Annual oration, delivered before the Chemical Society of Philadelphia, January 31st, 1801 / by Felix Pascalis, M.D. ; published by order of the Society.

Pascalis (Felix)

ANNUAL ORATION,

DELIVERED BEFORE THE

CHEMICAL SOCIETY

OF PHILADELPHIA,

JANUARY 31ST. 1801.

BY FELIX PASCALIS, M. D.

VICE PRESIDENT OF THE SOCIETY.

PUBLISHED BY ORDER OF THE SOCIETY.

Nous avons l'avantage de voir enfin,
les plus beaux jours de la Chimie.

MACQUER.

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1802.

ANNUAL ORATION, &c.

Gentlemen of the Chemical Society,

I COME, this day, to fulfil the honourable task of addressing your society, on subjects relative to Chemistry.

Permit me, at first, to congratulate you on the return of another year to be added to your commendable exertions for the improvement of a science which constitutes true philosophy, and imparts so many advantages to enlightened and polite nations.

Of these none have remained unknown to you, for as soon as this institution was formed, by the talents and diligence of its members, it stood adequate to the experimental researches pursued by the celebrated schools of Europe.—Less censurable than those venerable seminaries of learning, which have spent so many years in

false theories, in idle and useless systems, you have had the satisfaction of participating with them, in their discoveries, as early as your members could controvert, with the learned of all the world, any of the subjects or causes of the revolution that that science has experienced, within these few years. By whatever consideration personal praise could be waved, in your assembled Body, no doubt, it remains deserved by those who early promoted the sedulous cultivation of the most useful science. I subscribed to this laudable intention when I had the honour of being called as a member, in your institution. But I scarcely can confide in myself, this day, when by your appointment I am to display some of the admirable laws and numerous advantages of Chemistry. Was I adequate to the task, I would publicly declare that I became so among you, and after many years of our scientifical intercourse.

Necessity was the parent of our science in the most distant ages that historical records can trace; from avarice and cupidity it afterwards received some slow and ob-

scure improvements, but accurate analysis only has lately brought it to perfection. The ancient history of Chemistry offers such a lamentable view of ignorance, superstition and empiricism, that its pages seem no more useful but to prove how laborious, slow and uncertain is the advancement of human understanding, unless it is aided by the correct results of observation and by an unprejudiced love of truth. Happy is our age, in which at last, we are acquainted with the elementary laws of existing bodies! Those laws which extend to all material objects, visible or invisible known or still concealed from our observation; those laws, the limits of which, we do not know, because we cannot trace where the limits of nature are to be marked; those laws form and constitute the seience of Chemistry;—indeed by its principles it is connected with all the branches of natural philosophy, and by its comparative results, it dictates the rules of arts and the processes of manufactories. Under this twofold view, Chemistry embracing all wants and comforts of mankind, is now to be contemplated as

the most important and interesting subject, altogether to do honour to your pursuits in its study, and to encourage many more votaries to the acquisition of its numerous advantages.

Philosophy

You know, Gentlemen, how numerous are the branches of universal Philosophy! they form like a beautiful tree, which often has been drawn by the hand of genius; under its shade, all sages vied to find shelter or repose, and of its fruits they all wished to partake. When all these branches have been severally examined and studied, they appear so well connected and so much depending on the same laws, that they compose but one science, the mysteries of which cannot be disclosed, unless we enter into the laboratory of the chemist, and there we explore its processes. From these, all sciences in the physical order, must receive their tenets and elementary doctrines. Would the

Astronomy

Astronomer refuse to witness our invariable results of attraction and gravity, because we cannot explain their operations, as he does for the motions of the rolling sun, and planets, by the *direct ratio of*

masses, and by the *inverse ratio of the square of distances*: we must then propose some difficulties arising from the known characters of Caloric. That this element is not ponderous, and has no gravity to any given centre of density, that no law but that of a projectile power, can be attributed to it, is beyond doubt. How is it then, that all the bodies of the planetary system, the greatest number of which are solar or ignited, could equally obey the same law of the direct ratio of masses, and of the inverse ratio of the square of distances? Newton had calculated that the comet of the 8th of December, 1680. when in its perihelium had received a heat 2000 times greater than that of red hot iron. What matter, we ask, can be conceived to exist, as a centre of gravity, at a still more and infinitely higher degree of heat? The known laws of nature leave no room to any conjecture, except to that of an elementary and homogeneous fire, which cannot exert but an immense projectile power, that of course, it excludes entirely any share of attraction, by the direct ratio of masses, and the inverse ratio

of the square ratio of distances. A conclusion more than probable is therefore to be drawn, that to chemistry is perhaps reserved to disclose a different order of the primary laws of the universe.

In this, as well as in other investigations, the Philosopher must be aided by the results of experimental chemistry. Any proportion for instance, of the attributes of matter—is it well understood, unless the laws of Caloric are correctly defined?

Caloric

Caloric! astonishing principle of destruction and life! To describe well its activity and operations, it would be necessary to advert to mountains which it undermines, to the frightful craters it opens on their most elevated regions, and to the immense torrents of lava with which it inundates afterwards cities and empires. We might thence follow its burning streams into the abyss from whence it again breaks open its barriers, lifting mountains, raising islands, or if at liberty, uniting to water, boiling up in the shape of whirlwinds or clouds which darken the firmamament. This indestructible agent then divides itself in various scintillating mete-

ors, or by its sudden combination with air, forms the lightning, and by tremendous electrical detonations, spreads terror and devastation among mankind, threatens nature with the perturbation of all established order. However, you may master Caloric, Gentlemen, you may attract it from the regions above, under your lens and concentrate it in your crucibles, where to your command it will melt or volatilize the hardest metals, reduce rocks to the elasticity of clay, and clay itself to the adamantine hardness: where it will be disposed by your processes, into fixed and opaque substances, to arrange their pores for an easy passage of the light!— With you it will create as it were aerial and invisible bodies, among all the known substances you can enumerate and those that can be suspended in a gazeous state. After such comparative results, Philosophers may explain elementary laws concerning the *attributes of matter;* they are able to explain likewise the revolutions of seasons, and the phoenomena of the atmosphere. With the capillary tubes of observation they maymeasure spaces, density of

air, and gravity of fluids. How often scolastic philosophy blundered on those simple subjects, when chemistry had not yet controled all other sciences! The first who measured the parabola of a bullet launched into the air, by the thundering explosion of a cannon, attributed the almost incandescent heat of the metallic globe to the detonating mixture, because to chemistry only it belonged to demonstrate the power of friction in disengaging heat from its latent recesses. Other erroneous doctrines on that noble agent of nature which so often has been mistaken for a modification or produce of matter, have been exploded!—The supreme laws of the existence, and diffusion of Caloric in nature, are its necessary tendency to equilibrium with external temperature, and its power of overcoming the cohesion of particles, to satisfy its affinity with them.—But let us not pass over that other phenomenon of affinity, unnoticed. Without the knowledge of its laws, Philosophy would be mute at the view of the stupendous works of nature, or she would be

obliged to conceive as many deities as there are prodigies in the creation.

This is the great power which arranges, unites, and hardens homogeneous particles of matter, and exerts itself likewise with due proportion, upon heterogeneous substances. Under the heavy foundation of mountains, in the deepest subterraneous cavities of the earth, in the bottom of the seas, no where it finds obstacles sufficient to oppose its operation, except Caloric accumulated could suspend their effects, to a certain degree. Yet diſtance can truly impair or weaken the power of affinity : aproximation of course will augment it. In itself, it is composed of many tendencies, but these remain incommensurable. Their insulated effect is nul, and as soon as they are simultaneous, they become effectual. In fine affinity, which is attraction, adhesion, coheson, and aggregation, by the immediate reſult of elective power, is the primary cause of diſſolution and decomposition. Now let the Philosopher listen to the laws of affinity, and the minutest circumstances will be explained, from

Affinity

the spheric form of a bubble of air, or of a drop of water to the various degrees of elevation of fluid, in capillary tubes, or to their pressure, by the same, both effected in inverse ratio of the squares of diameters. To these we may add the phenomenon of blaze in ignited bodies, the mechanism of breathing and renewing animal heat, by the decomposition of common air, but more especially, the effects of the refraction of Light. The Philosopher may, no doubt, well explain how the density of the rays of light is like the square of the distance from its focus; how it is transmitted to the retina, in what angle it is reflected, and at laſt refracted;—to these elementary laws of Optics, Catoptricks and Dioptricks, the chemist adds a question ready to answer it; What is light? Light, which adorns the whole creation by an infinite variety of colours, because, each colour is light presented in a different angle of refraction or refrangibility; light is the element of all the worlds, of innumerable solar systems and comets; Light and Caloric are as often united, as

Light

vital air and Azot are aggregated to form the atmospheric orbit of the earth ; yet, caloric may be present without light, and viceversa : light ranks the firſt among the elements of nature by its tenuity and elasticity, for more rapidly than any other, it can traverse the immensity of spaces. It cannot be said to be like a modification of a diffused subtile matter, because we trace substances, with which it has an elective affinity ; it stimulates animated bodies, and to vegetables, it is as a last component part necessary to develope their succulent juices, their splendid flowers, their robust fibres, and their luxuriant colours ; No paradoxical doctrine will ever be able to erase from the books of Philosophy such truths inscibed in it, by the hand of the chemist.

Behold! another field is open ; but to the most ingenuous philosopher it will appear a dreary solitude, an immense desert, until Chemistry discovers in it, all the elements of the productions of nature. Air, that invisible fluid, but so sensibly perceived by our organs, has long been the object of innumerable inves- Atmosphere

tigations, yet in our days only, they have been successful. The learned among the ancients, filled up their atmosphere with their Genii, to explain contrary effects of that invisible orbit; and among moderns, it has long been a desideratum to account for an element which appeared necessary to fertilize the fields, and to nourish life, while it was dreaded as the destroyer of agricultural labour, or the vehicle of contagion and death among mankind. The attributes of its particles were still more incomprehensible, when it was considered that with a rapidity to be computed only by the imagination it could transmit light and sound, although they would be agitated in a thousand contrary directions. The pressure which it excercises round the globe, to the center of which it gravitates, was, at first, discovered by Toricelly, who traced to what height a column of fluid could be equal by its weight to the superior pressing column. More of its comparative gravity with other fluids was still better defined, when Monge declared, that if the whole atmosphere could disappear, all the liquids on earth, would suddenly

rise, be converted into vapour, and form another atmosphere; but all these progressive views scarcely unveiled one corner of a more extended view of the laws of nature. The chemist attempted the analysis and sinthesis of atmospheric air, and it was performed; moreover, he found out, and demonstrated, that its component parts could be equally concrete and fixed in organic bodies, or combined with other various solid substances; it has then been proclaimed that the Oxygen and Azot constituting common air, were nothing but another modification of matter itself, and a continuation of the chain of existing bodies. It was no more problematic afterwards, to ascertain how this fluid administered life to us, as often as there are instants during which we are allowed to exist, or how it effected the most principal changes and modifications in the animated or nianimated creation. The pneumatic observer could soon disengage the component parts of atmospheric air, from common materials, and imitate a new creation. Let honour be given to the memory of the great Newton; he was the first who

predicted the prodigies of our laboratories: "*Si se tangerent* said he, *particulae aëris—aër evaderet in marmor*," * but without the science of Chemistry, that oracle could never be explained, and philosophy could not advocate as a true proposition, that the atmosphere is the last reservoir where the elements of all bodies are ultimately received, and from where again they are substracted to create bodies and to support organic life: there is demonstrated another axiom long ago proclaimed by Lucretius, "*nothing is annihilated in nature*:" As soon as she has effected a dissolution, she exhibits in her very bosom the consoling power of a new creation!

But from the elevated regions of Heaven, and from all the primary elements and phenomena of the world, the mysteries of which have been disclosed by Chemistry, let us more minutely fix our attention on the surface of our globe. A more admirable view of the analysis and combinations of all existing bodies; their formation, growth, alteration and destruction, their

* Tract, de nat. acid.

treasures and deleterious qualities, every thing will be unveiled by our processes. More evidently we will then enumerate the infinite improvements which are applied to arts and manufactures by mineral, animal, and vegetable Chemistry.

You are fully acquainted, gentlemen, with the difficulties and confusion which attended the science of mineralogy, when laborious researches and observations, were transmitted through external and erroneous characters. Some such as Gellert and Wallerius could not distinguish any thing else but vitrescible matters, or argillaceous or apyres, or alkalines and calcarious : others would prefer the general division of earths, sands, and stones. Some simply divided minerals into earths, salts, combustible and metallic substances. As late as the year 1784, the famous Daubenton, took another erroneous classification, consisting of negative characters, of insoluble, incombustible, metallic, then transparent, and crystallized, smooth, &c. Now we may observe, that these descriptive methods, could not

Mineralogy

add the least improvement to science, and that they contributed to many erroneous assertions. It is not, for instance, by the presence of a metal that the ponderous spar is to be judged, since its basis is a primitive earth, and if this is a Tungstat of lime, or if the Wolfram itſelf (which is thought by many, another kind of primitive earth) is nothing but an ore of Tungstein, we are to be determined in these various opinions by accurate analysis only, and in no ways by external characters. Were these to fix our mineralogical definitions, by what given habitudes, would we be justified to class the beautiful fluoric spars of Derbyshire, or fluat of lime, among insoluble neutral salts? Error would be still more egregious and unavoidable, between the Sulphures of Molybdena and the Carbures of iron, which are so absolutely resembling each other. It has been found, that a Borate of lime may spark and scintillate as well as quartzose substances; that metallic carbonates must effervesce with acids, in short, there is not one descriptive method, but it will

in many points, lead us to contradictory facts. So sensibly was Daubenton convinced of their deficiencies, that he expressed his wishes for a method founded on analysis of constituent principles. Fourcroy begun it in 1780, but the Scyagraphy of Bergman, still better demonstrated the superiority of the method of constituent principles. This doctrine was embraced by Monge who retained external character for varieties only ; by Kirwan of England, Werner, Debern, Cromstedt and Chaptal ; thus the science of Mineralogy was forever added to the dominion of Chemistry.

With this conquest, we will not however consider it as the chief point in Chemistry, to form theories on the primitive state of the earth, to explore the ruins of extinguished volcanos, nor the most antique works of nature, from the grotto of Fingal to that of Antiparos. We will not indulge to the idle curiosity of enumerating the causes of the granitic ridges of mountains and of the calcareous secondary ones ; we may dispense with contemplating whether the ocean

has once been an atmospheric orbit, during the original conflagation of the Earth, or how, after its condensation it insensibly retired from the polary regions, and elevated plains of Tartary, to its pacific and Atlantic bed, leaving every where immense masses of its animal and vegetable productions. However useful to science, these mineralogical essais and deductions would be, with more real advantage, the chemist will be contented to analyze mineral substances, and to procure those which satisfy our wants, constitute our wealth, augument our comforts, which enriches our arts, and manufactures. Among these, Nitre may justly occupy the first rank. Any thing relative to the production of that precious saline matter is interesting as much to save expensive importations, as to perfect manufacturing proceſſes.— Let me remind you of that awful period of the French revolution, when the fate of 30 millions of people, divided, confused and famished, ruined and surrounded by sea and land, seemed to depend on a sudden formation of saltpetre, that on-

Nitre

ly means of defence, which was exhausted. Various ingenious ways were devised by the learned,— saltpetre was formed,— and the tyrants phalanx being dispersed, Liberty was triumphantly obtained, thanks to analytic science.—To all the known processes which may procure Nitre either from artificial beds, or lixiviation of certain substances, we now may add that of the decomposition of common metallic oxyds, and of ammoniac; but the most surprising, if further experiments could evince its efficacy, would be that of procuring the formation of nitric, acid by an only tenfold *compressibility* of the aggregate Oxygen and Azot composing atmospheric air. Various attempts with ingenious apparatuses promise great success, and if Citizen Guyton is not disappointed in his expectation, with gratitude, Chemistry will receive from him the power of accelerating the operations of Nature.

Oxygenated muriat of Potash.

It was during that lamentable period when the friends of Liberty were with importunity, compelling nature to supply them with some new means of defence

against their foes; that the discovery of Berthollet, on the tremendous fulmination of Oxygenated muriat of Potash were again resumed.—In this age of reason and benevolence, let us never boast of increasing the power of destruction, since the prevailing Philantrophy exerts itself against any system of warfare. We only remark therefore, that from various habitudes of the *Hyper*-oxygenated muriat of Potash, the most surprising effects are to be reckoned among the laws of nature. If you take about 20 Centigrammes, or 3 grs. of that saline matter, with one third of pulverized Sulphur, you may by a slight trituration, produce several detached detonations: but wrap up the mixture with paper, put it between an anvil and a hammer, strike a blow and the detonation will be equal to that of a cannon, surrounding you with a purple blaze, and white smoke.—With several other mixtures of that salt, shock or percussion will equally operate with the most tremendous power. This mechanical effect is therefore equal to that of caloric, or of fire communicated from one body to another. This singular pheno-

menon had been witnessed, although in a very small degree in the gun powder, but it had not been attended, in this point of violence, that by compression, the particles of Oxygen could unite to those of inflammable bodies, and form an abundant gazeous fluid to which a great quantity of caloric, gives such electricity as to strike on the air with an unparralleled violence.

Under the unremitting exertions of chemists, Mineralogical enquiries have developed as many curious facts as there were improvements to be added to all known processes, for obtaining muriatic acid, for cheaply crystallizing the sea salt, for extracting the Soda, for preparing the muriat of ammoniac, for purifying all combustible minerals that can be converted to our use, for preparing metals, and converting them to the most useful purposes, for adding new ones to the treasures we were already possessed of ; but one of the discoveries of the latter kind, is too remarkable not to be fully detailed here.

Long before the Phlogiston of Stahl had been exploded by the new analysis, and in spite of all the beautiful experiments of

Cast Steel

Bergman and Priestley, nothing very certain was known on the fabrication of various sorts of steel. Not longer, than twelve years ago, it was discovered at last that carbone only, in due proportion, would constitute various sorts of fused iron, and of steel : But the English who had been long in possession of a more perfect kind of cast steel, could not in the least be disturbed by the repeated researches of Vandermonde, Monge and Berthollet. The latter had ever declared that he was at a loss to account for the character of that precious metal. But a mystery which had been perhaps fortuitously discovered, which avarice and cupidity had so long concealed, was at last disclosed by the ingenious Citizen Clouet, and made public with a liberality, which, altogether honours science and the National character, the whole secret was I believe, found out by analogy; as different quantities of fused iron and of steel were known to be the result of various proportions of Carbone and of few vitrescible substances of the original ore. It was therefore concluded that a more intimate union of that element,

and of the purest clay, with the best iron, effected spontaneously at a due degree of heat, could form the famous English cast steel. Liberal private means, and even national expenditures have been largely and sedulously applied to numerous experiments, at the wind furnace of Macquer, to the 150th degree of Wedgwood's Pyrometer. The results, Gentlemen, have magnificently equalled the most admired steel of Huntsman and Marshall. The new theory of our chemistry has besides acquired another illustration of the elective affinities of iron, for carbone, since the Carbonate of lime, or marble in dust has been offered to it. The fixed air has been decomposed, and the results have been equally successful. So much for the wonderful secret of the cast steel of Sheffield, Yorkshire.

Alumine

Before I terminate this article of Mineral chemistry, let me remind you, gentlemen, of the great advantages obtained by other nations, from the class of alumines only. Among the compounds in which that primitive earth is predominating,

they have found all the materials from the common tile and brick to the most elegant works of Porcelain. Not only various kinds of clays have rendered infinite services for the commodities of life, but they may be turned into the best instruments of arts and utensils of manufactures of glass. Some clays have been found likewise to be good manures, and others are an excellent substitute for soap inthe Fuller's art.

That America possesses such treasures, it is needless to prove, and that they have not yet been applied to the use of the community, it is also an object of regret. Do, gentlemen, let a liberal patriotism animate your scientifical pursuits, among you who are to see the glorious days of the trans-Atlantic Republic. Encourage and repeat minerological experiments on all kinds of Alumine, the first who will successfully procure manufactured works of the kind and tolerably good earthen wares, will deserve well of his country and be rewarded by the gifts of fortune.

Vegetable Chemistry

By offering you, a few more observations on Vegetable chemistry, I hope I will further illustrate the dominion of that sci-

ence over all the branches of natural Philosophy. Indeed, not only the most interesting materials upon which we operate must be obtained from vegetables through the processes of combination, but the chemist moreover is called upon to explain the phenomena of vegetation.

Vegetable analysis has offered us three elements only, in vegetation ; Carbone, Hydrogen, and Oxygen. The number and proportion of these principles will afterwards be sufficient to answer any qu
on different other results of vegeta

Observation demonstrates that water and Carbone are the real nutritive principles of vegetation, that is to say ; Hydrogen and Oxygen are afforded to them by the decomposition of water, while Carbone is procured from the decomposition of animal and vegetable matter. All this is confirmed by the analysis of the fibrous part of plants which are a mere aggregate of Carbone. But in what manner is Carbone carried into all the parts of a plant or of a tree ? by what means can it circulate in them ? by what solvent is it rendered the precious food of vegetables ?

The solution of all these problems, gentlemen, is provided by correct and incontrovertible experiments.

Pure charcoal such as it is left in our hearths, or mixed with any kind of pure and dry earth, could not certainly be spread on the ground, and depended on as the best manure. But on the other hand, do not we know that dead vegetables, (from which much carbone can otherwise be procured by combustion) when relaxed or softened by maceration and putrefaction, are indeed the best materials for an excellent manure! How shall we account then, for the striking difference of pure carbone being ineffectual for vegetation, and of compound of carbone becoming so evidently necessary to it? why, in the latter case, that element is truly held in solution, by oily, extractive, alkaline and resinous vehicles. Now water, which has the faculty to dilute thoſe natural combinations, becomes itself the solvent which carries carbone through all the system of vegetation, and by which nutrition and digestion are accomplished.

To proceed to the last stage of formation and growth of vegetables, let us mention, that air, and perhaps azot, caloric, acids, motion, and even rest, may suffice to precipitate the carbone. These other eventual agents therefore, which every where, are found active, are those that effect the concretion and growth of any fibrous matter—these are wholly explaining the principles and mysteries of life in vegetation, because they support and animate its organs, distribute the nutritive matter, modify the action of perturbating causes, preside over all the operations of that living laboratory of nature, just as the Chemist directs the operations of his own, and changes the results by altering the form or number of his reagents.

These general principles being established by analysis and sinthesis, who can deny that Chemistry teaches the natural philosopher, how in the system ef Nature, primary substances can be arranged so as to form organized bodies,....and from thence, obtain such attributes with which we were formerly

unacquainted, active attributes! which we never dare assigne to matter! But if nutrition, growth, and decomposition of plants, are explained by the laws of chemistry, how much better any precepts respecting the choice of their soil, climate and temperature, of their management and multiplication, will be derived from the same science? not only agricultural rules are connected with Chemistry, but it dictates likewise a kind of vegetable Medicine, which has, its institute in Agriculture, of Hygiene, of Clinics and of Theurapeutics.

Vegetables as objects of analysis are to be considered as containing substances and compounds necessary to our pleasures and comforts, to arts and manufactures. Such are mucilages, oils, rosins, fecula, gluten, Sugar, various acids, colouring matter, wood, extractive substance, the Aroma, and the Oxygenous gas which all vegetables emit by their excretory organs; of these subjects I can now notice but few.

Nutritive principles in vegetation

It was very difficult formerly to define which of the component parts of vegeta-

bles, would afford a wholesome and nutritive food. The mucilage which exists in them, variously elaborated with acids gums or sugar, has been at last pointed out. Analysis has even traced that food in the abundant and pulverulent fecula which constitutes the greatest quantity of substance in our grains, roots and seeds, the same principle admirably combined or deposited in different organs of plants is the very means of their prepagation, growth, and fructification. In whatever plant it is more or less abundant, in what parts it can be more or less concentrated, it cannot escape the analysing investigation of the chemist who might extract a wholesome food from rejected vegetables and insipid roots.

Other treasures, gentlemen, are discovered by the leading method of analysis. As soon as oil that precious vegetable produce was known to be an intimate compound of Carbone and Hydrogen, as soon as its various states of gelatinous, fixed and volatile, were ascertained, the very organs of the plants in which it is abundant, were easily detected. Hence by com-

parative results of one known species bearing resemblance to another, by the shape, taste, analysis, of their pulps and seeds, it was found out that common bushes spontaneously growing, might supply us with one of the most indispensably necessary produce, at least for lamps and manufactures. Such are the *Onopordum Acanthium*, and the *Evonimus Europæus*.

The union of these oils, with alkalis to form soaps is the only advantage that had been obtained, but that they can also, through various processes, combine with earths, acids and oxyds, it has been minutely described, compared and experimented. Pharmacy has therefore already appropriated those processes to several preparations more useful and agreeable.—Poisonous and metallic oxyds the only trituration of which was highly dangerous, have been safely elaborated while enchained by oil, which has been afterwards easily removed; the art of painting has likewise been enriched with more imperishable colours. Already Citizen Merime, with oil and Copper has splendidly orna-

mented apartments with a new and inimitable *Verd Antique*.

Acetite and Acetate of Copper
Acetite of Lead

On the other hand, it was well known that certain vegetable acids when united to metallic oxyds, could procure precious materials for painting and dying. But the simplest and cheapest processes were never reduced to easy principles that could correspond with mechanical means and with an useful routine among poor manufactories: if such an improvement has been obtained from chemistry, it must be confessed, that it imparts its treasures even to the industry of the ignorant, and does not permit that they should be monopolized by a few individuals.—It had been a branch of commerce and considerable revenue, anciently established among the people of large districts of France, to prepare the Acetite and the Acetate of copper, with the Acetite of lead. They could not certainly make a more profitable use of the remaining grounds of their grapes, after the vinous fermentation. Their mechanical and easy operations were always the same, handed down without improvement from fathers to children, until they

were threatened to lose their annual produce by the concurrence of the Hollanders who manufactured and introduced, much purer and finer Acetite and of course preferred, chiefly for paints. The chemists of France immediately inquired into the causes of the inferiority of the metallic oxyds; they found it out in the great quantity of extractive principles in the grounds of grapes, and in several operations of the processes which were mechanically executed; they devised every thing accordingly; they traced to the poorest and most ignorant, the way of simplifying their work; they substituted distilled vinegar in some cases, so that in a little time the most beautiful oxyds and crystals were obtained; the danger of any concurrence was removed among thousands and thousands, of their grateful countrymen.

Acetite

What improvements were by the same time added to the tannerries of the country, under the philanthropic and ingenious exertions of Citizen Seguin! He accurately demonstrated the theory of the singular effects of the tanning principle which was formerly quite undefined.

This is the Gallic acid which dissolves the gelatinous matter, and precipitates it to consolidiction, just by its various degrees of concentration. From this discovery it was concluded that the art of dying was in many respects a colouring tannage which should not only please the eye by flattering colours, but that should remove even the solubility, or the corruptible tendency of woollen cloths. This advantage has been already experienced in the hospitals and armies. If the tanning principle is too abundant in colours extracted from wood so as to oppose their beauty, it is vice-versa concentrated by gelatinous matter, in short the quality of all coloured silks, wools, and cottons, depends entirely on the colouring matters, and on its mordent. I would not, gentlemen, fatigue your attention by a long series of other precious facts, every day obtained from Chemistry in objects of the greatest utility. Let it be said only that they are all admirable and ingenious. Such is the reduction of mordents to as few ingredients as possible, for the preservation of Cloths,

just by previous impregnation of oil ; such has been that of reddening by acids, the blue colouring matter of the Brazilian Wood ; that of dividing two colours confused in one, as the beautiful Yellow and Red in the *Carthamus Tinctorious* ; that of employing fermentation to destroy the extractive principle that contaminates the colours ; that in every case, of counteracting the developement of the red by the Alkalis, and the incomparable process, in fine, introduced in manufactories of Cloth, by Chaptal, to supply the Soap necessary to mill, to cleanse, and to felt, at the proportion of 48 pounds for 100 of cloths, with an animal soap obtained by the decomposition and solution in Alkaline lixivium, of all woollen rags, and worn out materials that are rejected in various operations in manufactures of that kind. It is necessary to add that no inconveniency in this œconomical process has been discovered which has not been effectually removed. These and other facts are very simple, but they require the penetrating attention of the Chemist, to be referred

to the fundamental elements of the science, even before they are applied to uses, experiments, rules of arts, and to processes of manufactures.

Animal Chemistry

Passing through a great number of discoveries and useful results, for which we are indebted to vegetable chemistry, I come to the last part of our division, that of animal Chemistry.

Medicine

With that definition, you anticipate me in the series of late discoveries and extensive improvements which in all its branches, Medicine has received from Chemistry. That science which directs all its pursuits to the preservation of health and life, to the relief and cure of human diseases, had been reduced during many ages, (and by the most unaccountable fatality) to absurd systems, or had been composed in its institutes, of few good precepts, and so few accurate observations that it was inadequate to the wants, or little entitled to the confidence of mankind. About the beginning of the last century, however, the institutes of Medicine appeared to be connected with as many of the physical laws, as can be applied to Physiology. Yet va-

rious contradictory systems continued to be advocated, without much retarding the progress of that science. But alas! in a period not much remote from our days, it has been again confused by metaphysical entities that have no connection at all with the laws of nature, and which as attributes of animated matter are unintelligible, erroneous and absurd. At last, in imitation of chemistry, the spirit of analysis has prevailed in all the branches of natural philosophy, and consequently the friends of the healing art, who wished independently and usefully to pursue the career of their labour, have renounced all logical systems, and composed their institues of medecine of such facts and aphorisms of the ancient and modern, that experience had rendered incontrovertible with all the results that physical laws and analytic animal chemistry, could consistently offer to their medical investigations.

But here, Gentlemen, let me bear evidence against the unrestrained spirit of novelty and the unphilosophical theories which of late have been mistaken for physiological and Chemico-medical improve-

ments. For whatever is handed to us of the results of animal chemistry useful to Medicine, is sufficient to recommend the connexion of both sciences, without any gratuitous, singular and perhaps false applications. I do not pretend to controvert here the supposed discoveries of Girtanner, of Beddoes, Davis and others, who with so rapid strides through the scabrous path of science, have promised to themselves and the public, to open a new Æra, and to dispel from among mankind all the diseases they were necessarily subject to. There are, Gentlemen, enthusiasts and fanatics among Philosophers, as well as among devotees and sectaries. Human understanding and science may likewise be degraded by assumed notions and fanciful theories, as much as they can be by the effect of ignorance. Indeed those Philosophers of Germany who pretended once to explain the case of a child born with a golden tooth, without having previously ascertained the evidence of the fact, were no less ridiculous than new theorists deserve to be thought, when they pretend to explain animal irritability by Oxygenation, and to cure dis-

eases, with certain gases, without having in the least established how much and in what respect the attributes of animated matter, could be assimilated to any of the laws of elective affinity, nor to the habitudes of the elementary principles in nature. No, no, the Loco-motive power of life, or rather, animal irritability has nothing in its effects that can be connected to those of the substances that we can torture by chemical processes. The simple contractibility of a muscular fibre, or the active secretion effected in the cavity of a viscus, will ever baffle our enquiries, and all the vast comparative systems, which we would derive the most ingeniously, from the laws, habitudes and combinations of the existing inanimated bodies. But if theories on organized and animated matter, or physiological causes of life and health, and on the origin of diseases, are to form a book of aphorisms perfectly distinct and different from the elements of Chemistry, there are however, certain points of contact, between the functions of our organs, and all the laws of nature, in which, much good has been done ; important discoveries have

been made and many more are to be expected, in medical science, from Analysis and animal Chemistry. To it, for instance, we are indebted for the knowledge of that kind of combustion of atmospheric air, which is effected in the lungs, of the Oxygenation of the blood, of the origin of animal heat, and of interesting conjectures, supported by experimental observations concerning the causes and characters of malignant fevers, and of their inflammatory or anomalous symptoms. To these great acquisitions we must add the Analysis of animal solids and fluids, the component parts of which have been admirably enumerated, and likewise some mysteries of their growth, distribution and final dissolution. Of course, new Pathological views have been judiciously offered, respecting certain visible or invisible agents, which cause perturbation of animal life; among them, deleterious gases, by their operation on animal irritability, stimulant, sedative or poisonous, have really disclosed a long series of our diseases. Animal Acids chiefly, and other primary combinations in the blood, in the

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Pathology

bile, in the bones, in earthy concretions and others, do form, Gentlemen, the most precious collection of facts and observations, that ever medical science could be improved with, for the relief and cure of a great many diseases. Let me mention one only, to prove the useful applications of chemistry to the science of medicine.—

Phosphorus

The great difference of characters of the Phosphoric acid, obtained from human bones, and of that produced by the deflagration of Phosphorus, lately induced Vaucquelin and Fourcroy, minutely to investigate the habitudes of that Animal substance. Their experiments accurately pursued in various Analytic and Sinthetic ways, proved beyond any doubt, that when 100 parts of Phosphate of Lime, were treated by mineral acids, any of these however, concentrated could not precipitate but 24 parts of Lime, and that of the 76 remaining, 17 only escaped as pure Phosphoric acid, while 59 parts of acidulated Phosphate of Lime were kept, in solution in the Sulphuric, or Nitric, or Muriatic acid. But these 59 parts being again decomposed by the Oxalic acid, or more

cheaply by the Nitrate or Acetite of Lead, would afford the whole proportion of Phosphoric acid, which with the above portion of 17, effected exactly 41 parts of that acid, which can saturate 59 of Lime to form 100 parts of Phosphate of Lime. Without mentioning here the reasons they assigned for that singular order of combinations nor the incontrovertible facts by which it is demonstrated, I come to the conclusion. Phosphoric acid has then the power of holding in solution the Phosphate of Lime, and strange to say, in that state is but partly attacked by mineral acids, while it entirely yields to the power of vegetable acids. Therefore, Phosphoric acid, must be powerful enough to soften, decay and distort the bones; and to its superabundant presence only, such disorders in those solids must be ascribed.— Moreover, if by any cause whatever, the usual secretion of Phosphoric acid effected through urine, is interrupted, the consequences will necessarily be injurious to the very support of our frame, by attenuating the Phosphate of lime of the bones, by causing it to deviate in our fluids, or

in membranous parts, where it will accumulate, or obstruct and torture the most delicate organs. Now, such is, in this instance, the help we have received from Chemistry, that we may oppose to the greatest ravages in animal oeconomy, if we know which is the superabundant principle that must be counteracted: and thus, in an infinite number of other cases, Chemistry teaches the Physician, on what necessary combinations animal functions are depending, by what assemblage of substance, Providence has marked the order of succeeding periods of Life.—I had almost said, even of Death; because, when that other modification of existence takes place.—Chemistry still more triumphantly can operate on the remnant of a Divine work, disunite all its aggregate compounds, and trace their particles to their original elements!

Pharmacy

This is not all; it is interesting to consider a moment with what simplicity and regularity, Chemistry has in general, composed our precepts of Theurapeuticks and methods of Pharmacy. How long and how often the exhibition of remedies

has been confused by empiricisms, embarrassed by ignorance and endangered by avarice! The learned of all ages ever lamented the almost inseparable evils of that branch of the healing art, but their regrets or their cares were ever inadequate to the accurate knowledge of the virtual properties of remedies, and of their proper classification. Behold! now Chemistry has swept off all the dregs of quackery and ignorance; it has detected the imposition of useless compounds, the fallacy of celebrated nostrums, and has exposed the danger, or the inutility of wondrous specifics which had been handed down by a credulous or fanatic care, as the most powerful agents in the cure of diseases. The Revolution in Science, as effectual as that in the political order, has equally silenced every kind of assuming authority, and of fanatic delusion. The universality of Analysis among all the productions and bodies in nature, has traced, all laws, all virtual properties, and almost all possible combinations... Away, therefore, with the vender of nostrums, who cannot rank among philosophers and

chemists; away with the physician whose incapacity or equivocal qualifications could have been formerly usurped under the garb of Science, and of literary titles. These, and all propagators of evil and errors, cannot stand the test of science, because like truth, science has impressed its features on the physiognomy of its votaries. Science is possessed of its own language, and that of chemistry, which has substituted its nomenclature to the absurd and unmeaning definitions of the old, is the last trait, gentlemen, which distinguishes its adepts from the vulgar or unskilled, as much as it guards its discoveries against any unfounded innovation, and exalts its supremacy, among philosophical sciences, by the language of truth, which belongs to it alone.

Here I conclude, Gentlemen, an imperfect survey of the improvements procured by Chemistry, to Philosophical Sciences, Arts and Manufactures. I may, very justly say, that society has received more real advantages from it, in a few years, than during all the preceding ages of ignorance, or of imperfect knowledge of

the Laws of Nature. I could not advert to every interesting view of that Science, within the short space of time I have fixed, and perhaps, fatigued your attention. * With regret thus, I have almost omitted to describe its flourishing cultivation in the Universities and Colleges of this great Republic. The splendid talents of several of their Professors, have still more promoted the sedulous emulation and the distinguished abilities of many students, in their numerous classes. But in the name of your institution, I must notice that in the Proffessor of Chemistry of this university, our worthy President, that science has not only gained a strenuous vindicator of its doctrines, but also a liberal inquirer after truth, an elegant, and successful experimenter.—You remember what a great man he has had to contend with; Priestley to whom our science is so much indebted, and whose opinions and

* In the Philadelphia Laboratories, new Experiments have been lately instituted, relative to the tremendous effects of the Fulminating Mercury. The Galvanic influence, also that astonishing phenomenon of PERPETUAL MOTION, has been minutely investigated by Pr. Woodhouse, both through the METALLIC PILE, and the CHAIN OF CUPS OF VOLTA.

experiments are to be consulted, in any of the elementary processes of our Laboratories; Priestley, who commands respect in his Chemical controversies, because, as long, as some mysteries in nature will perplex the Philosopher, he is entitled to the same degree of evidence, which he has exhibited in his doctrines; Priestley, the persecuted friend of Liberty, of Religion, and the model of all social and private virtues. Honoured is our Society with such Members; congratulated is the Republic, with such Citizens, and happy is the rising generation with such philanthropic examples, which have already opened to you the Golden Æra of SCIENCE and LIBERTY.

FINIS.