volitions and will.

Matter on the other hand acts always under like circumstances in the same manner.

The *intellect* is to the human locomotive what the engineer is to the steam locomotive.

It employs the extraordinary powers of this magnificent mechanism to mould exterior material nature, after its own interior spiritual nature, evolved in ideas and thoughts.

By his intellectual and moral nature, man overcomes all the barriers and obstacles of nature, not by a suspension or alteration of her immutable laws, but by peculiar application of those forces and laws.

His locomotive machinery, under the guidance of the intellect, ascends the loftiest mountains, penetrates the earth, descends into its bowels and brings forth its buried treasures, traverses the ocean more rapidly than a whirlwind and communicates its thoughts by the lightning of heaven.

What is this mysterious agent?

Whence came this immaterial spirit?

Place all the elements which compose the material universe in every conceivable circumstance; act upon them by all the physical and chemical forces combined, and you cannot produce even the simplest human being, plant or animal, much less the intellect of man.

Analyze the brain and nervous system: do we discover the mind? Three gases, a solid and a small quantity of earthy salts, is all that our analysis discovers.

Analyze carefully every organ, tissue and solid of the human body, and the results will be the same. Let the sharp scalpel of the skilled anatomist dissect the anatomy of the brain and organs, and let the most powerful microscope reveal their minute structure and unfold their wonderful machinery: does the immortal, immaterial spirit reveal itself to the sight, touch, smell or hearing of man?

The creation and existence of the mental and moral faculties of man must be referred to a being distinct from matter, who constituted and controls matter and all its forces, who has life in himself, and who has imparted life, intelligence and moral being to the organism of man.

Of all animated beings on this globe, man alone observes and stores up the results of his reason.

Man alone constructs science and controls the forces of nature.

Man alone constructs implements, weapons, tools and machines and philosophical apparatus for the application of the forces of nature.

Man alone forms laws for the government of society, holds courts of justice, presides as a judge and ruler, erects temples and daily prostrates himself in humble adoration of his Creator, Preserver and Lord.

The possession of moral and intellectual faculties combined, thus distinguishes man from every other form of matter and from every other being upon our globe.

There is no demonstrated transmission between the genus homo and the highest types of the lower mammalia; an impassable gulf separates them, and no process of development and no struggle for existence has ever elevated the most highly organized animal into the plane of the intellectual and moral life of man.

The Mode in Which the Mind Constructs Science.

No correct theory of education can be founded or comprehended, without the formation of clear ideas of what constitutes *science* and of the methods by which science is constructed.

The word science, derived from *scio*, I know, strictly means knowledge. According to the modern acceptation of the word, "*science*" is the knowledge of the laws of phenomena whether they relate to mind or matter. The term *phenomena* meaning a collection of associated facts, and the term *law*, the relation which pervades a class of facts, it is evident that the study of the laws of phenomena must necessarily include the study of the phenomena themselves and their individual facts.

By *mind*, we understand that which thinks, wills, and is capable of moral emotion.

By *matter*, we understand that which affects our senses.

It is evident that in the construction of every science we must have external objects with their phenomena and laws, and a mind which observes these external objects, notes their peculiar properties, and, by comparison and analysis, determines their relations to one another. Science, then, is the product of *mental operation*.

The method of developing, educating the intellectual faculties must be acquired by a careful study of the history of the origin and progress of science, for this is the true history of the development, progress and mode of action of the human mind. The methods or modes of action of the human mind, in viewing the phenomena of exterior nature, and in discovering their relations and laws, have been the same amongst all peoples and in all ages.

Science is the interpretation by the mind, of the actualities of existence. The ideas of the mind are science or truth, only when they are correct expressions of the phenomena and laws of the universe. The great end of science, and the great proof of its truth is the power which it confers upon man of predicting future events.

For the discovery of truth, and the establishment of science, we must have a mind endowed with special faculties, capable of analyzing and comparing its own phenomena and of inferring their fixed relations or laws; capable of receiving impressions through the nervous system and organs of sense, from exterior bodies, and of decomposing, analyzing, classifying and determining the fixed relations or laws of the exterior universe. If the faculties of the mind be altered, whilst the surrounding machinery of the material body and of the external universe remain unaltered, the discovery of the relations of the facts and phenomena of the external universe would be impossible. Thus, the love of Truth, as Truth, and for no other reason, is a fundamental principle of the human mind, the knowledge of the existence of which is derived from consciousness: it is a primary principle, whose existence must be referred immediately to the Divine Command. This is true of all the faculties of the mind; we can give no other reason for their existence and modes of action, than the will of the Creator. If the love of Truth was not a fixed disposition of the human mind, it would be impossible to receive any fact on testimony—it would be impossible to carry forward any investigation—it would be impossible to construct any science. In like manner, if the structure and functions of the nervous apparatus, which relates the intellectual faculties with the exterior world, be altered, whilst the intellectual faculties and the exterior world remain unaltered, the discovery of truth would be impossible.

It is evident therefore, that imperfections of the senses, imperfections of the nervous apparatus, and peculiarities of mental endowments are the first sources of error in the prosecution of knowledge.

The mind has no direct communication with exterior bodies, its relations with the exterior world are through the nervous system, endowed with special sensibilities, and developed upon the exterior into the organs of sense. The organs of sense are nothing more than portions of the nervous system adapted by conformation and the addition of peculiar apparatus, to receive and transmit impressions from exterior bodies. The mind can have no other knowledge of the exterior world, than that which is derived from the cognizance of the excited states, modifications or disturbances in the apparatus endowed with special sensibility, when acted on by the impressions of external bodies; and if all the organs of sense were absent the mind would be shut up to itself and would never acquire any knowledge of the various forms of matter, and of the various affections and motions of matter in the exterior world.

The phenomena or associated facts of the exterior world are innumerable; matter is never at rest, it is constantly undergoing alterations of form, appearance and constitution—perpetual change is written everywhere; even the sun with his planets are sweeping majestically through space, around a distant unknown centre; these changes of states, forms and conditions and these modifications of relations are the subjects of sensations and perceptions and are represented to the mind as simple ideas. The causes of the incessant activity of the component members of this world and of the universe, cannot be discovered by the unaided senses; because the senses represent only the superficial exterior appearances and relations of bodies, and cannot penetrate beyond, and are therefore limited in their respective capacities to the reception of simple ideas, and can never give any information of the immutable laws which govern all matter; the true nature, therefore, of exterior objects, the laws which regulate the phenomena of matter and the relations between the component members of the universe, are problems which the reasoning powers of man and not his senses can solve.

After the observation of the facts and phenomena of the exterior world, the intellectual faculties, by their powers of analysis, synthesis, causation, and judgment, separate each fact from dissimilar facts, and arrange the simple ideas into species, genera and orders; thus, acquiring a knowledge of new phenomena and associations of facts inaccessible to the external senses. By decomposing phenomena into their component facts by analysis and comparison of these facts, the intellectual faculties form abstract ideas which sum up the principles and laws of associated facts. The perfection of every science will, therefore, depend upon the diligence and care with which its cultivators study the simple properties and relations of bodies, and analyze and decompose and compare the more complicated phenomena. In the language of Bacon, "Man as the minister and interpreter of nature, does, and understands, as much as his observations upon the order of nature permit him, and neither knows nor is capable of more."

The neglect of this, the only true method of acquiring a knowledge of the laws governing inorganic and organic bodies, has been the cause of the failures of the ancient systems of philosophy. Upon the imperfect knowledge of a few ill observed facts and phenomena the ancients reared immense superstructures, whose bases were points and their summits infinity.

The history of the origin and progress of human knowledge at all times and in all places, demonstrates that in the pursuit of knowledge and in the direct study of nature, facts alone do not constitute science, and reasoning alone does not constitute science. We must have for the construction of science, the exercise of the senses furnishing the primary ideas, facts and phenomena of the exterior world; and then the exercise of the reasoning powers determining in virtue of their constitution and relations through the senses to the exterior world, the fixed relations or laws of these facts and phenomena.

To the formation of science two things are requisite; observation of things without, and an inward examination, decomposition, analysis and comparison of the results of observation.

It has been well said, 'that true knowledge is the interpretation of nature; and therefore it requires both the interpreting mind and nature for its subject; both the document and the ingenuity to read it aright. Thus invention, acuteness and connection of thought are necessary on the one hand for the progress of philosophical knowledge; and on the other hand, the precise and steady application of these faculties to facts well known and clearly perceived.'

The great end, therefore, of all human knowledge and investigation is to determine the fixed relations or laws of the universe; so that the precise condition of things at any future time may be predicted with absolute certainty, and so that the human mind may appreciate its relations with the universe and with the great Creator of the Universe.

It is evident from these principles that education should commence with the exercise and discipline of the senses. The intellectual faculties should be taught, carefully to observe and note the properties and relations and forces of surrounding bodies, and to arrange and classify the phenomena.

In the first exercises of the senses and intellectual faculties, we should imitate in a manner the action of the human mind in the first dawn of science when it first began to observe phenomena and accumulate facts; and the method in which at the present time it originates and developes new sciences. Man commenced the construction of science by viewing general classes of phenomena; the chronological commencement of science, therefore, is with the complex mass, whilst the logical development is with the individual elements. Thus, Astronomy which is conversant with the sublimest and most striking phenomena in nature, had the earliest origin; its first cultivators were shepherds who confined their attention to noting the most obvious phenomena of the motions and eclipses of the sun and moon, and the rising and setting of the stars. These, the first builders of astronomy, slowly accumulated materials for the formation of science, and in due time the reasoning faculties compared the individual facts with each other, separated the dissimilar and combined the similar, and thus arrived at a knowledge of the fixed relations or laws which sum up and express the whole details of associated facts.

It is evident from the mode in which the mind obtains its ideas and constructs science, that science is the result of patient and hard labor. The first knowledge acquired by the ancients consisted of isolated facts; gradually facts were accumulated, complex phenomena observed, decomposed, and their component elements arranged and compared, and the errors of the senses corrected, and it was not until after many ages, that the great fundamental laws of astronomy and physics were established.

In the work of education it should ever be remembered that the rise and progress of the science and philosphy of the whole human race, is similar to that of each individual mind.

Science Rests Upon the Supposition that the Physical Universe is Governed by Fixed Laws.

Science, therefore, is the resultant of the combined operation of the senses and intellectual faculties, and has for its object the determination of the laws or fixed relations of the phenomena of the universe, and is founded upon the supposition that these laws are fixed and immutable.

The end of all science is prevision, and when perfected it will enable us to predict with absolute certainty the future course of events.

The perfection of science depends, therefore, primarily upon the truthfulness of the impressions of the senses, and secondarily upon the care and accuracy with which the mind decomposes, analyzes and compares the facts and phenomena of the exterior world. The errors of the ancient systems of philosophy were not due to defective operations of the mind, or to an absence of the love of the truth or to defective physical and mental vigor, but to the neglect of the knowledge derived by actual observation through the senses.

All sciences approach perfection, as they approach to a unity of fixed principles, or certain high elementary conceptions, which are the representatives of the great architypal ideas, according to which the whole system is arranged. Inductive conceptions, are the exponents in the human intellect of the great principles in nature. The laws and profound principles which regulate the mechanism of the universe, are the originals, the conception and expression of them in the mind of man only the copies. The vast assemblage of physical causes, whether the great principles of cosmical forces, or the minute molecular affections, as they exist in the heavenly spaces or among terrestrial atoms, are the realities; the exposition and demonstration of them in the mind of the philosopher, only their images. Science is the partial reflexion in the human mind, of "the great all-pervading reason of the universe" : and the unity of science is the reflexion of the unity of nature, and of "the unity of that supreme reason and intelligence which prevails and rules over nature, and from whence all reason and all science is derived. All induction begins and ends in the conception of order, arrangement and uniformity throughout nature; and this, however inadequately comprehended by our science, is again the evidence of a supreme mind, and the universality of order in time and space, the manifestation of the universality of that supreme mind. Law is the supreme rule of the universe; and that law is wisdom, is intellect, is reason, whether in the formation of planetary systems, or in the organization of the worm."

The eternal laws by which and in accordance with which nature acts, are the mandates of an infinite perfect reason; so that the students of nature live in a constant contemplation and adoration of the omnipresent, infinite and all powerful divinity. "The laws of nature are the thoughts of nature, and these are the thoughts of God."

We are now prepared to examine the:

Character, Order and Relative Value of the Different Departments of Knowledge in the Work of Education.

Language.

In the development of knowledge, we must have signs and sounds, to denote the properties and actions and relations of matter exciting changes in the organs of sense, and sensation in the nervous system. We must have signs and sounds to denote the objects of thought. Without signs and sounds, there could be no communication of ideas between intelligences, because they are the permanent representatives of our ideas. It is evident, therefore, that Language was the necessary result of the action of the mind, and advanced in perfection and power, and compass, just as the human mind and science were developed.

Hence the Study of Language should be the Starting Point of all Education.

In this utilitarian age, the philosophical study of language, unfortunately, is too often neglected, and treated with contempt, as a waste of time. Nothing can be more erroneous. Language presents a stereotyped expression of the mode of action and development of the mind. The ancient languages of Greece and Rome present a pleasant field, upon which all minds in all nations may meet and converse with the mighty dead. Ancient languages resemble geological strata, rich in the accumulated remains of ages —each word is a fossil, which gives evidence of former organization and life, of ancient convulsions and mighty revolutions.

In the study of languages every word has a history of its own, and must also be studied in its relations with other words, and with analogous words in other languages; every sentence has its own construction and relations to previous sentences, and conveys a definite idea, which is related to preceding and subsequent ideas; the impossibility therefore of rendering the meaning of every sentence absolutely, and the consequent exercise of selecting the nearest and best of the two or more approximated renderings, cultivates in an eminent degree precision and judgment.

Value of the Ancient Languages in Education.

In the work of education, the ancient languages should never be exchanged for the modern languages.

The modern languages are degenerate and composite; it is well known that Latin enters into the vocabulary of the German tongues, and is the ground-work and framework of Italian, French, Spanish and kindred languages; consequently the study of the Latin language forms the best preparation for the acquisition of the modern languages.

The relations of the ancient to the modern languages have been thus aptly illustrated.

Indeed, when one considers these venerable forms of speech in connection with the history of Europe from the time in which they were spoken to the present day, one is tempted to compare them to splendid edifices reared by the genius of antiquity, fairly proportioned and presenting an outline of squared and polished blocks of the finest marble; but which, at a period when time had begun to impair without destroying their beauty, an earthquake and tempest suddenly coming on shook them from their foundations and hivered them into fragments. With whatever material came into our way, we moderns, when the storm had subsided, built ourselves habitations, convenient enough in point of accommodation, and destined to lodge many a gifted tenant, but, nevertheless, devoid of the grace, and decoration and exquisite symmetry of the original structure.

And if a few specimens of this architecture have escaped the wreck of ages, and survive in all their primitive chasteness and elegant simplicity, shall we not teach our youths to visit them, to admire their fair proportions, to study their cunning workmanship and to imitate whatever is imitable of their perfection?

Languages can only be learned thoroughly and scientifically by comparing them with each other; hence, learning Latin and Greek, the student learns English also in a far more thorough manner, and at the same time acquires in many respects a more perfect and powerful instrument of thought and expression.

The critical study of languages not only develops and strengthens the memory and reasoning faculties, but it also, in a manner that can be accomplished by no other study, and, in fact, not by all studies combined, refines the taste, enriches and purifies the imagination, and stores the mind with useful information in history and philosophy. The sublimest poetry, the deepest, most powerful and most learned works in politics, morals, law, medicine, philosophy and theology were written in dead languages, and in most cases remain still in the dead languages—the works of Aristotle and Plato will remain to the end of time, the text-books of the statesman, metaphysician and philosopher, the works of the greatest physician that ever lived were written and have been preserved in Greek; all the medieval records of medicine, and all the terms of the materia medica are found in Latin, and this is the language in which at this very day the physician writes his prescriptions, and while the Roman law is absolutely indispensable to the perfection and accomplishment of every lawyer, as the most comprehensive and self-connected of all the systems of jurisprudence, its study is absolutely necessary to the Latin philologist and antiquarian, for the most successful cultivators of ancient literature have been cultivators of Roman law, and it is well known that the knowledge of the dead languages is even more important and essential to the theologian than to the lawyer, physician, statesman or philosopher; for the interpretation of the sacred books, the most important function of the theologian supposes a profound knowledge of not only the languages, but also of the spirit and history of the languages of antiquity.

As therefore the study of languages develops all the faculties of the mind, the reason, judgment, memory, imagination and the taste, it is unquestionably the best basis of all education, general or professional, legal, medical and theological.

Natural Sciences.

The study of languages is the best basis of general and professional education, but it is not the only basis or means of harmoniously evolving the faculties and capacities of the mind in their relative subordination to the great ends of being. The grand phenomena manifested by the immense masses of matter, moving in the great ocean of space, the innumerable forms of matter, solid, fluid and gaseous, composing the atmosphere and crust of our globe, are related to man, and have at all times excited his wonder, and exercised his loftiest faculties in the search after their hidden causes; man's power over the forces and properties of matter, and his social elevation and power depend upon his knowledge of the properties, forces, relations and laws of the component parts of the universe; the highest faculties of the greatest men, of

Pythagoras, Aristotle, Archimedes, Galileo, Copernicus, Euler, Newton and Laplace, have found their most glorious field of action, and have been developed and ennobled, and have achieved those great triumphs which have elevated, dignified, and ennobled the human race, in the search by observation and experiment after the knowledge of the fixed relations and laws of the phenomena of the universe; when, therefore, we assert that the Study of Science is an effective means of developing harmoniously the powers of mind, and at the same time of endowing the mind with that knowledge by which it can alone direct and control the forces of nature for the advancement of the physical, social and intellectual good of the human race, we do nothing more than echo the sentiments of the illustrious founders of science.

THE STUDY OF THE NATURAL SCIENCES LEADS TO ENLARGED VIEWS OF THE PHYSICAL UNIVERSE AND LEADS TO THE DEVOUT ACKNOWLEDGMENT OF UNITY OF DESIGN AND THE EXISTENCE OF A GREAT FIRST CAUSE.

The labors of the natural philosopher and chemist have demonstrated a uniformity in the molecular and chemical constitution of all matter in the visible universe.

Thus, according to the atomic theory in its widest conception, as held by the philosophers of the nineteenth century, every portion of the whole universe, or at least that part of it which is accessible to us by means of the telescope, is occupied by atoms inconceivably minute, hard and unchangeable, separated from each other by attraction and repulsion.

This assemblage of atoms constitutes the matter of the material universe; and the attractions and repulsions, the forces by which they are actuated, and to which is referred all the power or energy which produces the changes to which matter is subjected.

The atoms thus endowed form a plenum throughout all space, constituting what is called the *ethereal* medium, and in it at wide intervals from each other, are isolated masses of grosser matter, which constitute our world, the planets, the sun and stars. These also consist of atoms of another order, or of groups of atoms, with spaces between them, wide in comparison with the size of the atoms, and these spaces are pervaded by the minute atoms of this ethereal medium. These bodies move in the medium without sensible resistance, or such as is only rendered evident by the minute retardation of the nebulous masses denominated comets. According to this theory, the various isolated bodies of the universe act upon each other by means of the force of gravitation, and also by tremors or vibrations in this medium, radiating in every direction from each body, as a centre. All matter, therefore, is porous, whether in the liquid, gaseous or solid condition. The pores may be considered to be of different orders, namely: pores between the atoms, between the molecules or assemblages of atoms, and between the still larger particles.

We are obliged to assign to the ethereal medium a similar constitution to that possessed by grosser matter, namely, that it consists of inert atoms, at great distances from each other, relative to their own size, and each kept in position by attracting and repelling forces. Through this medium impulses or minute agitations are transmitted over celestial space, from planet to planet, from system to system, and these tremors or waves constitute light, heat, and other emanations, which we receive from the sun, or in other words, the solar emanations are not matter, but motion communicated from atom to atom, beginning at the luminous body, and diffused in widening, spherical surfaces, enlarging in size and diminishing in intensity to the farthermost portion of conceivable space. The atoms of the ethereal medium are perfectly free to move in all directions, so that the earth and dense masses experience no retardation as yet measurable, though light bodies, as comets, apparently exhibit an effect of this kind, for the same reason that a stock of cotton is more retarded in falling through the air than a piece of lead.

Spectrum analysis has not only placed a new power in the hands of the chemist, which enables him to detect by the simplest and most expeditious process, the presence of chemical substances with a degree of accuracy and delicacy almost incredible, and thus enlarged the bounds of his knowledge of terrestrial matter, but it has armed him with an instrument by which he is able to overstep the narrow bounds of this earth, and to determine with as great a degree of certainty as appertains to any conclusions in physical science, the chemical composition of the atmosphere, of the sun and far distant fixed stars.

It has been demonstrated that in the solar atmosphere, at a distance of ninety-one millions of miles, substances such as sodium, calcium, barium, magnesium, iron, chromium, nickel and copper, zinc, strontium, cadmium, cobalt, hydrogen, manganese, aluminum and titanium, which enter into the composition of this earth, are present in the state of luminous gases. Simple elementary bodies, well known to us on this earth, have been shown to exist in the atmosphere of planets and fixed stars and comets.

The discoveries of the spectroscope have confirmed those of the telescope, and established a uniformity of chemical composition, as well as of the physical constitution of matter throughout the visible universe. Aggregated into masses which, though differing from one another in composition, like the various veins of ore which occur in masses upon the surface of our globe ; yet, all suns, worlds and comets are evidently of common origin, all obey the same laws, and all possess a chemical nature similar in kind.

Standing on the elevation below which the material universe, in its everlasting order, lies fresh and youthful forever, the truth is borne to us, that the revolution of a planet is only the repetition of the fall of a stone; in the path of a stone whirled through the air, the graceful curve of a jet of water, or the course of a drop of spray, in the energy through which a sparrow falls, we behold the power obeyed by the mightiest suns and planets of the universe.

Throughout the realm of nature, the highest order cognizable by man is subject to profounder ordinances; precisely as knowledge advances have the views of man been enlarged; once the thunder was a prodigy, yet it belongs to powers which beneficially nourish whatever is beautiful on the earth; the raging hurricane springs from the delicious breezes of the tropics, and is an essential portion of the harmonious system of the winds.

In the universe change rises above change, cycle grows out of cycles in magnificent procession; ever new and ever widening like the circles that emanate from a spark of flame, enlarging as they ascend, finally to be lost in the empyreum.

"And if all that we see; if from earth to sun, and from sun to universal star-work—that wherein we but behold images of Eternity, Immortality and God; if that is only a state or phase of a course of being, rolling onward evermore; what must be the Creator, the Preserver, the Guide of all? He at whose bidding these phantoms came from nothingness, and shall again disappear; whose name amid all things alone is *existence*. I am in *that I am*."

Logical Classification of the Departments of Science.

In the pursuit of science, either as a means of developing the faculties of the mind, or as a means of controlling the powers of nature, we should follow the *historical development* and logical classification of the various departments of science.

If the human intellect was able to view at once all the phenomena and laws of the universe, the classification and division of science into separate departments would be unnecessary, and all knowledge would be comprehended under one science. Some philosophers have even gone so far as to suppose that all the laws of the universe will be ultimately reduced to a single all-pervading law, which will be the expression of all the facts and phenomena of the universe.

Science being the interpretation of the actualities of the exterior world, the realities of existence, it is evident that it cannot be divided into different departments arbitrarily, but must be divided in accordance with the phenomena and laws of the exterior world, and of the phenomena of the mind.

In the pursuit of science, either as a means of developing the faculties of the mind, or as a means of controlling the powers of nature, we should follow the *historical* development and logical classification of the various departments of science.

Those sciences have attained to perfection first, which treat of the most general and simple phenomena, which form the foundation of complex restricted phenomena; the philosophical system of education should therefore commence with the study of the most general and universal sciences.

Logic.

Logic, the science of the laws of thought, which govern every act of the mind, objective and subjective, inductive and deductive, was developed by Aristotle, when astronomy, mechanics and physics were nothing more than accumulations of isolated facts, and chemistry and physiology were without a name.

Logic is the most general and abstract of all sciences, because the mind reasons in a fixed manner concerning all phenomena, and because the phenomena of the universe, simple or complex, are related to each other in a fixed manner, and are governed by fixed laws, and because the human mind has been constructed with exact reference, and in exact correspondence to the exterior universe.

Logic, therefore, may be studied immediately after the study of languages, independent of all sciences; while all sciences are constructed logically, and are therefore dependent upon logic; on the other hand, logic is necessarily connected with the philosophic study of language alone, for whenever the mind acts upon any subject, it acts according to certain laws, and under certain conditions.

Mathematical Sciences.

The mathematical sciences stand next to logic, because they are related to every branch of human knowledge, and are indebted to none, and enable the human mind to deduce the greatest results from the smallest data—and because they are the great instruments of exact inquiry relative to number, quantity, space, time and force, and consequently the great instrument of establishing the fixed relations of the component members of the universe, which exist in space and time, and are related to fixed laws.

Without mathematics there could be no science of mechanics, astronomy or physics, because abstract and concrete mathematics form not only the most powerful instrument in the investigation of the fixed relations of the component members of the universe, but they also constitute the great mass of astronomical and terrestrial physics. Without mathematics man would never have been able to overcome the obstacles and barriers of nature, and control and direct the forces of matter and predict the course of future events, because without mathematics, mechanics, astronomy, the measurement of time and systematic navigation which laid the foundation of the civilization of the world, would never have existed—without mathematics, the most splendid generalizations of the most splendid minds, of Galileo, of Newton, and of Laplace, would have been impossible, and the comprehension of the unity and harmony of the order of nature, and of the infinite power of the Creator, as manifested in the vastness of the universe, would never have been possible. All the useful and ornamental arts and occupations of life are indebted to mathematics. Mathematics are necessary to the architect, miner, railroad constructor, civil engineer, mining engineer, machinist, surgeon, ship-builder, and military and nautical men. The architect in planning the humblest cottage, or in building the most lofty bridges and public edifices, has all his works in exact mathematical measurements; out of geometry as applied to astronomy, grew the art of navigation, which has made possible the enormous foreign commerce which supports a large portion of our population. The success of nearly all modern manufactures depends on the application of rational mechanics; the properties of the lever, the wheel and axle, are involved in every machine, which must be regarded as a solidified mathematical theorem, and in the nineteenth century we owe nearly all production to machinery.

These facts demonstrate not only the importance of mathematics, but also the true position which they should occupy in the scale of sciences, and in the true system of education: the study of mathematics is indispensably preliminary to the study of all sciences, and should therefore, in conjunction with languages, form the point of departure of all education general or professional.

The mathematical sciences should be studied in the order of their complexity, historical development, and logical classification.

Thus, the study of abstract mathematics should precede the study of concrete mathematics; because, as an extensive and immense application of the principles of logic to number and quantity, they are purely instrumental, logical and rational, and form the necessary and absolute foundation of concrete mathematics, which notwithstanding the simplicity of the phenomena are founded upon observation of the exterior world.

Mathematics are to be studied rather in their relations to the physical sciences, and necessary arts of civilized life, than for themselves as a means of developing the mental faculties: for whilst they are of advantage in correcting the habit of mental distraction, and in cultivating the habit of continuous attention; the exclusive and extensive study of mathematics especially of the abstract division, so far from developing the powers of the mind most needed in the business of life, and in the discussion of the highest and most intricate truths, has a manifest tendency to debilitate the imagination, invention and reasoning faculties, and induce scepticism in morals, philosophy and religion.

To obtain the ends of education, concrete mathematics are more valuable than the abstract, because they exercise the powers of observation to a much greater extent, and the procedures are more open to the light, and are attended with greater consciousness and understanding.

ASTRONOMY.

The application of the principles of abstract and concrete mathematics, to the most general phenomena of the universe known to the human mind, resulted in the establishment of the fixed relations of number, form, quantity and arrangement and motions of those members of the universe whose phenomena came within the range of man's observation—resulted in the science of ASTRONOMY. The simplicity, and at the same time the universality of the phenomena of astronomy; the necessity of the long drawn and complex reasonings of abstract and concrete mathematics, of the principles of the calculus in its widest extent, of geometry, synthetic and analytic, and of mechanics, in solving the problems of astronomy; and the appearance of new phenomena and relations different from those of logic and mathematics, demonstrate that astronomy is more complex than mathematics—demonstrate that the laws of astronomical phenomena could never have been determined without the aid of mathematics—demonstrate that in the logical classification and philosophical system of education, astronomy should stand next to mathematics.

In the survey of terrestrial bodies and phenomena which logically follow the study of astronomical phenomena, all bodies and phenomena are divided into two great classes, INORGANIC AND ORGANIZED.

PHYSICS, CHEMISTRY AND PHYSIOLOGY.

INORGANIC BODIES enter into the structure of organized bodies, form the necessary conditions for their existence and the manifestation of their phenomena, and at the same time are wholly independent of organized animate bodies, are less complex in structure, and the laws of their existence are more universal; the study of inorganic bodies should therefore precede, and form the basis of the study of organized bodies. The sciences of inorganic bodies should also be studied with strict reference to their historical development, and the position which they occupy in the scale of logical classification; thus physics, which teaches the laws of the general phenomena of bodies and of the general motions or affections of matter which are unattended by any permanent change of the individual molecules, as heat, light and electricity, and which affect all bodies in similar manners, should precede chemistry, which teaches the laws of the compositions and decompositions which result from the mutual actions of dissimilar molecules, and which in every instance present something specific.

While INORGANIC BODIES are homogeneous in structure, and would remain forever at rest and unchanged, physically and chemically, unless acted upon by extraneous forces, *organized animate beings* on the other hand, although composed of inorganic elements and governed by all the laws of inorganic bodies, are not homogeneous in structure (all vegetables, from the simple cell to the most highly developed, and all animals, from the simple cell animalcule, to the complicated organism of man, are composed of cells, variously developed and grouped, so as to form organs and apparatus, capable of accomplishing definite results, when moved by the physical and chemical forces, resulting from the changes of inorganic matter); and living bodies, even the simplest forms of vegetables and animals, manifest new phenomena, (the development of a form from a formless mass, and the preservation of that form amidst unceasing chemical and physical changes; nutrition, secretion and generation, due to the combined actions of the physical and chemical forces guided by the vital principle); and the higher forms of animated beings present another set of phenomena dependent upon the existence of the nervous system and intellectual faculties; and in man we have another set of phenomena dependent upon the constitution and relations of the intellectual and moral faculties; it is evident therefore, not only that the phenomena of living beings, plants and animals, are more complicated and less general than those of inorganic inanimate bodies, but also that the study of organized beings should commence with the most simply constructed, the conditions of whose existence are less complicated, and proceed step by step, first through the vegetable kingdom and then through the animal kingdom up to the most complicated and restricted.

The study of the mechanical, astronomical, physical, and chemical phenomena of the globe; the study of the mechanical, physical and chemical structure and relations of all vegetables and animals; the study of the relations of the physical and chemical forces to each other, and the vital principle, form the necessary introduction to the study of the phenomena of man; the elements of whose physical structures are derived from the exterior world through the vegetable kingdom and undergo perpetual changes, like those carried on amongst the elements of the surrounding universe, under the action of the great forces, heat and gravitation, which work unceasingly throughout all nature —whose structures pass through successive stages of development, analogous to the progressing stages of development manifested in a permanent form in the lower animals, and are worked by mechanical and physical forces—and whose intellect directs and controls the forces of matter.

The complete knowledge of the relations of the intellectual and moral constitution of man alone, requires the knowledge of the relations of the moral and intellectual faculties of man, to the material structures by which they are surrounded—requires the knowledge of the nature, origin and development of all science—requires the knowledge of the constitution, phenomena and progress of the moral and intellectual faculties as revealed in all history scientific, civil, and religious, past and present.

PHYSIOLOGY.

PHYSIOLOGY, which rests upon astronomy, physics, chemistry and anatomy, and which could never have attained to the rank of a science, without those fundamental sciences, should form the third grand division of medical sciences; and can never be thoroughly comprehended without the knowledge of astronomy, physics, chemistry and anatomy.

That physiological phenomena depend as absolutely for their existence and manifestation upon astronomical phenomena, as upon physical and chemical phenomena, may be rendered evident by even a casual glance at the facts, that astronomical phenomena affect all bodies, whether they belong to this world or to the countless systems scattered through the great ocean of space; the law of gravity affects all bodies, inorganic and organic, inanimate and animate, and forms an essential condition for the existence of the universe in its present order; the plants and animals of our globe have all been constructed with exact reference to its structure, mass, and force of gravity, and the forces of the sun and sister planets, and fixed stars; if the mass and force of gravity of our earth were increased or diminished whilst the plants and animals retained their present constitution, the mechanics and chemistry of organized beings would be deranged; the weight of the moon and her distance from the earth, the distance of the earth from the sun and sister planets, the relations of the earth with the fixed stars, the length of the year and day, the inclination of the earth's axis, the size and shape of its orbit, and the duration and revolution of the seasons, and the character and intensity and distribution of the forces of the sun, have all been arranged by the great Architect, with exact reference to the constitution and preservation of the organized beings existing upon our globe; a single alteration in the astronomical relations of our globe would result in the complete destruction of animated beings.

We will consider more fully the extensive application of the facts of chemistry, to all the arts of life—to metallurgy, to agriculture, to medicine and to physiology and hygiene. All the essential facts of physiology and of sanitary science rest absolutely upon the labors and discoveries of the chemist.

It is to the chemist that we look for all the essential knowledge of the wonderful phenomena of circulation, respiration and nervous action.

We have thus presented a general view of the relations of the grand divisions of science, and endeavored to unfold the principles of the logical classification and philosophical evolution of the departments of human knowledge.

Field for Moral, Physical and Intellectual Development of Man.

The great fields for the physical, moral and intellectual development (*education*) of the human race are:

1st. The Family.

2d. The Church.

3d. The School.

4th. The College.

5th. The University.

The first four schools should furnish the essentials of a moral, intellectual, scientific and liberal education, and prepare the individual for the prosecution of special lines of study, such as the application of physics and chemistry to the arts, agriculture and medicine, and furnish rules for the moral conduct of man in his social and political relations.

The earliest education at all times, past and present, is that of the FAMILY.

Every child must be trained to acquire that knowledge and those arts which will help in the maintenance of the economy of the household and which will add to the comfort, happiness and support of the parents.

The child should be taught to yield cheerful and implicit obedience to the parental authority, and love should be founded upon mutual respect and confidence.

As the family is the fountain of life and strength to the State and nation, we cannot have a law-abiding and united people, and a vigorous and healthy national life, if the education of the children in the family be defective. A wholesome respect for the sanctity and majesty of law must first be engendered in the heart of the boy in his own home and by the father and mother who bore him. Lawlessness and vice in the social relations, and corruption in politics and injustice in the conduct of government and in the administration of the laws, have their origin in defective family education. We cannot expect the development of a pure, healthy and noble race of women and men, when the blood of the mother and father has been poisoned by the contagion of vice, and the debasing effects of alcohol. Can the vulture breed the eagle? Can the jackal engender the lion?

From all ages the CHURCH *has been a source of education*. The earliest physical and intellectual training of man was acquired by the practice of the arts of the chase and war, and subsequently of those of agriculture. Savage man viewed all natural phenomena with superstitious awe, and he was easily led to hero worship, and the erection of the physical forces of nature, into innumerable benign and evil deities, the fantastic creation of his own fears and imagination. The belief in the immortality of the soul, and of a future existence of pain or pleasure in accordance with the good or bad acts of each individual, has been wide-spread at all times and amongst most races, and has underlain and given form and life to religious superstitious systems, beliefs and rights.

As soon as an educated priesthood took the place of *diviners, sorcerers and jugglers*, who abused the credulity of the earlier races, the PRIEST *or* representative of the superstitious and religious ideas, became a potent factor in the affairs of education, as well as those of government.

We find the SCHOOLS OF THE PROPHETS established at an early day in Egypt and Persia.

The training required for imposing religious ceremonials, the life of the priest apart from the family, the accomplishments of writing, reading and music, formed a nidus for the organization of culture, and an opportunity for the efforts of a philosopher in advance of his age. The schools of Egypt, Assyria and Persia, although in a manner theological, were largely educational. The Hebrews had little or no effect upon the progress of science, but the obligations of the human race to the learning and science of the priests of the Nile valley are great indeed. Much of their learning is obscure at this day; but there is reason to conclude that there is no branch of science in which they did not progress, at least so far as observation and careful registration of facts could carry them.

The priests of Egypt were a source of enlightenment to surrounding nations, even to the great law-giver of the Hebrews; and those poets, historians and philosophers who at a later age were most active in stimulating the nascent energy of Hellas, were careful to trace their ideas and philosophy and cosmogonies and arts to the wisdom of the Egyptians. Greece, in giving her undying name to the literature of Alexandria, was only repaying the debt she had incurred centuries before.

Education became secular in those countries where the priesthood did not exist as a separate body. At Rome, until Greece took her conqueror captive, a child was trained in the arts of life in the Forum and in the Senate House.

The Greeks were the first to develop a system of education distinct from ecclesiastic training, and Plato is the author of the first systematic treatise on education.

The University.

The university should furnish great libraries, museums, laboratories, schools of arts and sciences, lecture rooms, lecturers, instructors, original investigators, philosophers and learned professors, with every facility and appliance for the full and free prosecution of the highest branches of human knowledge.

The fully equipped university should embrace distinct departments for theoretical, practical, scientific and professional education, as:

1. Natural History.—(a) Botany; (b) Mineralogy; (c) Zoölogy; (d) Biology; (e) Comparative Anatomy; (f) Ethnology; (g) Physiology; (h) Climatology; (i) Physical Geography; (j) Geology; (k) Natural History, or geographical distribution and progressive development and comparative embryology and structure of plants, animals and man.

2. Theoretical and Applied Mathematics, Physics, Astronomy, Mechanics and Chemistry.—(a) Mathematics, theoretical and applied, abstract and concrete; (b) Astronomy; (c) Physics; (d) Mechanics; (e) Civil Engineering; (f) Metallurgy; (g) Mining Engineering; (h) Mineralogy; (i) Chemistry, inorganic and organic; (j) Technical Chemistry; (k) Agricultural Chemistry; (l) Agriculture.

3. Medical Science and Art.—(a) *Physics* in their relations to mechanical, chemical, cosmic and vital phenomena; (b) *Inorganic and Organic Chemistry;* (c) *Chemistry* in its application to the preparation, manufacture and determination of reagents, tests, chemicals and

medicinal agents; (d) *Physiological Chemistry;*(e)*Pathological Chemistry;* (f) *Materia Medica*, medical botany, medical mineralogy, physical and chemical and therapeutical properties, and physiological and toxicological action of remedial agents—natural history, origin and preparation of mineral and vegetable medicines; (g) *Comparative and Human Anatomy;* (h) *Pathological Anatomy;* (i) *Pathology*; (j) *Biology*, embryology; (k) *Physiology*, comparative and human; (l) *Therapeutics;* (m) *Toxicology;* (n) Theory and Practice of Medicine; (o) *Obstetrics;* gynecology; abdominal and genito-urinary surgery; (p) Diseases of Women and Children; (q) *Theoretical and Practical Surgery*, surgical pathology, laryngology, dental and aural surgery; ophthalmology, otology, surgery of abdominal and genito-urinary organs; (r) *Hygiene;* (s) *Medical Jurisprudence.*

4. LEGAL SCIENCE.—(a) General Principles of Civil, Commercial and International Law; (b) Civil Law; (c) Criminal Law; (d) Commercial Law; (e) National and International Law.

5. LANGUAGE.—(a) *Ancient Languages*: Sanscrit, Arabic, Chinese, Hindoo, Egyptian, Greek, Latin; (b) *Modern Languages:* English, French, German, Russian, Italian and Spanish; (c) Philosophy of Language; (d) History of Language, mode of origin and progressive development.

6. HISTORY.—(a) History of Ancient Nations; (b) History of Modern Nations; (c) Philosophy of History.

7. *Military Science.*

8. *Naval Science.*

9. *Theology.*—(a) Didactic; (b) Pastoral; (c) Logic; (d) Mental Philosophy; (e) Philology; (f) Languages: Sanscrit, Hebrew, Egyptian, Greek, Latin; (g) Natural Theology; (h) Theoretical and Practical Theology.

10. *Arts—Fine Arts.*—(a) Drawing; (b) Painting; (c) Sculpture; (d) Music; (e) Poetry.

It appears to be reasonable to hold that the United

States of America should establish at a locality as near as possible to the center of population of the Republic, a NATIONAL UNIVERSITY to which all the colleges and universities of the individual States should be tributary.

Each State should be represented by its most eminent men in the various branches of human knowledge, and the National University should be amply endowed with scholarships, to be filled by the most intelligent and worthy young men of the several States, who have won their special positions by competitive examinations. Thus, the humblest, as well as the richest citizen of the United States, would have an opportunity, upon merit, and merit alone, to enter the door of the temple and be maintained free of expense during the prosecution of his studies, and would have unfolded to him the theoretical and practical learning, wisdom and science of all countries and of all ages. The National University should be removed from political influences and should be situated within the great valley of the Mississippi, so as to be equally accessible to all portions of this vast republic. The government of the United States of America maintains its army and navy, and its military and naval schools; why then should not the money of the people be applied to the accomplishment of the greatest good by the development and education of the highest and noblest powers, intellectual and moral, of her citizens?

The system of education in each State should be modelled upon the highest and most philosophic plan, and the individual public schools, colleges and State universities should form component parts of one grand system, culminating and finding its highest expression in the *National University*. Each State should organize a graded system of public schools and colleges, from the grammar school up to the university.

Education descends from above to the masses; from the highly educated to the ignorant; hence, the State promotes the highest ends of education, not merely by the establishment of common schools, accessible to all, but also by founding and sustaining institutions in which the highest and best instruction in the branches of theoretical and applied science, in chemistry, mathematics, mechanics, physics, agricultural chemistry, languages, law, medicine, and in all the branches of human knowledge, may be accessible to the best minds in the commonwealth.

Medical Education.

The principles upon which the education of medical students should be conducted do not differ from those already unfolded; the student who designs becoming a physician should, in his collegiate course, bend his mental energies to those branches of science as Physics, Chemistry, Biology, Comparative Anatomy, Physiology and Botany, which are most intimately connected with the science of medicine. The want of preliminary and thorough scientific training is the source of incalculable and almost unremediable difficulty to the medical student in the pursuit of the different branches of Medical Science.

It is of importance that the medical student should form correct and enlarged views, as to the nature, scope and mutual relations of the different branches of knowledge included under the general term Medical Science.

Up to a comparatively recent period the majority of American medical colleges presented in their working courses seven Professorships or Lectureships under the following heads:

1. Chemistry and Pharmacy.
2. Materia Medica and Therapeutics.
3. Anatomy.
4. Physiology and Pathology.
5. Obstetrics.
6. Surgery.
7. Theory and Practice of Medicine.

The advances made in all branches of knowledge, and especially in the science of medicine, during the past century have exceeded in extent and value those of all past ages ; and it is no longer possible to compress its vast domain within the narrow limits of "SEVEN PROFESSORSHIPS," or to compass its circle within the brief span of less than THIRTY MONTHS.

The present age owes its wonderful progress to experimental scientific research.

The value and perfection of modern educational systems are due to a large extent to practical demonstrations in the fields of physics, chemistry, physiology, pathology, therapeutics and clinical medicine.

Universities of learning and science must be regarded as composed of two distinct bodies. On the one hand must be ranged the organizing powers and executive officers—the trustees and professors; and on the other hand, the greater and more useful body, the grand army of the ALUMNI. The voice of the latter should not be silent, but should speak in thunder tones, demanding a firm, wise and steady enlargement and practical advance of the colleges and universities all along the lines of literature, art and science.

We propose to consider the relations of the various branches of knowledge, grouped under the head of the Art and Science of Medicine, and to present such an analysis of each, as shall illustrate at once their mutual and scientific development and possibilities.

In accordance with the principles of classification previously laid down we shall proceed from the general to the complex and restricted. The science of medicine will thus resemble a pyramid, the broad base of which rests upon the physical and chemical phenomena of inorganic, organic and living matter.

PHYSICS AND CHEMISTRY.

The study of the physical forces should precede that of chemistry proper.

The science of chemistry has contributed more to the physical and industrial progress and wealth of the human race than all the other branches of knowledge. Chemistry is the basis of hygiene and physiology, and it has furnished facts of inestimable value to the agriculturist, to the mining engineer, and to the manufacturing chemist.

The introduction of the study of inorganic and organic chemistry into the public schools of Louisiana and of all the States and territories of the Republic will not only aid in the intellectual training of the children, but will aid materially in the agricultural and mining progress and development of the States.

Chemistry is an experimental science. Its conclusions and principles are supported by *facts*. If our knowledge were bounded simply by the observation of the facts and phenomena presented by nature it would be limited and uncertain in its nature. To supply the deficiency, the philosopher has resorted to *experiments*.

It may be said, without exaggeration, that nine-tenths of the facts upon which the science of chemistry is founded have been evolved by artificial means; and without the great body of truth thus furnished by experiment, the science could not have existed.

It is impossible for the student of chemistry and of medical science, to overestimate the importance of this great branch of knowledge, which not only enlarges to the greatest extent the power and dominion of man over the powers and properties of matter, administers to the wants and comforts and pleasures of life, and arms the skillful physician with his most sure and potent weapon in the treatment and prevention of disease, but it also, in a pre-eminent degree, develops and strengthens the mind of the medical student, by the habit of careful experimental research, accurate observation and patient and deep thought, which its practical study in the laboratory developes.

In becoming familiar with chemical experiments and manipulation, the medical student not only observes the most important properties and phenomena of nature, by actual demonstrations, but he gains that knowledge which may enable him when properly applied, to extend the bounds of our knowledge. After he has learned not only how to devise experiments, but also skillfully to perform them, whenever a doubt or question arises in his mind, as for instance concerning the purity and efficacy of his drugs, or the nature and action of morbid products, he will find that it will be best answered by the result of *actual experiment.*

Whatever preliminary knowledge therefore enables the medical student to perform experiments in the quickest and most correct manner, should be esteemed by him of the *utmost value.* Experiment becomes to the student like the external senses to the mind—channels of information, by not merely unfold'ng and illustrating the direct object of inquiry, but also opening collateral views, which pursued and extended, terminate in additional chains of information and discovery.

"Nothing" as Dr. Johnson observes, "is to be considered as a trifle by which the mind is inured to caution, foresight and circumspection. The same skill, and often the same degree of skill, is exerted in great and little things."

Medical Physics ane Medical Chemistry.

A comprehensive course of lectures on Medical Physics and Medical Chemistry, to be of practical value to the practitioner of medicine, should embrace:

I. *Medical Physics.* Molecular Constitution of Matter. Specific Gravity. Weights and Measures. Osmosis. Diffusion of Gases. *Heat.* Manufacture and Uses of Thermometers. Agencies of Heat. Climate. Heat as a Therapeutical Agent. Sources of Heat. *Light.* Structure and Uses of the Microscope. The Spectroscope and Spectroscopic Analysis. Relations of Light and Heat to Plants and Animals. *Electricity, Static and Dynamic.* Magnetism. Galvanism. Relations of Elect.icity to Chemical Affinity. Agencies of Electricity. Application of Electricity to the treatment of diseases. Relations of the Physical, Chemical and Vital Forces.

II. *Medical Chemistry.* Chemical Affinity. Chemical Nomenclature and Notation. Classification of Elements and their Compounds. Chemical Reagents. Analysis. Synthesis. Inorganic Chemistry. Chemistry of the Non-Metals. Pharmaceutical Operations with the Metalloids. Toxic properties and therapeutic properties of the

Non metals and their Compounds. *Chemistry of the Metals.* Pharmaceutical prerarations of the Metals and their Compounds. *Organic Chemistry.* Carbon and its Compounds. Pharmaceutical preparation, therapeutic application and toxic properties of Organic Compounds.

III. *Vegetable Chemistry.*

IV. Animal Chemistry.

V. Pathological Chemistry.

Each simple body may be considered in its relations to the physical forces, and with reference to its relative chemical powers, as will be fully illustrated by the following tables:

TABLE I.—CLASSIFICATION OF THE ELEMENTS IN ELECTRO-CHEMICAL, MAGNETIC AND DIAMAGNETIC ORDER.

Electro-Chemical Order.		Magnetic and Diamagnetic.	
Electro-Negative.	Electro-Positive.	Magnetic.	Diamagnetic.
Oxygen,	Gold,	Iron,	Bismuth,
Sulphur,	Platinum,	Nickel,	Phosphorus,
Selenium,	Palladium,	Cobalt,	Antimony,
Nitrogen,	Mercury,	Manganese,	Zinc,
Fluorine,	Silver,	Chromium,	Silico-bor. of lead
Chlorine,	Copper,	Cerium,	Tin,
Bromine,	Bismuth,	Titanium,	Cadmium,
Iodine,	Tin,	Palladium,	Sodium,
Phosphorus,	Lead,	Crown Glass,	Flint Glass,
Arsenicum,	Cadmium,	Platinum,	Mercury,
Chromium,	Cobalt,	Osmium,	Lead,
Vanadium,	Nickel,	Oxygen.	Silver,
Molybdenum,	Iron,		Copper,
Tungsten,	Zinc,		Water,
Boron,	Manganese,		Gold,
Carbon,	Uranium,		Alcohol,
Antimony,	Aluminium,		Ether,
Tellurium,	Magnesium,		Arsenicum.
Silicon,	Calcium,		Uranium,
Hydrogen,	Strontium,		Rhodium,
	Barium,		Iridium,
	Lithium,		Tungsten,
	Sodium,		Nitrogen.
	Potassium.		

TABLE II.—CLASSIFICATION OF THE ELEMENTS IN GROUPS, ACCORDING TO THEIR *CHEMICAL EQUIVALENCY* IN RELATION TO HYDROGEN. THE ATOM OF ONE ELEMENT IS BY NO MEANS NECESSARILY EQUIVALENT IN CHEMICAL POWER TO THE ATOM OF ANOTHER ELEMENT.

MONADS. Elements Usually Equivalent to 1 Atom of Hydrogen.	DYADS. Elements Usually Equivalent to 2 Atoms of Hydrogen.	TRIADS. Elements Usually Equivalent to 3 Atoms of Hydrogen.	TETRADS. Elements Usually Equivalent to 4 Atoms of Hydrogen.	PENTADS. Elements Usually Equivalent to 5 Atoms of Hydrogen.	HEXADS. Elements Usually Equivalent to 6 Atoms of Hydrogen.
Hydrogen.	Oxygen.	Nitrogen.	Carbon.	Niobium.	Molybdenum.
Fluorine.	Sulphur.	Phosphorus.	Silicon.	Tantalum.	Vanadium.
Chlorine.	Selenium.	Arsenicum.	Titanium.		Tungsten.
Bromine.	Tellurium.	Antimony.	Tin.		Osmium.
Iodine.	Barium.	Bismuth.	Zirconium.		Chromium
Lithium.	Strontium.	Gold.	Thorium.		Manganese
Sodium.	Cadmium.	Rhodium.	Lead.		
Potassium.	Magnesium	Boron.	Platinum.		
Rubidium.	Zinc.	Aluminium.	Palladium.		
Cæsium.	Copper.		Iridium.		
Thallium.	Mercury.		Ruthenium.		
Silver.	Lanthanum		Iron.		
	Didymium.		Cobalt.		
	Glucinum.		Nickel.		
			Cerium.		
			Uranium.		

The equivalent power of an element may be indicated by affixing dashes or Roman numerals to its symbol.

TABLE III.—CLASSIFICATION OF THE ELEMENTS.

I.—NON-METALS.

The non-metallic elements are fourteen in number, exclusive of Arsenic, which by some chemists has been grouped with Sulphur, Selenium, Tellurium and Phosphorus. We have, however, classed Arsenicum amongst the metals which it resembles in some of its properties.

		Symbol.	Atomic Weight.			Symbol.	Atomic Weight.
(1).	Oxygen,	O	15.96	(2).	Chlorine	Cl	35.37
	Hydrogen	H	1		Bromine	Br	79.75
	Nitrogen	N	14.01		Iodine	I	126.53
	Carbon	C	11.97		Fluorine	F	19.00
(3).	Phosphorus	P	30.96	(4).	Boron	B	11.0
	Sulphur	S	31.98		Silicon	Si	28.0
	Selenium	Se	78.0				
	Tellurium	T	128.0				

II.—METALS: 49 in number.

(5).	Potassium	K	39.04	(11).	Manganese	Mn	54.8
	Sodium	Na	22.99		Iron	Fe	55.9
	Lithium	Li	7.01		Cobalt	Co	58.6
	Rubidium	Rb	85.2		Nickel	Ni	58.6
	Caesium	Cs	133.0				
(6).	Calcium	Ca	39.9	(12).	Chromium	Cr	52.4
	Strontium	St	87.2		Molybdenum	Mo	95.6
	Barium	Ba	136.8		Tungsten	W	184.6
					Uranium	U	240.0

(7).	Beryllum.........Be		90.
	Magnesium....., Mg		23.94
	Zinc.........Zn		64.9
	Cadmium ....Ca		111.6
(8).	Lead ....Pb		206 4
	Thallium.........Th		203.6
(9).	Copper.........Cu		63.0
	Silver.........Ag		107.66
	Mercury ....Hg		198.8
(10).	Yttrium.........Y		93.
	Cerium.........Ct		141.2
	Lanthanum.........La		139.0
	Didymium ....Di		147.
	Erbium ....Er		169.
	Aluminium.........Al		27.3
	Iridium.........Ir		113.4

(13).	Tin.........Sn	117.8
	Titanium.........Ti	48.0
	Zirconium.........Zr	90,0
	Thorium.........Th	231.3
(14).	Vanadium.........V	51.2
	Arsenicum.........As	74.9
	Antimony.........Sb	122.0
	Bismuth.........Bi	210.0
	Tantalum.........Ta	182.0
	Niobium.........Nb	94.0
(15).	Gold.........Au	196.2
	Platinum.........Pt	196.7
	Iridium.........Ir	196.7
	Osmium.........Os	198.6
(16).	Ruthenium.........Ru	103.5
	Rhodium.........Rh	104.1
	Palladium.........Pd	106.2

Of these 63 elements, a distinction must be drawn as to their relative utility and importance to the medical student; and this elimination of the extended consideration of the more rare and less useful elements and their compounds from the curriculum of medical chemistry has proved of value and great importance to the speaker, in that it has enabled him to concentrate the energies of his students upon those elements and their compounds which enter into the composition of the body of man, and which furnish his most valuable remedial agents. This proposition will be illustrated by the following:

Table IV.—Elements Concerned in the Chemical Changes Taking Place in Life.

Non-Metallic		Metallic	
Oxygen,	Sulphur,	Potassium,	Aluminium,
Hydrogen,		Sodium,	Iron,
Nitrogen,	Phosphorus,		
Carbon,		Calcium,	Manganese.
	Chlorine,	Magnesium.	
Silicon,	Iodine.		

Of the preceding 16 simple bodies connected with the chemical changes taking place in life, we find that very few are absolutely essential to the formation of the protoplasm of the vegetable and animal kingdoms, namely: oxygen, hydrogen, nitrogen and carbon. Oxygen and nitrogen constitute the atmosphere; oxygen and hydrogen combine to form water, the most widely diffused of all liquids, and absolutely essential to all animal and vegetable development, evolution and growth; carbon, in various combinations with oxygen and hydrogen, forms the basis and frame-work of all organic compounds.

The physics and chemistry of water embrace the physics and chemistry of the crust of our globe and of the animal and vegetable kingdoms.

Without the physical and chemical properties of water we could have no manifestation of animal or vegetable life. Without the peculiar chemical and physical constitution of the atmosphere all life would be impossible as now known to the human intellect.

Of the 63 elements only 4 occur in the air; about 30 have been detected in the sea, and the remainder are found irregularly distributed through the solid mass of our earth.

The following table gives the proportion of the chief constituents of the earth's crust; all the other elements occur in quantities less than any of those mentioned.

TABLE V.—THE COMPOSITION OF THE EARTH'S SOLID CRUST IN 100 PARTS BY WEIGHT.

Oxygen	44.0 to 48.7	Calcium	6.6 to 0.9
Silicon	22.8 to 36.2	Magnesium	2.7 to 0.1
Aluminium	9.9 to 6.1	Sodium	2.4 to 2.5
Iron	9.9 to 2.4	Potassium	1.7 to 3.1

What determined this distribution of the elements?

Why should oxygen, the most important of all elements to the origin and development and perfection of plants, be at the same time the most abundant and widely distributed of all the elements?

Did the vegetable and animal kingdoms pre-arrange and pre-determine the chemical and physical proportions and relation of the crust of the globe and its aqueous and aerial envelopes?

Were the forces emanating from the sun, by which all vegetable and animal life is sustained on this earth, engendered by, or in any manner related, as cause and effect to he physical and chemical forces of the sun?

Everywhere in this universe we find a mutual relation and correlation of the physical and chemical forces; and upon their uniform relations or laws, as determined by one all-pervading and all-mighty cause, rest manifestations of life and intellect.

The great importance of a thorough knowledge of the chemistry of oxygen, hydrogen and nitrogen to the medical student and practitioner, is most clearly illustrated by the following table, giving the chemical equivalents of certain organic compounds:

TABLE IV.—CHEMICAL EQUIVALENTS.

Albuminoids (Lieberkuhn),	$C_{72}H_{112}N_{18}SO_{23}$	Kreatin	$C_4H_9N_3O_2$
Excretin	$C_{78}H_{156}SO_2$	Kreatinin	$C_4H_7N_3O$
Taurocholic acid	$C_{26}H_{45}NO_7S$	Uric or lithic acid	$C_5H_4N_4O_3$
Glycocholic acid	$C_{26}H_{43}NO_6$	Urea	CH_4N_2O
Cholic acid	$C_{24}H_{40}O_5$	Oxalic acid	$C_2H_2O_4$
Taurin	$C_2H_7NO_3S$	Starch	$C_6H_{10}O_5$
Glycocin	$C_2H_5NO_2$	Dextrin	$C_6H_{10}O_5$
Bilirubin	$C_{16}H_{18}N_2O_3$	Glycogen	$C_6H_{10}O_5$
Biliverdin	$C_{16}H_{20}N_2O_5$	Cane sugar	$C_{12}H_{22}O_{11}$
Tyrosin	$C_9H_{11}NO_3$	Glucose	$C_6H_{12}O_6$
Leucin	$C_6H_{13}NO_2$	Lactose	$C_6H_{12}O_6$
Hippuric acid	$C_9H_9NO_3$	Inosite	$C_6H_{12}O_6$
Xanthin	$C_5H_4N_4O_2$	Lævulose	$C_6H_{12}O_6$
Cystin	$C_3H_7NSO_2$	Cholesterin	$C_{26}H_{44}O$

For purposes of systematic study we have arranged the non-metals in four groups and the metals in twelve groups, but it must be observed,

1. That such classifications are, to a certain extent, arbitrary. Thus we may arrange the metals in eight groups as follows:

1. METALS OF THE ALKALIES, 5 in number—1, Potassium; 2, Sodium, 3, Lithium; 4, Caesium; 5, Rubidium.

2. METALS OF THE ALKALINE EARTHS, 3 in number—6, Barium; 7 Strontium: 8, Calcium.

3. METALS OF THE EARTHS, 8 in number—9, Aluminium; 10, Glucinum; 11, Yttrium; 12, Erbium; 13, Terbium; 14, Cerium; 15 Lanthanum; 16, Didymium.

4. METALS MORE OR LESS ANALOGOUS TO IRON, 6 in number—17, Cobalt; 18, Nickel; 19, Uranium; 20, Iron; 21, Chromium; 22, Manganese.

5. MAGNESIAN METALS, 3 in number—23, Magnesium; 24, Zinc; 25, Cadmium.

6. METALS WHICH YIELD ACIDS WHEN THEIR HIGHER OXIDES ARE COMBINED WITH WATER, 12 in number—26, Tin; 27, Titanium; 28 Zirconium; 29, Thorium; 30, Molybdemum; 31, Tungsten; 32, Niobium; 33, Tantalum; 34, Vanadium; 35, Arsenicum; 36, Antimony; 37, Bismuth.

7. FOUR METALS—38, Copper; 39, Lead; 40, Thallium; 41, Iridium.

8. NOBLE METALS, 9 in number—42, Mercury; 43, Silver; 44, Gold; 40, Platinum; 46, Palladium; 47, Rhodium; 48, Ruthenium; 49, Osmium; 59, Iridium.

If a strictly natural order were to be followed in grouping the elements it would be necessary to modify the foregoing arrangement. In many instances these natural relations between the individual elements thus grouped together are very striking, in others they are more obscurely marked and in the case ot the metals of the earth proper, as well as of the noble metals, the natural chemical relations of their elements with the others are as yet but incompletely known.

The metals may also be classified for analytical purposes and for purposes of ready detection, according to their behavior with certain chemical reagents as hydrosulphuric acid, hydrosulphate of ammonia and carbonate of ammonia, as in the following table.

ANALYTICAL CLASSIFICATION OF THE METALS.

I.	II.	III.	IV.	V.
Metals, the solutions of which are precipitated by HYDROCHLORIC ACID, because their compounds with chlorine (chlorides) are insoluble or nearly so, in water and in diluted acids.	Metals, the solutions of which are precipitated by HYDROSULPHURIC ACID in the presence of hydrochloric acid, because their compounds with sulphur (sulphides) are insoluble in water and cold diluted acids.	Metals, the solutions of which are precipitated by HYDROSULPHATE OF AMMONIA in the presence of ammonia, because the sulphides of the first five and the oxides of the last two are insoluble in water and in ammonia or its salts.	Metals, the solutions of which are precipitated by CARBONATE OF AMMONIA because their carbonates are insoluble in water and in ammonia or its salts.	Metals, the solutions of which are not precipitated by the foregoing tests.
Lead. Silver. Mercury (in the mercurous or proto-salts)	Lead. Mercury (in the mercuric or per-salts). Bismuth. Copper. Tin. Antimony. Arsenic.	Iron. Nickel. Cobalt. Manganese. Zinc. Aluminium. Chromium.	Barium. Strontium. Calcium.	Magnesium. Potassium. Sodium. Ammonium.

The preceding facts illustrate the vast extent and complexity of the science of chemistry, and the impossibility of covering the entire field in the short space of five months.

The great defect in the system pursued in the majority of American medical colleges is the want, in the first place, of preliminary training, and, in the second place, of the necessary time, and, in the third place, of carefully graded courses.

It is manifestly impracticable for the professor of chemistry to give an equal amount of time to the consideration of the individual elements.

An extended experience as a teacher of medical chemisistry has led to the adoption of the following plan of instruction as best adapted to establish the most thorough knowledge of those branches of chemical science which will be of the greatest scientific and practical utility to the medical student and practitioner:

1st. The individual elements are considered in their relative importance in their relations to the chemical constitution and processes, and to the treatment of diseases of man, as in the following order:

Non-Metals.

1. Oxygen.
2. Hydrogen.
3. Nitrogen.
4. Carbon.
5. Phosphorus.
6. Sulphur.
7. Chlorine.
8. Bromine.
9. Iodine.

Metals.

1. Potassium.
2. Sodium.
3. Calcium.
4. Magnesium.
5. Iron.
6. Antimony.
7. Arsenic.
8. Mercury.
9. Lead.
10. Copper.
11. Zinc.
12. Silver.
13. Bismuth.
14. Tin.
15. Nickel.
16. Gold.
17. Manganese.
18. Lithium.

2d. Each element is considered in its four-fold relations, namely:

(a) Natural history, properties, geological and geographical distribution, mode of extraction and preparation.

(b) Physical and chemical properties, relations and compounds.

(c) Physiological and therapeutical properties and relations. Relations to organic compounds.

(d) Poisonous properties. Toxic effects and antidotes.

ORGANIC CHEMISTRY.

The complexity and the vastness of the field now covered by the modern science of Organic Chemistry may be demonstrated by a mere enumeration of the more important chemical processes and compounds.

ORGANIC CHEMISTRY, OR THE CHEMISTRY OF THE HYDRO CARBONS AND THEIR DERIVATIVES.

Organic Analyses: Classification of Organic Bodies; Metamorphorsis; Synthesis. Differences between Organized and Organic Bodies. Differences between Organic and Inorganic Compounds.

Ultimate Organic Analysis: Determination of Carbon, Hydrogen, Oxygen, Nitrogen, Chlorine, Bromine, Iodine, Phosphorus, Sulphur, and other elements. Calculation of Analysis, Determination of Vapor Density. Determination of Molecular Formulæ. Empirical and Rational Formulæ.

CLASSIFICATION OF THE CARBON COMPOUNDS.

I. FATTY BODIES.—PARAFFINS.

Fractional distillation.

II. THE COMPOUNDS OF THE MONAD ALCOHOL RADICALS.

The Alcohols and their Derivatives. General Principles of Classification, Homologous Series; Illustration from the Alcohols. Collateral series. Theory of Compound Radicals. Theory of Isolated Radicals—Atoms. Molecules. Chemical Types. Theory of Multivalent or Polyad Elements.

Production of Chemical Metamorphosis by Oxidation, Reduction and Substitution. Synthesis of Organic Compounds.

Different Varieties of Fermentation. Products of Fermentation.

Synthesis of the Primary Alcohols and the Fatty Acids. Secondary Alcohols and Ketnos. Tertiary Alcohols. The Methyl Group. Methane or Methyl Hydride. Methyl Alcohol. Methyl Oxide or Di-Methyl Ether. Ethereal Salts of Methyl. Sulphur, Tellurium, Selenium, Compounds of Methyl. Nitrogen Basis of Methyl, Cyanogen, Compounds of Methyl. Nitro-compounds of Methyl. Phosphorus Compounds of Methyl. Arsenic Compounds of Methyl, Cacodyl or Dimethylarsine Compounds.

Compounds of Methyl with Antimony, Boron, and Silicon. Metallic Compounds of Methyl, Trichlormethane or Chloroform.

The Formyl Group. Formic Aldehyde: Formic Acid, the Formates.

The Ethyl Group. Ethane, Ethyl Alcohol, Alcoholometry. The Alcoholates, Ethylates, Ethyl Ether, or Ethyl Oxide, Chlorine substitution products of Ether. The Ethereal Salts of Ethyl or Ethyl Compound Ethers: Ethyl Sulphuric Acid, Ethyl Sulphates, Ethyl Nitrites and Nitrates, Phosphites and Phosphates of Ethyl. Arsenites, Arsenates and Borates of Ethyl, Ethyl Silicates, Carbonates, Ethyl Formates, Sulphur Compounds of Ethyl, Xanthic Acid, Compounds of Ethyl with Selenium and Tellurium, Nitrogen bases of Ethyl, Cyanogen Compounds of Ethyl, Ethylated Ureas, Ethyl Semicarbonides, Ethylated Thio-Ureas, Nitro-Compounds of Ethyl, Phosphorus, Arsenic, Antimony, Bismuth, Boron and Silicon Compounds with Ethyl, Compounds of Ethyl with the metals.

Actyl Compounds: Acetic Acid, the Acetates or the Salts and Ethers of Acetic Acid, Haloid Compounds of Acetyl, Sulphur and Nitrogen Compounds of Acetyl.

Acetonitril and its Derivatives. Methyl Cyanide, Pulmonuric Acid.

Substitution Products of Acetic Acid. Chlorine substitution products, Mono-Chloracetic Acid, Dichloracetic Acid, Trichloracetaldehyde or Chloral, Chloral Hydrate, Trichloracetic Acid, Bromine and Iodine substitution products.

III. COMPOUNDS CONTAINING THREE ATOMS OF CARBON, OR THE PROPHYL GROUP.

IV. COMPOUNDS OF FOUR ATOMS OF CARBON OR THE BUTYL GROUP.

V. COMPOUNDS CONTAINING FIVE ATOMS OF CARBON OR THE PENTYL GROUP. Pentane and its derivatives.

Isopentine and its derivatives.

The Amyl Compounds. The Amyl Ethers.

VI. Compounds with Six Atoms of Carbon or the Hexyl Group.

VII. COMPOUNDS CONTAINING SEVEN ATOMS OF CARBON OR THE HEPTYL GROUP.

VIII. COMPOUNDS CONTAINING EIGHT ATOMS OF CARBON OR THE OCTYL GROUP, Octyl Compounds, Tetra-Methyl, Butane and its derivatives, Hex-Methyl Ethane, Octric Acids.

IX. COMPOUNDS CONTAINING NINE ATOMS OF CARBON OR THE NONYL GROUP.

X. Compounds Containing Ten Atoms of Carbon or the Decatyl Group, the Capric or Decatyl Acids.

XI. Compounds Containing Eleven Atoms of Carbon or the Hendecatyl Group.

XII. Compounds Containing Twelve Atoms of Carbon or the Dodecatyl Group.

XIII. Compounds Containing Thirteen Atoms of Carbon or the Tridecatyl Group.

XIV. COMPOUNDS CONTAINING FOURTEEN ATOMS OF CARBON OR THE TETRADECATYL GROUP.

XV. COMPOUNDS CONTAINING FIFTEEN ATOMS OF CARBON OR THE PENTADECATYL GROUP.

XVI. Compounds Containing Sixteen Atoms of Carbon or the Hecdecatyl Group.

XVII. Compounds Containing Seventeen Atoms of Carbon.

XVIII. Compounds Containing Eighteen Atoms of Carbon.

XIX. Fatty Acids Containing from Nine to Twenty-five Atoms of Carbon. The Waxes, Fatty Acids, Soap.

XX. Compounds Containing Divalent Radicals. Dyad Alcohol Radicals.

Dioxysuccinic or a Tartaric Acid. Uric Acid Derivatives. The aloxan, parabanic, and allantoin groups, xanthine, sarcine, and guanene caffeine and theobromine guanines.

XXI. Compounds of Trivalents or Triad Radicals. Propenyl alcohol or glycerine—the fats or glycerides and glycine acid.

XXII. Compounds of the Monad-Alcohol Radicals. Compounds containing from ten to fifteen atoms of carbon. Oleic Acid.

XXIII. Tribasic Acids. Citric Acid, Citrates, Aconitic Acid.

XXIV. Drying Oils:

XXV. Alcohols of the Tetratomic Radicals. *Alcohols of the Hexatomic.* Radicals. *Carbohydrates.* The sugar group. The Amylose group The Saccharoses.

XXVI. Aromatic Compounds, or Compounds Rich in carbon. Aromatic hydrocarbons. Isomerism in the aromatic group.

XXVII. Dihydroxy-benzine and allied products.

XXVIII. Trihydroxy-benzine, Pyrogallol.

XXIX. Diamidobenzenes.

XXX. Essential Oils and Resins.
Essences, Resins and Glucosides *Coloring Matters, Yellow Dyes, Red Dyes, Blue Dyes.*
Products of Destructive Destillation.
Compounds of Cyanogen: Bases of Animal Origin, Uric Acid and its derivatives.

XXXI. Bases of Animal Origin.—Urea, Kreatine, Kreatinine, Sarkosine, Methyluramine, Guanine, Xanthine, Hypozanthine, Glycosine, Alanine, Leucine, Tyrosine.

XXXII. Uric Acid and its Derivatives, Urates, Products of the decomposition of Uric Acid.

XXXIII. Albuminoid and Gelatinous Principles.—Gelatine, Products of the Oxidation of the Albuminoid and Gelatigenous Groups.
Protein and its Derivatives, Albumin, Paralbumin, Globulin, Vitellin, Fibrin, Casein, Legumin, Gelatin, Orsein, Chondrin.

XXXIV. Chemical Properties of the Solids and Fluids of Animals.
Bones, Cartilage, Silk, Feathers, Hair Sponge, Chitin Cartilage, Muscular Tissue, Juice of Flesh, Inosic Acid, Inisate, Inosin (Muscle-Sugar).
Components of the Brain. Cerebric and Oleophosphoric Acids, Myelin, Protagon and Neurine.
Plastic Nutrient Animal Liquids. Blood, Hæmoglobin, Crurorin or Hæmato-Crystalin, Hæmatin or Hæmatosin.
The Chyle, Milk, Lymph, Saliva, Gastric Juice, Pancreatic Juice, Mucus-Mucin.
The Bile.—Glycocholic Acid, Cholic Acid, Cholates, Choloidic Acid, Dyslysin, Choloidanic Acid, Taurocholic or Cholic Acid, Hyocholic Acid, Taurin, Cholesterin, Cholesterolin, Cholesteric Acid, Lithofellic Acid, Biliary Calculi, Colouring Matters of the Bile, Bilirubin, Cholepyrrhin, Biliverdin.

XXXV. Excrementitious Products.—The Urine in Health and Disease, Constituents of the Urine, Normal, Abnormal, Urinary Sediments and Calculi, Diabetic Urine, Albuminous Urine. Sweat, Cutaneous Excretions, Pulmonary Excretions, Solid Excrements, Excreatine, Excretolic Acid.

We have thus only given the mere names of the subjects and genera of the substances which at present are grouped under the head of "Organic Chemistry," and the bare recital of this formidable catalogue is sufficient to appal and dishearten the brightest and most sanguine student.

How absolutely essential to the progress of the medical students is the faithful guidance of the professor of chemistry who after a survey of the entire domain of organic chemistry selects, arranges and illustrates those subjects and substances which are of the greatest value to the medical student and practitioner?

How shall we estimate the value of careful demonstrations of the great organic groups and of the most important processes of analysis, and of the most important bodies, as the alcohols alcaloids, vegetable and animal products—the composition of the urine and blood in health and disease with all the most important tests, chemical, microscopical and spectroscopical demonstrations!

II.—MATERIA MEDICA.

Materia medica designates that department of medicine which is devoted to the consideration of the chemical, physical, botanical and medicinal properties of remedies.

A thorough knowledge of the nature, strength, source and purity of remedies, should embrace the study of

(a) Botany.

(b) The geographical and geological distribution of minerals, plants and animals, yielding remedies for the treatment of diseases.

(c) The mineralogical characters of remedies.

(d) The chemical relations, reactions and incompatibles of remedies, whether derived from the inorganic or organic kingdoms.

The progress of materia medica as a branch of medical knowledge has been largely dependent upon the progress of chemistry.

In the present state of knowledge we appear to be always on the verge of the most amazing results, and we are often at a loss to know when or where the outcome will be. Chemistry, which used to be chiefly analytical, has latterly shown signs of progress in a new and unexpected direction; it has now become synthetical. There are virtually no limits to the substances which can be made synthetically. Thus, Berthelot, in considering the possible number of combinations with acids of certain alcohols, calculates that if you give each a name, allowing a line for the name, then print 100 lines on a page, and make volumes of 1000 pages, and place a million volumes in a library, it would require 14,000 libraries to contain this catalogue.

Berthelot properly calls such bodies *infinite*, instancing the synthetical construction of the alcohol and aldehyde series, of the organic acids, of the amides, of urea, and the millions of possible bodies which loom in the future.

It is well known that bodies of this nature have important relations to the properties of the nervous system in man. We have but to mention sulphuric ether, chloroform, chloralhydrate, nitrite of amyl and the various amides.

The experiments of Bernard on amygdalin have shown that this question is even more intricate and vast than was expressed by Berthelot.

It is manifest, therefore, that the possible agents for affecting the human body *are infinite*, and that the problems relating to pathology and therapeutics, which may be experimentally discussed and solved in the higher animal organisms, are equally infinite.

It is customary in many medical colleges to combine *Materia Medica and Therapeutics under the same division or chair*. Such combination, however, is neither necessary nor philosophical.

Therapeutics, in that it treats of the use and administration of medicines in the cure of disease, necessarily presupposes on the part of the student something more than a knowledge of chemistry and materia medica—it demands also a knowledge of physiology and pathology.

III.—Pharmacy.

Pharmacy treats of the collection, classification, preparation, preservation and dispensation of medicines. The physical and chemical processes and analytical and synthetical methods of pharmacy do not differ from those of organic and inorganic chemistry. In like manner the chemical reagents are all the results of the operations of the chemist.

A systematic course on PHARMACY should embrace the following subjects:

(a) Laboratory and dispensary stove, furniture, apparatus and implements.

(b) Analysis of the various pharmacopœias, used by the United States of America, the British Empire, the German Empire, the French Republic and other nations.

(c) Specific gravity, weights and measures; modes of generating, measuring, regulating and applying heat, trituration, crystalization, filtration, solution, evaporation and distillation; percolation or the displacement process.

(d) The different parts of plants, their collection, desiccation and powdering.

(e) INORGANIC PHARMACEUTICAL CHEMISTRY.

Non-metallic elements and their medicinal preparations: Inorganic acids, monad metals and their medicinal preparations; dyad, triad, tetrad and pentad metals and their medicinal preparations.

(f) Quantitative and qualitative analysis. Reagents, test solutions, volumetric solutions.

(g) PHARMACY IN ITS RELATIONS TO ORGANIC CHEMISTRY.

(h) Lignine fibre and its derivatives.

(i) Farinaceous, mucilaginous and saccharine principles. Starches, amylaceous medicines, etc. Gums and mucilaginous medicines. Sugars, tests for sugars and other carbohydrates, saccharine group of medicines.

(j) Animal products used in medicines.

(k) Fermentation, alcohols and ethers; alcohol and its derivatives Ether: chloroform, chloral, iodoform, etc.

(l) Fixed Oils and Fats. Fatty Acids. Lead Plaster. Glycerine. Fixed Oils and Fats used in Medicine.

(m) Volatile Oils, Camphors and Resins, and their use in Medicine

(n) Organic Acids used in Medicine.

(o) Organic Alkalies and Alkaloids. Natural and Artificial Quaternary Alkaloids. Native Tertiary Alkaloids. Artificial Tertiary Alkaloids. Opium, Cinchona, Strychnos, Solanaceous and Tertiary Alkaloids. Alkaloids of Animal Origin.

(p) Neutral Organic Principles.

(q) GALENICAL PHARMACY.

(r) Medicinal Waters.

(s) Infusions, Decoctions, Spirits and Tinctures, Medicated Wines, Vinegars, Elixirs and Cordials.

(t) Fluid Extracts.

(u) Syrups, Honeys and Glycerites.

(v) Opium and its Derivatives. Assay of Opium.

(w) Liniments, Powders, Abstracts and Extracts, Resins and Resinoids, Conserves, Confections, Lozenges, etc.

(x) Pills, Pill Masses, Suppositories, Cerates, Ointments, Oleates and Plasters.

(y) EXTEMPORANEOUS PHARMACY.—Prescriptions. Language and Mode of Writing Prescriptions. Of the Art of Selecting and Combining Medicines.

(z) On Dispensing and Compounding Prescriptions. The Furniture of a Physician's Dispensing Office. Dispensing.

The source of medical instruction furnished by a thoroughly equipped medical college should be so full and comprehensive, that the diploma conferring the degree of

Doctor of Medicine should also qualify the graduate to practise the subordinate and inferior art of the druggist or Master of Pharmacy. The success of the druggist should depend absolutely upon the support and encouragement of the physician, otherwise the druggist would usurp the office of the physician and prescribe for diseased people, as well as compound and vend his medicine. Every graduate of a recognized regular school of medicine has undoubtedly the right not merely to prescribe, but also to compound and dispense his own medicines to the sick under his care. If the surgeon is empowered by his diploma to use his knives in operations upon the living human body, in like manner the physician has the inalienable right of preparing and dispensing his own medicines. Without this right the practice of the medical profession would be impossible through vast districts of the United States.

We observe at the present day a constant tendency on the part of retail and wholesale druggists, pharmaceutists and manufacturing chemists, to usurp the functions of the medical profession.

The retail druggist, in many instances, not only retails intoxicating liquors, and sells deadly poisons, but he prescribes for diseases and sells his own preparations or those of the patent medicine vendor. The retail druggist also frequently recommends the prescriptions of the neighboring practitioner, and in not a few instances has obtained patents for the exclusive use of the same.

When druggists pretend to devise and prepare certain medicinal compounds, which they recommend to the public as specifics for the cure of certain diseases, and sell the same to any and every ignorant and unsuspecting dupe, they deliberately usurp the powers and privileges of the regular medical profession, and should be prosecuted for practising medicine without a license. The question of malpractice is also worthy of consideration.

The large manufacturing drug and chemical houses of the commercial centres of the United States and foreign countries not merely subsidize the public press, which literally fattens on their advertisements, but they have invaded the sacred temple of medicine, and planted their emblems, fitly represented by the hog and other unclean beasts, in the very heart of the medical literature of the day.

Whether the medical profession possesses the inherent power to control these evils by first purging its garments, and then invoking the strong arm of the law, remains as one of the grave problems of the future.

The plain duty of our medical schools is to impart that amount of thorough and comprehensive knowledge in chemistry, materia medica, pharmacy, physiology and therapeutics, as will furnish a corps of thoroughly educated and skilled physicians, fully equipped, to guard and guide the public in all matters relating to the preservation of health and the healing of diseases.

The true independence of our beloved Southern country in this and in all other matters relating to her physical and intellectual welfare and progress, must be achieved by enlarging and perfecting our institutions of learning and science, and by the most careful training and the highest moral, intellectual and scientific development of her sons.

IV. Anatomy.

The province of Anatomy is to determine the construction, form and relations of the structures of organized bodies.

(a) Comparative Anatomy.
(b) Human Anatomy (Anthropotomy).
(c) Developmental or Embryological Anatomy.
(d) Morphological Anatomy.
(e) Teleological or Physiological Anatomy.
(f) General Anatomy, Anatomy of the textures and organs. Histology, Microscopical or Minute Anatomy.
(g) Regional Anatomy, Anatomy of the organs and tissues and blood, vessels in their natural positions and relations.
(h) Surgical Anatomy, the Anatomy of the bones, muscles, nerves and blood vessels considered in their relations to the nature and objects of surgical operations.
(i) Morbid or Pathological Anatomy.

From its manifold aspects, Anatomy forms the basis of the biological sciences; and a thorough knowledge of this fundamental branch of medical science is absolutely essential to the physiologist, pathologist, obstetrician, surgeon and practitioner of medicine.

Human Anatomy, the dissection or separation of parts by cutting, can only be learned thoroughly and practically in the dissecting room and in the dead-house.

An abundant supply of well injected and well preserved human bodies exposed in well ventilated and well lighted rooms, is absolutely essential to the successful pursuit of practical anatomy by the medical student.

The utmost caution and the highest skill should be exercised in the preparation and preservation of human bodies designed for dissection and the study of practical Anatomy in the warm, moist climate of New Orleans and other Southern cities.

Every facility should be furnished to the medical student for the careful and thorough examination of the organs and tissues by the aid of the microscope.

It is impossible to teach Anatomy by the aid alone of lectures, class demonstrations, models and drawings. The medical student should regard the dissection of the human body as at once his highest duty and most valuable privilege.

V. PATHOLOGICAL ANATOMY AND HISTOLOGY.

The advance of medical science necessitates the separation of pathological anatomy into a distinct branch of medical science, which should receive the care and attention of a teacher or professor especially devoted to its development and illustration.

A well ventilated, commodious and well lighted laboratory supplied with the latest improvements in optical instruments, (microscopic, photographic instruments, spectroscopes and polariscopes), and stocked with the necessary instruments for making minute dissections, and sections of the diseased organs and tissues should at all times be at the command of the professor of pathological anatomy for the through and systematic instruction of his students.

All the best reagents for staining and preserving tissues, as well as all the necessary apparatus for the study of bacteria and their culture, should be liberally supplied.

It is impossible to overestimate the value of the results which might flow from the careful and systematic investigation of the pathological anatomy of such diseases as yellow fever and the various forms of malarial fever.

If the teachers of pathological anatomy had spent more time in the dead-house and had labored more assiduously with the microscope, the profession would have been supplied with substantial facts as to the true pathological anatomy of many diseases, and more especially of yellow and malarial fevers. We should no longer hear the absurd and false statement that *yellow fever has no recognizable pathological anatomy—no distinctive pathological lesions.*

If any substantial advance is to be made in the knowledge of the causes and rational treatment of insanity, it must be based upon and arise out of the careful determination of the pathology of the cerebro-spinal nervous system.

Those in charge of hospitals and asylums for the insane should embrace every opportunity for the thorough physical, chemical and microscopical examination of the structures of the cerebro-spinal and sympathetic nervous systems.

The systematic and practical course in *Pathological Anatomy* and *Histology*, should embrace the following subjects.

(a) The method of making post-mortem examinations.

(b) Methods of preparing pathological specimens, and of preparing them for study.

(c) Morbid changes in the heart and blood vessels.

(d) Morbid changes in the blood.

(e) Degenerations.

(f) Changes caused by inflammation.

(g) Structure and mode of development of tumors: fatty tumors; cancers, etc.

(h) Pathological changes characteristic of phthisis, leprosy, syphilis, etc.

(i) Pathological anatomy and histology of the various organs, textures, as the integuments; muscular and fibrous tissues; circulating and respiratory apparatus, nervous system, digestive system, genito-urinary system, etc.

(j) Animal parasites.

(k) Bacteria: microscopical and chemical examinations; culture experiments; methods of demonstrating the presence and effects of bacteria, methods of staining etc.

(l) The lesions found in general diseases (fevers, etc.), in poisoning and in violent deaths.

VI. Biology.

Biology deals with the phenomena manifested by living matter. Though it is customary to group apart such of these phenomena as are termed mental, and such of them as are exhibited by men in society, under the heads of Psychology and Sociology, yet it must be allowed that no natural boundary separates the subject matter of the latter sciences from Biology.

Psychology is inseparably linked with Physiology, and the phases of social life exhibited by animals other than man, fall within the province of the biologist.

The Biological Sciences are sharply marked off from the abiological, or those which treat of the phenomena manifested by non-living matter, in so far as the properties of living matter distinguish it absolutely from all other kind of things, and as the present state of knowledge furnishes us with no link between the living and the non-living.

Distinctive Properties of Living Matter.—The distinctive properties of living matter are:

1. Its chemical composition, containing one or more forms of a complex compound of Carbon, Hydrogen, Oxygen and Nitrogen, the so-called Protein, which has never yet been obtained except as a product of living bodies, united with a large proportion of water, and forming the chief constituent of a substance which in its primary unmodified state is known as *protoplasm*.

2. Its universal disintegration and waste by oxidation and its concomitant reintegration by the intus-susception of new matter. Lime is constantly associated with the breaking up of the protoplasm into oxides, of the elements Carbon, Hydrogen and Nitrogen.

The new matter taken in to make good this loss is either a ready formed protoplasmic material supplied by some other living being, or it consists of the elements of protoplasm, united in simple combinations which consequently have to be built up into protoplasm by the agency of living matter itself.

In either case the addition of molecules to those which already existed takes place, not at the surface of the living mass, but by interposition between the existing molecules of the latter.

The decrease, increase or stationary condition of the protoplasm depend upon the balance between these two processes.

3. The tendency of living matter to undergo cyclical changes. All living matter proceeds from pre-existing living matter, a portion of the latter being detached, acquiring an independent existence. The new form takes the character of that from which it arose, exhibiting the same power of propagating itself by means of an off-shoot, and sooner or later, like its predecessor, ceases to live and is resolved into the more highly oxidated compounds of its elements.

4. The activities of living matter depend upon moisture and upon heat, with a limited range of heat and with certain structural organization.

5. Even in the simplest forms of living matter the microscope reveals that they are heterogenous optically, and that the different parts differ chemically and physically, and that in more highly organized things more heterogeneity is exchanged for a definite structure, whereby the body is distinguished into visibly different parts, which possess different powers or functions. Living things which present this visible structure are said to be organized.

Living matter or protoplasm and the products of its metamorphosis may be regarded under four aspects:

1st. External and internal form or structure.

2d. It occupies a certain position in space and in time.

3d. It is subject to the operation of certain forces, in virtue of which it undergoes internal changes, modifies external objects and is modified by them.

4th. Its form, place and powers are the effects of certain causes.

In correspondence with these four conditions or aspects of living matter biology is divisible into four chief subdivisions.

1st. Morphology.
2d. Distribution.
3d. Physiology.
4th. Ætiology.

Morphology includes anatomy, histology (minute or microscopal anatomy); development, or the history of the anatomy of a living being at the successive periods of its existence and of the manner in which an anatomical stage passes into the next; taxonomy, or the arrangement of living beings into groups according to their degrees of likeness.

Distribution.—Differences produced or manifested in fauna and flora by land and water, by latitude, elevation and by climate should be considered in present and in past geological epochs.

Physiology.—Living beings are not only natural bodies having a definite form and mode of structure, growth and development; they are machines in action, and under this aspect the phenomena which they present have no parallel in the mineral world. The actions of living matter are termed its functions, which may be referred to three categories:

1. Functions which affect the material composition of the body and determine its mass, which is the balance of the processes of waste on the one hand, or those of assimilation on the other.

2. Functions which subserve the process of reproduction, which is essentially the detachment of a part with the power of developing into an independent whole.

3. Functions in virtue of which one part of the body is able to exert a direct influence on another and the body

by its parts or as a whole becomes the source of molar motion.

The first may be termed sustentative, the second generative and the third *correlative*.

4. *Ætiology*.—Morphology, distribution and physiology, instigate and determine the facts of biology. Ætiology has for its object the ascertainment of the causes of these facts and the explanation of biological phenomena, by showing that they constitute particular cases of general physical laws.

VII.—Human Physiology.

The word physiology may be used in a general or in a restricted sense. It has been used of old to denote all inquiry into the nature of living beings; but the phenomena can be studied from two apparently different points of view.

The most striking character of a living being is, that it is an agent performing actions and producing effects in the world outside of itself.

We have on the one hand the peculiar molecular chemical and vital actions of the living being; and on the other its relations to the medium in which it lives and performs its acts.

Physiology embraces a study of:

1st. The living phenomena of the human body in their natural or healthy state.

2d. The physical structure and conformation of the solid parts.

3d. The determinate chemical composition of the solids and fluids.

4th. The dynamical characters.

5th. The nature, occurrences, character and correlation of certain chemical, physical and vital changes which go on during that active state which we call LIFE.

Life results from the concurrent exercise of the several functions performed by various organs. The living state follows a determined evolutional history from the commencement of life to its close.

As anatomy teaches the structure of an organized body, organic chemistry, its chemical constitution, and physics its physical properties; so physiology deals with the phys ical, chemical and vital actions which occur in an organized body during life. Physiology, therefore, requires a knowledge of physics, chemistry and anatomy.

In the older sense Physiology embraced morphological problems and so corresponded with Biology; in the more modern sense, physiology leaves these matters on one side and deals only with the actions of living beings on their surroundings (the study of these necessarily involving correlative study of the effect of the surroundings on the living being), and appeals to matters of form and structure only so far as they throw light on problems of action.

It is evident that man regarded as a machine capable of accomplishing definite results, must be governed by physical laws capable of expression in the exact terms of physics. On the other hand, physiology presents problems peculiar to the condition known as life. The three-fold problems of physiology may be thus represented:

1st. The determination of the laws according to which the complex unstable food is transmuted into the still more complex and still more stable living flesh, and the laws according to which this living substance breaks down into simple stable waste products, void or nearly void of energy. The amount of these chemical changes and the resultants in muscular and nervous force and in the form of animal heat can be made the subject of accurate experiment.

2d. The determination of the laws according to which the vibrations of the nervous substance originate from extrinsic and intrinsic causes, the laws according to which these vibrations pass to and fro in the body, acting and re-acting upon each other, and the laws according to which they finally break up and are lost, either in these larger circles of muscular contraction whereby the movements of the body are affected, or in some other way.

3rd. The determination and consideration of the abstruse problems as to how these neural vibrations become attended with changes of consciousness, as well as the less subtle vibrations of the contracting muscles, are wrought out of sudden complex chemical decompositions of the nervous and muscular substances ; or in other words, to determine how the energy of chemical action is transmuted into and serves as the supply of that vital energy which appears as movement, feeling and thought.

Physiology depends for its advancement upon well devised and carefully executed experiments, and a correct knowledge of this branch of medical science can never be acquired by the student from mere lectures, tables, diagrams and artificial models. Those only have advanced physiology who have interrogated nature and extorted her secrets by direct research and well devised experiments.

The foundation of scientific Physiology was laid by William Harvey, in the year 1616 (the year of Shakespeare's death), when he delivered his lectures in St. Bartholomew's Hospital, London, and first brought forward his views on the movements of the heart and blood, which were published in his treatise on the blood, in 1628. His great work on Generation, published in 1651, laid the foundation of scientific Morphology, and solved many of the most important problems of Biology.

In his final deed of gift of his property to the college and library which he had erected, and for the endowment of an annual oration, the orator, Dr. Harvey, orders in his deed of gift to "*exhort the fellows of the college to search out and study the secrets of nature by way of experiment, and also, for the honor of the profession, to continue mutual love and affection among themselves.*"

The discovery of Oxygen by Joseph Priestley, on August 1st, 1774, which he obtained by heating the red oxide of mercury by means of the sun's rays concentrated with a burning glass, not merely directed the attention of chemists to the composition of the atmosphere, but led to the overthrow of the phlogistic theory, and formed the foundation of the splendid labors of Lavoisier, who placed chemistry in the path which it has ever since followed.

The discoveries of Black, Priestley, Scheele and Cavendish, as well as his own experiments, enabled Lavoisier to establish the correct theory of combustion and of the origin of animal heat, and placed the science of the physics and chemistry of living beings upon its true basis.

Scarcely one hundred years have elapsed since the science of physiology has been placed upon the unalterable laws of physics and chemistry.

The experiments, dissections and original researches of John Hunter enlarged the bounds of comparative and human physiology, and established important principles in surgical pathology.

The all-important questions relating to:

1st. The Functions of the Brain.

2d. The Functions of the Spinal Cord.

3d. The Functions of the Sympathetic Nervous System.

4th. The Relations of the Cerebro-Spinal and Sympathetic Nervous Systems to each other, and to the processes of Respiration, Circulation, Nutrition, Animal Temperature and to such diseased states as Fatty Degeneration, Inflammation and Fever.

5th. The Relation of the Cerebro-Spinal Nervous System to spasmodic diseases, such as Traumatic Tetanus, Epilepsy, Catalepsy, Hysteria and Hydrophobia.

6th. The determination of the functions of the individual portions of the brain and their relations to motion, sensation and intellectual action, memory, language, imagination and will.

These and other important inquiries have been made the careful subject of experiments upon living animals, by a host of able and learned physiologists, and the further advance of our knowledge with reference to these abstruse subjects must depend mainly upon:

1st. Careful observation of the phenomena of living animals.

2d. The careful record of pathological phenomena during life and of pathological changes after death.

3d. Vivisections. The injury or ablation of definite portions of the cerebro-spinal and sympathetic nervous systems by the knife, electricity, or certain physical and chemical agents.

The continuous practice of experiments upon animals (*vivisection*) is absolutely necessary to the progress and perfection of the physiology of the nervous system, and each thoroughly organized medical college should be furnished with a well equipped physiological laboratory furnished with the instruments, re-agents and living animals necessary for the scientific elucidation and demonstration of the most abstruse problems.

VIII.—Pathology.

Pathology, The Science of Disease, cannot be defined unconditionally, for the terms health and disease, well and ill, local and constitutional, and diatheses are, to a certain extent, indefinite. The doctrine of disease (*or that which is suffered*) has varied in different ages and with the different sects of philosophy and medicine.

Although Hippocrates laid down the broad principle that the medical art, upon which all men are dependent, should not be made subject to the influence of any hypothesis, and that the care and cure of the sick should not be subordinated to Pathological theory, but should be guided by experience; yet the practitioners of medicine have at no time been able to dispense with theory. Even the avowed followers of Hippocrates, whilst apparently remaining steadfast amidst the rise and fall of systems, have been more or less influenced by theory at every step of their practice. The view held by Cullen has met with the approval of physicians, as presenting a rational view: "You will not find it possible to separate practice from theory altogether; and therefore if you have a mind to begin with theory, I have no objection....*to render it safe it is necessary to cultivate theory to its fullest extent.*"

Dr. Charles Creighton has well said: "The progress of pathology hitherto has been exactly parallel with the progress of philosophy itself, system succeeding system in genetic order. No other department of biological science has shown itself so little able to shake off the philosophical character, or to run in the career of positivism or pure phenomenalism. This unique position of pathology among the natural sciences is doubtless owing to the fact that it is a theory of practice, a body of truth and guess-work existing for the benefit of a working profession which is daily brought face to face with emergencies and is constantly reminded of the need of a reasoned rule of conduct. It is idle to attribute the philosophising habit in medicine, or the habit of system-making, to an unscientific method in past times. The extremely various points of view from which the problems of diseased life are approached in the very latest and most authoritative writings, are an evidence that the difficulty is really inherent in the subject matter.

"The positive progress of the biological sciences does not essentially depend on the philosophical conception of life as action and reaction; but the notion of action and reaction comes to the front on every page of a pathological treatise, and at every step of practice.

In considering the forms of diseased life, if not in the study of living things themselves, we are constantly driven back to that ultimate analysis. The influences from without which make up Ætiology, or the doctrine of the causes of disease, assume a position in medicine, the urgency or immediate interest of which far exceeds that of the biological problem, the correspondence between life and its circumstances."

The standing difficulty in pathology has been its relation to ætiology, or the relations of the "*ens morbi* to the *agens morbi*."

The great truths enunciated by Thomas Sydenham in the seventeenth century have been recognized more and more by the medical profession, from the death of the *English Hippocrates*, in 1689, to the present moment.

Sydenham advenced the cause of medical science by advocating and practising the inductive method of Hippocrates.

Thus, Sydenham taught:

1st. The improvement of physic depends—first, upon collecting a genuine and natural history of all diseases; and second, laying down a fixed and complete method of cure.

2d. All diseases ought to be reduced to certain and determinate kinds, with the same exactness as we see it done by botanical writers in their treaties of plants.

3d. In writing a history of a disease, every philosophical hypothesis which hath possessed the writer in its form, ought to be totally laid aside, and the manifest and natural phenomena of diseases, however minute, must be noted with the utmost accuracy, imitating in this the great exactness of painters, who, in their pictures, copy the smallest spots or motes in the original.

4th. In describing any disease, it is necessary to enumerate both the peculiar and constant phenomena or symptoms, and the accidental ones separately; of which latter kind are those which differ occasionally by reason of the age and constitution of the patient, and the different methods of cure. * *

5th. The seasons of the year that principally promote any particular kind of diseases are to be carefully remarked. Some diseases happen indiscriminately at any time, whilst many others, by a secret process of nature, follow the seasons of the year with as much certainty as some birds and plants. A knowledge of the seasons in which diseases ordinarily arise, is of great use to a physician towards discovering the species of the disease as well as the method of curing it; and the consequence of neglecting this knowledge leads to ill success, both in the discovery and cure of diseases.

These principles constituted the work of Thomas Sydenham, THE NOVUM ORGANON OF THE MEDICAL

SCIENCES in the seventeenth century, as the great work of Lord Bacon, which had appeared in 1620, was the immortal NOVUM ORGANON of all the physical and natural sciences.

A clear distinction should be made between that which is *esopathic* and that which is endopathic in disease; and general pathology should follow the direction and order of physiology.

Pathology deals with:

1. The causes of disease—Ætiology.

Ætiology is related with and gets its subject matter from:

(*a*) Cosmical Physics.

(*b*) Meteorology.

(*c*) Geology.

(*d*) Physical Geography.

(*e*) The chemical constitution and relations, and the fauna and flora of the atmosphere, earth and terrestrial waters.

(*f*) Chemistry.

(*g*) Botany.

(*h*) Zoölogy.

(*i*) Sociology.

It has well been said that Ætiology is without limits.

2. To ascertain the esoteric connections existing among diseases themselves.

There are certain groups of symptoms which recur with the uniformity of a type in the most various diseases, which depend upon one constant factor—*the human* body and its structural and functional tendencies.

The causation of disease may be classified as:

(1) EXOTERIC—EXOPATHIC.

(*a*) Injury from without, climate and terrestrial causes.

(*b*) Parasites; including Bacteria, Bacilli, etc.

(*c*) Morbific ferments and poisons engendered without the living organism.

(2) ESOTERIC—AUTOPATHIC.

(*a*) Deficient rudiments and defective growth, premature morbidity or obsolescence, hypertrophy and atrophy.

(*b*) Derangement of the chemical changes and disturbances of the balance of the forces by over-exertion.

(*c*) The development of morbific agents within the body itself.

Diseases may also be considered in a systematic treatise on general pathology.

As General or Local—

Under the head of General or Constitutional diseases, nosologists have classed such diseases as yellow fever, malarial fever, typhoid, typhus and relapsing fevers.

Under the head of Local diseases have been ranged:

Diseases of the respiratory, circulating and nervous systems, of the locomotive, digestive and excretory organs and absorbents.

The larger number of maladies do not arise autochthonously, and the exopathic point of view may be regarded as the dominant one at present; and it is from the Ætiological side that the most wide-spread and fatal contagious and infectious diseases are chiefly studied.

IX.—Therapeutics.

Therapeutics is the most practical and useful branch of medical science, for it is the cure of disease which both the practitioner and patient seek.

Therapeutics necessitates for its successful study and practical application a knowledge of chemistry, materia medica, pharmacy and pathology; and should be based upon:

1st. The accurate study of the natural history of disease.

2d. The effects of remedies upon the healthy human organism.

3d. The effects of remedies as determined by carefully and well executed experiments upon living animals.

4th. The effects of remedies during diseased states of the human organism.

The power of the physician over disease depends mainly upon the force and culture of his intellectual powers upon the extent and character of his knowledge of the symptoms and pathology of various diseases and upon his knowledge of the effects, power and value of therapeutic measures and agents.

Therapeutics has advanced as the knowledge of man has advanced as to the pathology of exopathic and endopathic diseases, and with the enlargement and perfection of the materia medica.

The progressive advances of chemistry have furnished the physician with his most potent and valuable remedies, as Quinine, Salicine, Salicylic Acid, Salicylates, Antipyrin, Antifebrine, Morphia, Brucia, Strychnia, Cocaine, Bromides and Iodides of Sodium, Potassium and Calcium, Ether, Nitrate of Amyl, Chloroform, Chloral, Nitro-Glycerine and a host of others. No limits can be placed upon the possible therapeutic agents which may be developed by the labors of the chemist, and hence therapeutics is the most progressive of the branches of medical science.

It must be admitted that the therapeutics of the day are to a large extent empirical, and that numerous careful clinical observations by the bed-side, and careful experiments upon living animals in the therapeutical laboratory are needed to place this branch of medical science upon a firm and broad scientific basis.

By experimental Physiology the functions of various parts of the body and their relations to each other are being gradually determined.

In experimental Pathology, diseases are induced artificially in order that we may discern the alterations produced by them in the functions.

In experimental Pharmacology drugs are administered in order to determine the part of the body which they affect, and the nature of the alterations which they produce in its functions.

In *Rational Therapeutics* the physician endeavors to recognize from the symptoms of the patient the organ affected by disease, the nature of the disturbance in its function and to apply a remedy which will counteract such disturbance. Great advances must in our day be made in *rational therapeutics* before we can hope to obtain such exact knowledge as we desire.

When the efforts of the physician are directed towards the *removal of the cause of disease* it has been called *Pathogenetic Therapeutics.*

In *Symptomatic Therapeutics*, when the cause of the disease cannot be recognized or cannot be removed, the treatment is directed to those parts of the organism on which the cause of disease acts, so as to lessen or remove the symptoms which it would otherwise produce.

When the physician can neither remove the cause nor remove the symptoms, but is forced to trust to the *vis medicatrix naturæ*, and endeavors to maintain the patient's strength by food and nursing, the terms expectant treatment or expectant therapeutics have been employed.

In its widest acceptation expectant therapeutics includes nursing, climate and measures of treatment, such as regulated exercise, gymnastics, friction, massage, the application of heat and of simple or medicated cold and hot water.

X.—Science and Practice of Medicine.

The science of medicine rests upon the knowledge of diseases, of the conditions under which they arise, of their nature, causes, and their modification or cure; and necessarily implies a knowledge of Chemistry, Materia Medica, Pathology and Therapeutics.

If the student of medicine has mastered the essential laws and facts of Medical Physics and Chemistry, and of Materia Medica, Pathology and Therapeutics, he is prepared to consider Medicine as an *Art* of practical value, to diagnose, to prevent, to cure diseases, to alleviate human suffering and lengthen out human existence.

The art of Medicine should be founded upon facts and principles capable of clear demonstration and of universal applicability.

What we have stated with reference to pathology and therapeutics in the uncertain and empirical application to the causes and cure of many diseased states applies with equal force to medicine regarded as an art.

The terms science and art of medicine must be regarded as generic, and the professor of a chair having this title, or the author of "The Practice of Medicine," must necessarily draw their materials from pathology and therapeutics, and find their illustrations in the careful and ample records of *clinical* medicine.

The Art of Medicine may be divided into two distinct branches:

1st. The cure of disease and the relief of those who suffer (THERAPEUTICS).

2d. The prevention of disease and the preservation of health (HYGIENE).

XI.—HYGIENE.

The prevention of disease and the maintenance of the conditions for the preservation of health must be based upon the sciences of chemistry, physiology and pathology.

Medicine has ever been related to humanity, but its relations to the wants of man have been increased, and are ever increasing, in the complex state of modern society, with the exigencies of its fast growing population.

In our day, preventative and public medicine (*Hygiene*) has become an important branch of medicine, when one of the peculiarities of modern life is shown from statistics to be the tendency to increase of population in great towns, and to the creation and support of vast standing armies.

In England, between 1841 and 1851, there was an increase in the population of towns of over 100,000 inhabitants of 23 per cent., and in the following decennial period, 1851-1861, there was in France, in towns of similar magnitude, taken collectively, an increase of 50 per cent.; in the United States of America the tendency to accumulate and concentrate the population in great centres has been equally great; and in our Southern country, since the civil war, the negro population has shown a constant tendency to crowd the cities, and add to their unhygienic condition, and increase their mortality.

The active, restless population of our great American Republic is advancing all along the lines of science and art.

By her position, by the character of her population and by her commercial intercourse with all nations of North, South, Central and Insular America; of Europe, Asia and Africa, the United States is the very heart of our world, and should of all the nations of the earth be the foremost in the promotion of domestic, public and international hygiene.

Hygiene should be considered and studied under the following heads.

Hygiene.

I. Domestic Hygiene.

(a) Meteorological Conditions (Climate).
(b) The Soil or Site of the Dwelling.
(c) The Character of the Sub-soil, Water and Air.
(d) The Materials of Dwellings.
(e) Drainage and Sewage.
(f) Ventilation.
(g) Water Supply.
(h) Heating and Lighting of Dwelling.
(i) Clothing and Personal Cleanliness.
(j) Work and Exercise.
(k) Food Supply.

II. Public Hygiene, National Hygiene.

(l) Boards of Health.
(m) Location of Towns and Cities.
(n) Drainage and Sewage.
(o) Construction of Houses and Street-Paving; Open Squares, etc.
(p) Relations of Race to Public Hygiene and to the National Death-rate.
(q) Public Sanitation.
(r) The Arrest of such Contagious and Infectious Diseases as Yellow Fever and Small-Pox. Vaccination.
(s) Disinfectants: Their Chemical Relation, Their Relative Value and Mode of Use, Heat, Corrosive Sublimate, Carbolic Acid, etc.
(t) Quarantine, Domestic and Maritime.
(u) The Conduct of Railroads during the Progress of Epidemics.
(v) Hygiene of Armies and Navies.
(w) Hygiene of Schools, Public Buildings, Jails and Prisons.

III. International Hygiene.

(x) Quarantine Considered as an International Regulation.
(y) The Establishment of National Commissions for the investigation of contagious and infectious diseases, and for the prompt communication from one nation to another of all facts relating to the existence of diseases prejudicial to the public health.
(z) The Treatment and Continuous Exchange of Prisoners of War.

XII.—Science and Practice of Surgery.

In all countries, the accidents of ordinary life, of personal conflicts and of war, led to the application of surgery and surgical art from the earliest times, in the setting of bones, the staunching of blood, the extraction of arrows and the binding up of wounds. A knowledge of the healing powers of the tissues was known to men in all nations and at all times. In both branches of the Aryan stock surgical practice as well as medical, reached a high degree of perfection at a very early period. It would be foreign to our purpose to inquire whether the Greeks derived their medical and surgical knowledge from the Hindus through the medium of the Egyptian priesthood, or whether the Hindus owed that high degree of medical and surgical knowledge and skill which is reflected by Charaka and Susruta, commentators of the Yajur-Veda, to their contest with Western civilization after the campaign of Alexandria.

We have a strong argument for the former view of the Eastern origin of medical and surgical science, in the close correspondence between the Susruta and Hippocratic collections in the sections relating to the ethics of medical practice; the description of lithotomy, and the description in the Susruta of certain dexterous operations, as that of Rhinoplastic of native invention; besides the use of such remedies as arsenic, mercury, zinc and many other substances of permanent value, not containing a single article of foreign source.

There is also evidence in Strabo, Arrian and other writers that the East enjoyed a proverbial reputation for medical and surgical wisdom at the time of the invasion of Alexander the Great.

The testimony of Herodotus indicates great advances among the Egyptians at an early era in medicine and surgery; and it is worthy of note that the tendency of the present day is to the multiplication of special branches in the practice of the arts of surgery, and to the devotion of physicians to special lines of study and practice, as was the habit with the ancient physicians of Egypt.

Thus Herodotus says, that the art of medicine is thus divided amongst the Egyptians: "Each physician applies himself to one disease only, and not more. All places abound in physicians; some physicians are for the eyes; others for the head, others for the parts about the belly, and others for internal disorders."—Herodotus: *Euterpe* II, p. 125.

Surgery may be considered as a science and as an art under two heads:

1st. Scientific or general surgical principles of surgical pathology.

2d. Operative surgery.

The special divisions of Surgery as applied to actual practice are as follows:

(a) Military Surgery.
(b) Naval Surgery.
(c) Ophthalmology.
(d) Dental and Oral Surgery.
(e) Otology.
(f) Laryngotomy.
(g) Abdominal Surgery.
(h) Pelvic Surgery.
(i) Genito-Urinary Surgery.
(j) Anal Surgery.
(k) Orthopædic Surgery.
(l) Uterine Surgery.

Such divisions are to a certain extent arbitrary, and the same general principles of physiology, pathology and therapeutics must govern the scientific surgeon, regardless of the special branch of his art to which his energies are devoted.

The increase of specialists in our day has not tended to elevate the standard of professional ethics, but, on the contrary, has promoted discord in the ranks of the profession.

Without doubt, important advances have been made during the past twenty years, in the application of the well-known principles and agents of chemistry to the antiseptic treatment of wounds, and abdominal surgery owes much of its increasing success to the scrupulous attention to the laws of hygiene on the one hand, and to the scientific use of antiseptics.

Modern surgery has made marked advances in the treatment of the brain and nerves and wounds of the abdominal viscera by operative procedure and antiseptic measures, as will be shown by the following brief outline:

Intercranial Hæmorrhage.

Trephining is now recognized as a legitimate operation in the treatment of intercranial hæmorrhage following a traumatic injury where life is endangered from compression of the brain due to this cause.

Intercranial hæmorrhage from the middle meningeal artery is now looked upon by surgeons as a positive indication for the use of the trephine whether the skull is fractured or intact.

Abscess of the Brain.

During the last few years a number of cases of deep-seated chronic abscesses of the brain have been successfully treated by incision and drainage. In most cases a positive diagnosis was made before the operation and when this was not possible, the abscess was actually located by making one or more exploratory punctures.

Tumors of the Brain.

The removal of endocranial tumors by operative procedure constitutes the most recent advancement of cerebral surgery. The success of such dangerous operations as the evacuation of abscesses and the removal of tumors of the brain manifestly depend upon:

1st. The position and extent of the abscess or tumor, as determined by accurate diagnosis based upon extensive anatomical, physiological and pathological knowledge of the anatomical structures and physiological functions of the brain.

2d. The proper use of Anæsthetics.

3rd. The mode of operating.

4th. The previous preparation of the patient.

5th. The actual size and location of the abscess or tumor as determined by the operation.

6th. The technique of the operation including: (a) The treatment of the wound; (b) The treatment of the brain; (c) The use of antiseptics and antiseptic sutures and dressings.

CYSTS OF THE BRAIN.—TREPHINING FOR EPILEPSY.

Recent experience in the treatment of epilepsy has strengthened the faith of the profession in this method of treatment in well selected cases where some tangible lesion in the skull or its contents can be brought into direct connection with the development of the disease. The operation of trephining has been shorn of its risks since the introduction of antiseptic surgery, and hence the modern surgeon regards himself as warranted in proposing and performing an operation in all intractable cases of this dreadful disease. When he is able to detect some latent cause amenable to direct treatment, and if he fails to cure the disease, he has the consolation that his interference did not expose the patient to any great risks of life, and seldom if ever, is followed by aggravation of symptoms.

SURGERY OF THE ABDOMEN.

The brilliant results obtained in cerebral surgery accomplished largely through the study of symptoms, thus leading to correct diagnosis, has stimulated surgeons who perform operations upon the organs of the abdominal cavity to increase and define their knowledge in this respect: the methods of operative procedure have been greatly improved and the details so well defined as to assure successful results when faithfully carried out; and the careful study of symptoms has greatly advanced knowledge in the direction of diagnosis, so that the field of diagnosticated laparotomy has been lessened.

The operative treatment of penetrating wounds of the abdomen complicated by visceral injury of the gastro-intestinal canal, is now sanctioned by the best surgical authorities and may be considered as a well established procedure based as it is upon the results of experimentation and clinical experience. A visceral wound of the stomach or any portion of the intestinal canal sufficient in size to give rise to extravasation into the peritoneal cavity must be looked upon as a mortal injury unless promptly treated by abdominal section. The great difficulty that presents itself to the surgeon in the absence of positive symptoms, is the differential diagnosis between a simple penetrating wound and a penetrating wound complicated by injury of the gastro-intestinal canal.

Dr. N. Senn, of Chicago, has sought to solve the doubts in such cases and to enlarge our means of accurate diagnosis by demonstrating by a series of well devised experiments that "the rectal insufflation of hydrogen gas is an infallible test in the diagnosis of visceral injury of the gastro-intestinal canal in penetrating wounds of the abdomen.

Increasing experience demonstrates that the best results are obtained in operations upon the abdominal cavity when they are performed under rigid antiseptic methods, which are each day being simplified, and in this way it becomes in the power of surgeons even in localities most remote to employ them.

The great achievements of abdominal surgery have been accomplished only through the methods of antiseptic surgery, and the medical schools should imbue their pupils with the principles and practice of antiseptic surgery.

XIII.—Obstetrics, Gynæcology, Diseases of Women and Children.

Every woman bearing children, from the primeval or original mother of the human race, has experienced with greater or less severity the pangs of labor, and hence from the earliest times the occupation of the MIDWIFE has been recognized. In ancient times the midwife was clad in the modest garb of woman; but in our day her representative of the male sex is BOOTED and SPURRED, and brandishes his flashing forceps and dazzling speculum, and boasts that obstetrics is both a science and an art.

The teacher of obstetrics deals with the condition of normal and abnormal labor, with the surgical operations necessitated by the emergencies of labor or by the pelvic diseases incident to females and peculiar to their genito-urinary system; he also treats of the septic fever and accidents, as hemorrhage and pelvic abscess, peculiar to the puerperal state, and of the diseases incident to childhood.

These subjects are grouped together rather from their connection in time and space than from any scientific principles of classification.

Under the head of obstetrics, gynæcology, and diseases peculiar to women and children may be included the following:

(a) Embryology.
(b) Morphology.
(c) Normal labor (Physiological labor).
(d) Abnormal labor due to the action of extrinsic or intrinsic causes. The natural or physiological course of labor may be deranged by the states of the system induced by scant and improper diet, by the action of febrile poisons; by the existence of the syphilitic or scrofulous or tuberculous diathesis, Bright's disease, cardiac disease, dropsy and various nervous derangements as epilepsy and insanity; by the occurrence of premature labor, hæmorrhage, convulsions; the pelvis also may be so malformed as to prevent the natural delivery of the child, and to necessitate either the destruction of the fœtus or the performance of the Cæsarean section.
(e) Abdominal Surgery (Ovariotomy).
(f) Pelvic Surgery.
(g) Hygiene, and the antiseptic treatment of the puerperal state.
(h) Uterine Surgery.
(i) Diseases peculiar to women; hysteria, disease of uterus and ovaries: prolapsus uteri, etc.
(j), Diseases peculiar to childhood and especially to the period of dentition.
(k), Principles regulating the nutrition and physical training and development of children.

The recent successes achieved by obstetrical surgeons in the performance of the Cæsarian section in this country illustrate in a forcible manner the progressive nature of this branch of medicine, and must be attributed to the following causes:

1st. To the performance of the Cæsarean section at the earliest practicable moment, without waiting until the powers of the patient have been exhausted in fruitless efforts to expel the fœtus.

2d. To the maintenance of the strength of the patient by suitable nourishment, administered in small quantities at regular intervals.

3d. In the systematic and scientific application to the wounded surface of antiseptic sutures and antiseptic dressings.

4th. The careful attention to ventilation and cleanliness —to all the requirements of an enlightened hygiene.

XIV.—Medical Jurisprudence.

The duty of the physician is not merely to prevent and cure diseases, but he is the natural guardian of the lives of his fellow-citizens, by detecting poisons, and pointing out the nature of the weapons and injuries inducing death.

The scientific physician has often to summon all his skill and wisdom, and press into the public service all his knowledge in chemistry, microscopy, physiology and pathology, in the investigation of cases of poisoning, rape, and injuries inflicted by firearms, and weapons of every description. The life of a human being often turns upon the decision of the chemist and microscopist as to the nature of the spot or stain upon a garment, whether paint or blood, or upon the determination of the presence or absence of arsenic, antimony, lead, morphia, strychnia, or some other poison in food, drink or in the stomach and organs of man.

We cannot overestimate on the one hand the responsibility of the conscientious and learned physician who undertakes a medico-legal investigation; and on the other the obligations of the public for the invaluable services rendered to law and justice by exposing crime, which, but for the learning of the chemist, microscopist and patholo gist, would remain forever hidden.

We may truly say that the scientific and pure-minded physician is the NATURAL AND ORDAINED GUARDIAN OF THE PUBLIC PEACE AND HEALTH.

A knowledge of Medical Jurisprudence necessitates the careful study of the following branches of science:

(*a*) Chemistry (*qualitative and quantitative analysis*).
(*b*) Toxicology.
(*c*) *Microscopy. Spectroscopic analysis.*
(*d*) Physiology.
(*e*) Pathology.
(*f*) The general principles of civil and criminal law, as applicable to Idiocy, Imbecility, Insanity, Illegitimacy, Rape and Murder, or attempt to Murder, by firearms, instruments of all kinds, by drowning, strangulation, and poisoning.

XV.—CLINICAL MEDICINE.

Clinical medicine can be successfully pursued by the students in the wards of the Hospital, by the bedside of the patient, and under the direction of learned and experienced teachers.

Clinical medicine, though a special department of knowledge, is so intimately connected with other sciences that, when the claims of these are satisfied, it has been said that nothing would remain to it; it would not even be too much to assert that, were it possible to compress in one human intellect all that is now known of other sciences, such knowledge would be compatible with entire ignorance of the department of clinical medicine.

Clinical work stands apart, but has the most intimate relations to all that surrounds it; it is elucidated by the light of physics, chemistry and physiology, yet is not comprehended by them.

Whatever theoretical notions the physician may have entertained as to the nature or treatment of disease, when brought face to face with the sick and suffering in the presence of his earnest and intelligent students, he is compelled to submit every question to the crucial test of actual observation. His duty lies in giving an exact and scientific character to his observations, and to investigate the phenomena of disease with that concentration which is necessary in every physical inquiry, and with all those aids which are afforded in increasing perfection by modern science.

The clinical teacher should have no system to satisfy, and no dogmatic opinions to enforce; and he should go to his daily bedside work, untrammelled by any exclusive theories in pathology or therapeutics, but he should investigate disease in every possible way and by all the appliances of medical science.

The clinical teacher must bring into the court of inquiry all possible evidence, and decide upon it by the light of science and experience.

The constant study of disease gives certainty to diagnosis by following the subjects of fatal diseases to the dead house, and subjecting all the organs and tissues to a rigid post-mortem examination; and bringing to our aid chemical reagents and microscopical investigation, gives precision to our pathological knowledge.

In the present age the means of physical diagnosis and of careful clinical study have increased with unexampled rapidity, and no bounds can be set to the possible conquests of medical science.

Half a century ago there was no conception of those means of modern investigation and research which are applied daily to the discovery and explanation of physiological and pathological phenomena.

To the interpretation of sounds heard within the body, Laennec and a host of subsequent observers, brought precise acoustical observation and experiments, and showed us how to map out the condition of internal parts, the action of which we hear but cannot see.

By the application of optical instruments, Czermak, Desormeaux and Cruise have laid open to us many organs of the body, before inscrutable—the pharynx, the vocal chords, the trachea, the vagina, the uterus, the urethra, the bladder; so that the actual, but hidden causes of many phenomena are no longer matters of argument, but of sight and demonstration. The secrets of the eye have been disclosed by the physical contrivances of Helmholtz and others; and the proposition has been worked out by Ogle and Allbutt and others, *that some states of the eye* are not very important in themselves as local abnormities, but as being pathognomic of other suspected conditions in other and distant organs.

The skillful apparatus of Marey has so supplemented the sense of touch that the very phenomena of the pulse and heart are registered; and thereby, through indirect clear induction, we can fathom the secrets not only of the circulating apparatus, but of nerve action and nerve lesion behind and beyond. In every practitioner's hand the microscope and the test-tube answer in a moment questions of the gravest moment, which were once unanswerable.

The exploration of the nervous system by physical agencies, by manometers and the like through the labors of M. Duchenne and others; and the registration of changes of temperature, in evidence of chemical alterations, and in proof of corresponding alterations in the organism, may also be cited as illustrations of the advances of physical inquiry as applied to the investigation and correct diagnosis of disease.

Clinical Investigation and Instruction in the Charity Hospital of New Orleans.

During the past twenty years I have followed the plan now indicated, in the prosecution of my clinical labors and in the instruction of medical students in the wards of the Charity Hospital of New Orleans.

1. Investigation and Record of Cases.

(a) *History of Case;* name, date of admission; number of ward and bed; age, nativity, occupation, weight, height, temperament; general description of person; habits, temperate or intemperate; indications; preceding diseases or injuries; history of present attack.

(b) Expression of countenance; complexion; state of intellect; general appearance of body, full or emaciated; appearance and expression of eyes; color of conjunctiva; condition of tongue; results of physical exploration of different parts of the body and of the different regions; state of appetite and digestion; condition of bowels, constipated or loose.

(c) Pulse full, soft, rapid, feeble; tracing of pulse by means of the sphygmograph; action of heart; condition of general and capillary circulation; description of aneurisms, etc.

(d) Examination of fauces, larynx, etc., by laryngoscope; auscultation and percussion of heart and lungs; physical signs; detail of all facts relating to the normal and abnormal sounds in the heart, pericardium, pleura and lungs, etc.; mensuration, palpation and succussion.

(e) Condition of abdomen and abdominal organs; size and condition of spleen, liver, kidneys, etc.

(f) Condition of cutaneous system; presence or absence of eruptive diseases.

(g) Condition of biliary and urinary and intestinal secretions.

(h) Changes of temperature; number of beats of the heart and of the respirations during the minute; character of the changes of circulation, respiration and temperature.

(i) Condition of blood; qualitative and quantitative and microscopical examination of the blood.

(j) Amount and character of the urinary secretion; qualitative and quantitative analysis of urine; amount, color, nature of urine and urinary deposits; presence or absence of albumen, diabetic sugar, spermatozoa casts, blood, etc.

(k) Daily and hourly record of all important symptoms.

(l) Careful post-mortem examinations in fatal cases, illustrated by microscopical and chemical analysis.

II.—The Clinical Lectures by Bedside of Patients in Wards of the Hospital.

The daily lectures in the Hospital are illustrated by:

(m) Demonstration of the physical apparatus, and chemical and microscopical reagents and methods adapted to the investigation of disease.

(n) Instruction of the student in case-taking, clinical records, methods of physical examination and exploration.

(o) Auscultation, Percussion, *Physical Diagnosis*, Careful Diagrams illustrating the pathological lesions and stages of Pulmonary and Cardiac Diseases.

(p) *Diseases of the Cutaneous, Nervous, Digestive and Urinary System illustrated* by lectures, diagrams, microscopical drawings and demonstrations.

(q) *Local Diseases, such as Laryngitis, Bronchitis, Pneumonitis,* Pleuritis, *Endo-Carditis*, Carditis, Valvular diseases of the heart, Aneurism, Peritonitis, etc.

(r) *General or Constitutional Diseases—Fevers: Gastric Fever, Intermittent, Remittent* and pernicious malarial fever, Yellow Fever, continued fever, Typhus, Typhoid and relapsing fevers, Rheumatism, Syphilis, septic and zymotic diseases, Cholera, Small-Pox, Scarlatina, Measles, etc., Phthisis.

(s) Diseases of Nervous System.

(t) Diseases of Respiratory, Circulatory, Digestive, Genito-Urinary and Lymphatic systems.

III.—Illustration and Demonstration of the Relative Position, Size and Color, and Microscopical Character and Pathological Appearance of the Organs by Paintings, Charts and Models.

IV.—Post-Mortem Examinations.

V.—Chemical and Microscopical Examinations and analysis of the Blood, Urine, and, in Fatal Cases, of the Secretions, Excretions and Organs, in the Practical, Chemical and Pathological Laboratory.

The preceding gives but a brief and imperfect outline of our labors and plan of instruction which we have pursued in the Charity Hospital of New Orleans.

The extent and value of the Charity Hospital of New Orleans for clinical study and instruction will be illustrated by the following table:

CHARITY HOSPITAL OF NEW ORLEANS, LOUISIANA, UNITED STATES OF AMERICA—TABLE OF ADMISSIONS, DISCHARGES AND DEATHS FOR FIFTY-SIX YEARS.

YEAR.	Remaining.	Admitted.	Disc' arged.	Died.	YEAR.	Remaining.	Admitted.	Discharged.	Died.
*1832	309	2,170	1,703	568	1860	730	14,000	12,257	1390
1833	169	3,851	2,617	1114	1861	891	8,665	7,919	798
1834	262	5,841	4,745	1052	1862	......	6,016	5,532	719
1835	265	6,205	4,999	1226	†1863	......	......	......	......
1836	222	4,754	4,163	585	1864	373	4,861	3,999	812
1837	228	6,103	4,640	1420	1865	423	6,466	5,580	669
1838	271	4,687	3,890	683	1866	640	9,329	8,108	1122
1839	239	4,833	3,611	955	1867	738	8,612	7,260	1438
1840	267	5,041	4,370	619	1868	637	4,981	4,365	490
1841	314	4,380	3,093	1156	1869	660	6,177	5,327	784
1842	......	4,404	3.516	761	1870	717	7,837	6,764	1118
1843	......	5,013	3,672	1041	1871	672	6,671	5,730	891
1844	......	5,846	5,059	713	1872	700	5,541	4,846	825
1845	383	6,136	5,446	563	1873	570	5,090	4,124	993
1846	401	8,044	7,074	855	1874	543	5,231	4,360	860
1847	427	11,890	9,369	2037	1875	554	4,945	4,121	753
1848	829	11,945	10,010	1897	1876	525	5,690	4,780	742
1849	609	15,558	12,133	2745	1877	693	6,002	5,290	805
1850	719	18,476	15,989	1884	1878	600	5,878	4,615	1120
1851	......	18,420	16,777	1871	1879	604	5,248	4,390	693
1852	......	18,035	15,057	2098	1880	643	5,527	4,140	658
1853	......	13,759	10,733	3164	1881	534	5,843	4,351	825
1854	......	13,192	9,976	2702	1882	559	6,980	5,375	805
1855	......	12,192	9,701	2391	1883	668	8,152	7,134	1013
1856	......	9,432	8,601	974	1884	620	7,280	6,245	985
1857	......	8,897	7,914	1017	1885	556	6,143	5,212	1005
1858	572	11,137	8,993	2290	1886	639	5,807	4,764	960
1859	644	12,775	11,257	1321	1887	722	5,999	4,336	941

*Present buildings erected in 1832.
†No report for 1863.

Grand total of Admissions 432,187
Grand total of Discharges 360,331
Grand total of Deaths 63,321
Mortality .... 14.65 per cent.

The Charity Hospital of New Orleans forms the grandest field for the study of the diseases of tropical and subtropical regions; and no men enjoy superior advantages for the study of Southern diseases, and especially for the clinical investigation of the fevers and diseases characteristic of warm climates than the students of medicine who are daily admitted to its wards, or the resident students, who reside permanently within its walls.

The importance with which the medical students gathered annually in New Orleans from many of the Southern, Southwestern and Western States of the great Valley of the Mississippi, view the position of resident student, will be seen from the following correspondence:

Petition of Medical Students of Tulane University of Louisiana, with Reference to the Appointment of Resident Students—Reply of Joseph Jones, M. D., President of the Louisiana State Medical Society.

MEDICAL DEPARTMENT OF TULANE UNIVERSITY OF LOUISIANA,
NEW ORLEANS, February 13, 1888.

To Professor Joseph Jones, M. D., President of the Louisiana State Medical Society:

Sir:—It is with feelings of great pleasure and satisfaction that we, the undersigned, students of the Medical Department of Tulane University of Louisiana, acknowledge your efforts to have repealed the Legislative Act of 1886, whereby the selection of medical students for positions in the Charity Hospital was restricted to applicants then resident in the State of Louisiana.

Believing, as we do, that a better selection can be made by choosing the most worthy, regardless of section or State; and furthermore, believing it to be of the greatest importance to have the ablest and most proficient students as sub-medical attendants in immediate charge of the various wards of the institution, subservient to the orders of the attending physicians and surgeons, thereby securing the most careful and intelligent attention, medical and ministerial, to the thousands of suffering poor who seek the comfort and shelter of this noble institution to be cured of their diseases and healed of their wounds; and believing, furthermore, that the continued enforcement of said act will tend to impair the growth of the Medical Department of Tulane University, said Medical Department having been enabled to offer her most proficient students to the service of the Charity Hospital *regardless of section or State*, and at the same time offering, as an incentive to all students desirous of so doing, the opportunity to compete in examinations, necessary to appointment to resident studentship.

Whereas, the continued prosperity of the above mentioned University, and the interests of the Charity Hospital, are matters of great importance to us; therefore we respectfully ask that you, in your official position as President of the Louisiana State Medical Society, give this matter the attention it deserves, and use your efforts to have it brought before the next Legislative Assembly, urging its repeal.

We, knowing your devotion to your chosen profession, to the State of Louisiana and to the city of New Orleans, to the Charity Hospital, to which you have given so many years of valuable service, conferring benefits to suffering thousands, whom you have treated within its walls, whose testimony can be had from many portions of the civilized world; a knowledge of the above facts makes us feel that we can ask this of you with the confident assurance that your best efforts will be expended in its accomplishment.

We know your kindly regard for ourselves, and your untiring efforts to place us in the position of the most valuable practical and advanced ideas in medical science; and appreciating your disregard for self-interest and advancement, we hope to emulate those noble and elevated sentiments whereby we can rise superior to sectional thought, and render justice where merited. We hope that your efforts may be strengthened to the accomplishment of the purpose as herein set forth; and again asking that you give this matter your attention, and use your best efforts to have it brought to the attention of the Legislature of Louisiana, we hereunto subscribe our names.

(Signed) A. W. Boren,

and by 160 other students of the Medical Department of the Tulane University of Louisiana.

156 Washington Avenue, 4th District,
New Orleans, La., February, 15, 1888.

To A. W. Boren, and the medical students of the Medical Department of Tulane University of Louisiana:

Gentlemen—I have the honor to acknowledge the receipt of your communication of February 13, 1888, and beg leave to submit the following: The act to which you refer, containing the proscriptive legislation regulating the mode of selecting the resident students of Charity Hospital of New Orleans, was passed by the General Assembly of the State of Louisiana at the regular session of 1886, Act No. 47, "Making appropriations to defray the ordinary expenses of the State Government." * * * "Approved July 3, 1886, by S. D. McEnery, Governor of the State of Louisiana." The following is the portion of Act 47 which relates to the subject referred to in your communication:

"Charity Hospital in New Orleans. To support of Charity Hospital in New Orleans for year ending June 30, 1887, forty thousand dollars. For the year ending June 30, 1888, forty thousand dollars: *Provided*, that none but resident Louisianians be admitted as resident students. Act of General Assembly of Louisiana, 1886, p. 72."

We will not discuss the question of the legality of an act of the General Assembly of Louisiana, which makes an appropriation for the support of the destitute sick, contingent upon the performance of an act by the Board of Administrators, of which His Excellency, Governor S. D. McEnery, is President, which related solely to the nativity of the students to be appointed, and not to the mode of expenditure of the funds devoted to such charitable purposes as the purchase of food and medical supplies, and the payment of the salaries of the house surgeon, assistant house surgeon, treasurer, and other employees of the hospital. It is more important that we should inquire into the official interpretation of the special and proscriptive legislation of Act 47.

Through the courtesy of Edwin Marks, Esq., Secretary and Treasurer of the Charity Hospital, we have been able to make the following extract from the letter of Governor S. D. McEnery, of February 9, 1887, giving his *official* interpretation of that part of Act 47 which relates to the class of students to be selected as resident students:

Executive Department State of Louisiana,
Baton Rouge, February 9, 1887.

Edwin Marks, Esq., Secretary Charity Hospital, N. O.—Dear Sir: * * * My interpretation, in the Act of the General Assembly referred to, of the words "resident Louisianians," is that they mean citizenship. Any citizen of the State is a Louisianian, and the words do not imply or mean that the person should be native born. I presume that your inquiry is made in order to ascertain whether the medical students at the Tulane University from other States can be admitted as resident students in the

Hospital, from the fact of their residence in the State during the time they have been pursuing their studies. This residence is not sufficient. If the student is under age, he of course cannot select his residence; but if he is of age and came to the State with the intention of acquiring a residence in the State, and of remaining permanently here, then he is entitled to admission.

It is the intention of the act of residence coupled with the intention of remaining permanently, which fixes his residence, and which will entitle the party to become a resident student of the hospital. (McRowan vs. McGwin, 15 and 637.)

Respectfully yours,
(Signed) S. D. McEnery, Governor.

Regarding the action of the General Assembly of Louisiana of 1886, in Act 47, relative to the appointment of resident students in the Charity Hospital as unjust and unwise, and as injurious to the best interest of the students and patients, I embraced the earliest opportunity to obtain the sense of the highest medical authority in the State, to the end that the obnoxious clause might be repealed, or rather that such legislation might never again be repeated.

To accomplish this end, I attended the meeting of the Louisiana State Medical Society held in the month of April, 1887, in Alexandria; as will be seen from the following extracts of the proceedings of that Society.

Resident Students of the Charity Hospital of New Orleans, La.

Dr. Joseph Jones offered the following:

Whereas, The Charity Hospital of New Orleans receives the distressed and destitute, sick and wounded, of the States of the Union, and all the nations of the world, be it

Resolved, By the members of the Louisiana State Medical Society, that the position of resident students in this great and noble institution should be open to the competition of all honorable, intelligent and accomplished medical students. Be it further

Resolved, That the General Assembly of the State of Louisiana be respectfully and earnestly requested by the Louisiana State Medical Society to rescind the law enacted by the General Assembly of 1886, excluding all medical students from competition for the position of resident students of the Charity Hospital except natives and residents of Louisiana.

Resolved, That the action of the General Assembly of Louisiana of 1886 was in violation of those true, generous and patriotic principles which have ever characterized the philanthropic citizens of Louisiana.

Resolved, That the President of the Louisiana State Medical Society be empowered to urge the abrogation of this law of 1886, establishing, for the first time in the history of Louisiana, the unwise and illiberal policy of excluding from the competitive examination of the medical service of the Charity Hospital the intelligent and enterprising medical students of other States.

Dr. Joseph Jones supported the preceding resolutions by the following arguments:

(*a*) The object of this great and noble institution is the relief of suffering humanity, the healing of disease, the restoration of the sick to the performance of the active duties of life, and the advancement of the highest intellectual, moral, and physical welfare of the commonwealth.

(*b*) The generous citizens of Louisiana have not confined their benefits and ministrations to their own citizens. Upon a careful examination and classification of statistics of the Charity Hospital of New Orleans during the period of forty years (1836–1876), we find that 310,659 patients were admitted, and of this number 248,011 were foreigners, 54,403 natives of the United States outside of Louisiana, and only 11,761 were natives of Louisiana: It is evident from these statistics that the noblest and broadest charity has actuated the citizens, and especially the medical profession, of Louisiana, in the charitable ministrations to the destitute sick of all States and countries.

(*c*) By again throwing open the field for honorable competition of all accomplished medical students, regardless of their nativity, the State of Louisiana will secure the most effective service and achieve the greatest good to suffering humanity.

Duly seconded and carried.

In conclusion, allow me to direct the attention of the students of the Medical Department of the Tulane University of Louisiana, and of our sister States, who may in future desire to compete for the position of resident students in the Charity Hospital of New Orleans, to the following important facts:

1. *That Act 47 is not a law of the State of Louisiana.*

2. The operation of Act 47, as far as the appointment of resident students of the Charity Hospital is concerned, ceases absolutely on July 1st, 1888.

3. Unless the General Assembly of Louisiana, at its subsequent meetting, is induced to repeal this unwise and proscriptive legislation, *the Board of Administrators* of the Charity Hospital of New Orleans, will, after the 30th of June, 1888, be untrammelled in their appointment of resident students. They may, or let us hope they will, act regardless of *State lines*, basing the appointments upon *merit* and *merit alone.*

As your friend and professor, and as a representative of the medical profession, I shall cheerfully comply with your request, and exert any influence at my command to avert similar legislation in the future.

With thanks for the kind and courteous terms in which you have been pleased to couch your petition, and with kind regards,

I remain as ever your friend,

JOSEPH JONES, M. D.,
President Louisiana State Medical Society.

One of the most important measures for the advancement of the medical profession, and for the promotion of its higher education in the State of Louisiana, is the establishment of a State Medical Library, for the preservation of the archives of the Society, the diffusion of medical knowledge, and the promotion of original scientific research in all the departments of medical science.

The speaker urged the consideration of this important subject upon the attention of the Louisiana State Medical Society, as is well known, at its Ninth Annual Meeting in Alexandria, April, 1887.

The Charity Hospital, of New Orleans, would seem to be the proper place for the collection and preservation of the Archives of the Louisiana State Medical Society, in virtue of its being the great medical centre of clinical service and clinical study, and investigation of all diseases, but especially of those peculiar to our Southern States.

The medical profession of the valley of the Mississippi should at all times have access to these valuable archives, sheltered within the walls of an institution, whose portals are open by day and by night to the sick and destitute of all States and all nations.

The students also, who annually throng the wards of the Charity Hospital in the prosecution of their clinical studies, would have free access to the State Medical Library.

Conclusion.

I have thus endeavored to lay before the members of the Louisiana State Medical Society the results of our investigations relative to THE PRINCIPLES OF EDUCATION AND THEIR SCIENTIFIC APPLICATION TO THE DEVELOPMENT OF MEDICAL SCIENCE.

No nobler or grander theme has ever engaged the energies of my life; and if the sketch has been imperfect and meagre, the failure rests with my own imperfections, but not with the importance of the subject.

We hold

1st. That the students should be thoroughly prepared and equipped for the study of medicine by a systematic and philosophic preliminary course of study of the fundamental branches of science.

2nd. That a thorough course of medical instruction should embrace not less than fifteen chairs or departments with the necessary number of professors and instructors, furnished with all the necessary instruments, reagents, agents and well constructed and thoroughly equipped chemical, anatomical, physiological, therapeutical and pathological laboratories.

3rd. Medical students should be taught by actual experiments and demonstrations in chemistry, physics, physiology, pathology and therapeutics.

4th. Students should be prepared by their course of study, not only for the practice, but also for the development and advancement of medical science.

5th. The course of medical studies should be graded, and should embrace for their completion not less than four years.

6th. Clinical instruction is essential to the perfection and advancement of medical knowledge with the student of medicine—and should be prosecuted from the inception to the end of the medical course of study.

In presenting an outline of this vast subject we fear that we have taxed beyond endurance the patience of this intelligent and cultured audience, but we crave indulgence in view of the importance and elevated character of the science of medicine; its object, the preservation of the health and lives, and the healing of the diseases and the amelioration of the physical and mental sufferings of our fellow-human beings, its extent embracing a knowledge of all science, whether relating to matter or mind.

Health has ever been looked upon as the first of all blessings, and the truly wise and good physician is justly entitled to the regard, esteem and even veneration with which he has been held in all ages and amongst all nations, even the most barbaric, and by the afflicted and destitute poor, as well as by kings and princes. "Homines ad deos nulla re propiores accedunt quam salutem hominibus dando," is the expressed opinion of the celebrated Roman orator.

The nobleness of medical science has been well shadowed by the ancient poets, in that they made Æsculapius to be the son of the sun, the one being the fountain of life, the other of health or the second stream. But how infinitely more honored by the example of our Saviour, who, as Lord Bacon has said, made the body of man the object of his miracles, for we read not that he vouchsafed to do any miracle about honor or money, except that one for giving tribute to Cæsar, but only about the preserving, sustaining and healing of the body of man!

While we should be duly impressed with the dignity and responsibility of the medical profession, at the same time it should ever be remembered that the true physician is endowed with the modesty of the philosopher, and even in his highest and most self-sacrificing labors for the good of humanity must expect to encounter the opposition and neglect not only of his fellow-men, but even of the profession itself.

Whilst the dream of the elixir of life and of the philosopher's stone no longer animates the ardent child of nature, a pure mind and heart, actuated always by a sense of duty and by a lofty endeavor after the truth, may well receive the description of the *Angelical stone* of the alchemist: *The Angelical stone can neither be felt, seen nor weighed; it will lodge in the fire to eternity without being prejudiced; it hath a divine power, celestial and invisible, and endows its possessor with divine gifts.*

The physician works with deadly knives, and still more deadly medicines; he is entrusted with the lives of his fellow men; his life is spent in the nearest communion with the sick and dying, in sight of the very gates of eternity; the work of the physician, therefore, requires the highest self-command, the loftiest moral training, and the purest religious belief. The intimate association with disease and death, the frequent view of the effects of vice in all its forms; the temptation to promote private interests and elevate one's-self in the good opinion of others by the secret undermining of the professional reputation of rivals; the great power which the privacy with which a physician works, confers of injuring rivals by those delicate and almost imperceptible stabs, which are all the more powerful and fatal, because inflicted at a time when all the sympathies are aroused; the temptation to exaggerate personal qualification and power over disease: all tend, if not restrained by a noble, self-sacrificing spirit, by high moral culture and pure religious belief, to degrade the noblest profession, the noblest field for the exercise of the highest intellectual and moral faculties, into a field of strife—into a dark school for the development and education of the meanest and lowest principles of evil. As immortal beings, and as members of a profession which deals with immortal beings in their last extremities, you cannot if you would, shut your eyes to the importance of MORAL EDUCATION.

Happily the very pursuit of knowledge tends to develop the moral faculties.

It has been truly said, "that knowlegde is not a couch whereon to rest a searching and restless spirit, or a terrace for a wandering and variable mind to walk up and down, with a fair prospect, or a tower of state for a proud mind to raise itself upon, or a fort, or commanding ground for strife and contention, or a shop for profit and sale; but a rich storehouse for the glory of the Creator and the relief of man's estate."

The end of scientific education is the reflection in the human mind of the relations and laws of the members of the universe and the enrichment of the intellect with that knowledge which enables man to predict the course of future events, and direct and control the forces of nature to the advancement of his physical and social position.

In all our labors we should be encouraged by the thoughts that the humblest cultivator of natural science and especially of medical knowledge, is like the coral insect, helping to rear an edifice, which, emerging from the vexed ocean of conflicting credence, shall be first stable and secure, and at last shall cover itself with verdure, flowers and fruits, and bloom beautiful in the face of heaven.