selfish isolation. To know truth that we may tell it, apply it, make it fruitful, is the key note of science; and the truth about ores and minerals, fire clay, fluxes, and blasting powders is as worthy of knowledge as the atmosphere of a fixed star."


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Contents.

(Illustrated articles are marked with an asterisk.)



## THE INTELLECTUAL ENJOYMENTS OF SCIENCE.

Those who, for several years past, have been advocating the more generous introduction of scientific training into our schools and colleges, at the expense, if necessary, of giving less attention to philological studies, have, as a main argument, insisted on the greater utility of the knowledge of scientific truths as compared with the knowledge of the ancient Greek and Roman authors, so liberally imparted to our college-going youth. They have pointed out the glorious results with which science has enriched human society in the nineteenth century, and the comparative sterility of the so-called classical studies; they have pointed out the success in practical life of those men who have received a scientific education, while those whose whole training was merely philological have, in many cases, been starving for want of capacity to earn an honest living by useful practical labor, either mental or mechanical. In short, they have confined themselves to the task of praising science from a mere utilitarian point of view, forgetting that it may have higher claims, not only equal to those on which the friends of the old and time honored custom of studying the classics base their defense, but even surpassing anything which may be asserted in favor of the effect of studies of the dead languages and literature on the development of the human mind.

The higher classes of society, especially in England, consider labor, if not directly degrading, at least below their special domain. They are apt to regard that kind of knowledge which is merely useful and such as men in practical business are in need of as without interest; and in place of attempting to acquire, for instance, so much knowledge of light and electricity as to be able to understand some optical apparatus or the electric telegraph, they prefer to concentrate their attention upon the writings of Virgil or the poems of Homer. A knowledge of Latin and Greek is supposed to be about the highest enjoyment reserved for a man of high culture, for the reason that these studies are pursued, not for a secondary, base, utilitarian purpose, but out of pure love for what is beautiful and true.

Those lovers of science who feel and know that in the study of God's handiwork, Nature, there is much more enjoyment, beauty and truth than in the study of literature, which is a mere human production, have therefore recently been raising their voices so as to persuade the most cultivated classes, if possible, that the pursuit of scientific studies is at least as much worth their notice as the pursuit of philology; that that they should not abhor a chemical laboratory, or philosophical cabinet, as dull and dry; that there are fascinations hidden in these sacred precincts of science, which have only to be tested, with the purpose of impartial investigation, in order to be appreciated. This order of defenders of science have found a powerful advocate in Professor Tyndall, who, in his recent lectures, so often insisted that the classes of people for whom he spoke "should take science to their bosoms, not as the servant of Mammon, but as the supporter and enlightener of the mind of man." And the effect of his often repeated appeals has been something marvelous; people of high standing in society, and of corresponding cultivation of mind, who have been accustomed to occupy themselves in their spare hours with reading poetry and works of fiction or, at the very best, the so called classics, have furnished their libraries with works on science, and are studying optics, the polarization of light, etc.; and some have even gone so far as to buy, in place of useless ornaments, prisms, microscopes, and polariscopes, and are delighting themselves and their friends with the revelations made by those instruments, which seem to give us additional organs of sense.

We make no objection to Professor Raymond's remarks (republished elsewhere in this number) made lately before the Institute of Mining Engineers at Boston, and again taking up the defence of scientific pursuit from the utilitarian point of view; we wish only to defend the position of Professor Tyndall, who in aristocratic England has, by his social status, during his whole life been compelled to appeal to the feelings of the higher classes in regard to that which is worthy of their attention, and who by his untiring efforts has elevated the standing of science and of the men of science, in the eyes of the rulers of society and of the whole world, to a hight never before reached.

## PILE DRIVING AND THE LAWS OF IMPACT.

A subscriber propounds the following question: "A pile driver, weighing 2,500 pounds, falls through guides 25 feet high. With what force will it strike the last blow, friction not being considered?" The reply to this is that the striking force may be any amount from 2,500 pounds upward. The question, as asked, does not give sufficient data for its solution. When a heavy body falls, an amount of energy is stored up in it which is proportional both to the weight of the body and the distance fallen through. It is generally estimated in units called foot pounds. In the given case, the energy accumulated in falling, or the work done on the ram by gravity, is equal to $2,500 \times 25 = 62,500$ foot pounds. Before the ram can be stopped, an equal amount of work must be done in retarding it, since it is a well ascertained law of nature that the energy stored in a body while putting it in motion, is precisely equal to that which it gives out in resisting arrest. This amount of work, 62,500 foot pounds, can be done either by a force of one pound acting through 62,500 feet, by 62,500 pounds acting through one foot, or by any force acting through such a distance that the product of force into distance shall be equal to 62,500 foot pounds.

Before we can answer the question asked, therefore, we must know how far the pile moves while resisting the falling weight. Again, if we were told the mean resisting power of the pile, we could calculate precisely how far it would be driven by the last blow. Were the ram to strike the pile after falling $23\frac{1}{2}$ feet and to come to rest at 25 feet, the mean force exerted would be $62,500 \div 1\frac{1}{2} = 41,666\frac{2}{3}$ pounds. Were the pile driven 3 feet at the last blow, the ram still having a total fall of 25 feet, the mean pressure would be $62,500 \div 3 = 20,833\frac{1}{3}$. If the pile moved but an inch, the force developed would be $62,500 \div \frac{1}{12} = 750,000$. In actual practice the pressures would be less than those calculated, because part of the work done would be expended in crushing the head of the pile, and in overcoming the friction in the guides. Our figures are maximum values, which may be approached but never quite reached.

Knowing the distance moved by the pile under the last blow of the ram, and calculating, as we have done, the mean resistance offered by it, it is customary, with some engineers, to take one eighth the latter figure as the safe load which can be put on that individual pile without danger of its sinking. In ordinary soil this rule is sufficiently correct, but it sometimes happens that a heavy pressure, suddenly applied, will move a pile almost imperceptibly, while it will gradually sink to an indefinite distance under a very light load. In other cases, as along our docks, a pile may be set with apparently very feeble carrying power; and yet, after the mud has become well packed about it, and has been rendered somewhat compact and adherent by the superincumbent pressure, the pile will carry a heavy load. Experience and judgment only can be safely trusted in such cases. The load carried by a pile in the stiffest soil has been, in some cases, made as great as 80 tuns, but a usual load is 20 or 25 tuns.

The velocity of striking is calculated by multiplying the hight of fall by 64·3 and extracting the square root of the product. The coefficient, 64·3, has been determined by careful and a thousand times repeated experiment.

## WATER AS FUEL.

"On Monday and Tuesday afternoon," says the San Francisco *Alta*, "a large number of citizens, by invitation, visited the brass foundery on Fremont street, for the purpose of witnessing some experiments with a new fuel recently invented. They were shown into that portion of the establishment occupied by the furnaces, and in one corner found a brick furnace, some eight feet long and six feet high. On the top of this was an iron tank holding about ten gallons, which was filled with crude petroleum. From this tank a pipe about an inch and a half in diameter led into the side of the furnace. A small jet of oil, not larger than a small goose-quill, was permitted to flow out of this tube; a light is placed beneath this jet, and it immediately ignites. Another pipe, about an inch in diameter, leads from a steam boiler stationed some fifteen feet away. This pipe leads a small jet of steam upon the burning oil, and the moment the steam strikes the oil the oxygen in the water is set free and ignites with a tremendous roar, generating in a very few moments a most intense white heat.

"From this small source the entire chamber of the furnace, which is some two feet by five feet, is filled with a flame so brilliant and dazzling that one cannot gaze on it for more than a moment at a time. This flame possesses all the heat of an oxyhydrogen flame, and beneath its fierce power the hardest metals melt in a few moments. The inventor of the apparatus by which the elements of heat, which nature so generously provides, can be utilized is a very modest man, saying that he did not want to bring his discovery before the public until he had fully demonstrated that it would do all he claimed for it. He says that the cost of his furnaces will be only a nominal sum that will be within the reach of every one who owns a quartz ledge, while the amount of oil consumed in twenty-four hours will not exceed ten gallons, at a cost of two dollars.

"The inventor has every confidence in his discovery, and declares his ability to furnish fuel for a voyage of one of the Panama steamers to and from Panama for the insignificant sum of $200, while the entire quantity will weigh not to exceed twenty-five tuns. He further says that, at an expense of five dollars per day, he can run furnaces that will smelt one tun of ore every thirty minutes. If only one half of what is claimed can be accomplished, the discovery will prove of incalculable advantage to the mining interests of the Pacific coast, and will create a revolution in steam travel throughout the world."

REMARKS BY THE EDITOR.—There are, in the above article, a number of points upon which we propose to make a few comments: Many attempts have been made to construct furnaces for burning petroleum, but none of them have gained enough favor to be universally adopted. There are a few establishments in the country where it is claimed that the fuel is crude petroleum, but authentic reports of the economy of the furnaces are wanting. In Paris an ingenious contrivance was invented by the well known philosophical instrument maker Wiesnegg, which, in a small way, yielded good results. The appliance for distributing the oil consists of a pipe with branches and of a grooved grate along which the oil flows after dropping from these tubes. A wrought iron cistern contains the supply of petroleum, and is connected with the distribution by an india rubber tube. The grate is placed vertically; the air, being admitted between the bars, supplies the oxygen for the combustion of the petroleum vaporized by the heat of the fire. The petroleum is supplied to the grate a little in excess of the requirements of the furnace, and the surplus drops into a receiver and is volatilized by the heat of the furnace and the vapor is consumed. No blast is necessary. A somewhat similar contrivance was suggested by Deville for use on locomotives and on steam ships. This savant was employed by the French government to conduct a series of experiments looking to the employment of petroleum as fuel. Samples from all parts of the world were tested and the heating effect was determined by the number of kilogrammes of water that could be raised from zero to one degree centigrade by one kilogramme of oil. A trial was made by Deville upon locomotive engines arranged to permit the use of liquid fuel. One of these consumed about thirteen pounds of oil for every eleven hundred yards of distance traveled; while the coal burning engines of the same class required for the same work more than twenty pounds of solid fuel. The Deville furnaces for burning petroleum have been tried in this country, but little is known about them and it is a question whether, at the present low rates for crude material, they could not be advantageously introduced for many purposes. Deville and Wiesnegg accomplished the combustion of petroleum by introducing the oxygen of the air through peculiarly constructed grates. Neither of them could have been so unphilosophical as to try steam, for they would have known that, in order to generate the steam, so much fuel would be required as to take away the entire economy of the application. One furnace would have to be built to generate the steam to carry on the combustion of the petroleum in the second furnace. We have here again the perpetual motion of combustion lurking in the minds of the careless spectator, and there is something so captivating in the thought of burning both water and petroleum as fuel that everybody is at once ready to adopt the new invention as a wonder of the age. We do not say that water cannot be burned; every scientific man knows that it can, but we assert that cannot be burned economically. In order to bring water to the condition of fuel, other fuel must be consumed. If this result is attained by means of a galvanic battery, zinc and sulphuric acid are the fuel; if by a magneto-electric machine, the machine must be driven by a steam engine. If steam is burned in a grate by coals or by petroleum, we must first use fuel to get the steam. It generally happens that the original fuel burned costs more than the fuel produced by the water, so that there is a clear loss. If the two fuels have the same value, the process is not economical, as the cost of machinery and the wear and tear of manipulation must be taken into consideration; and what would be the use of transforming one fuel into another which is no better?

This water burning business has become a nuisance that can only be abated by the dissemination of correct scientific principles. Pumping water into a reservoir by a costly engine in order that it may drive a small wheel at the bottom is fully as economical as any of the contrivances for burning water with which we are acquainted.

## CHEMISTRY IN LEIPSIC.

The university of Leipsic possesses one of the finest and best equipped laboratories in Germany, with no less a person than Professor Kolbe as lecturer on chemistry. Recently a thick octavo volume of nearly 700 pages has been published, giving a detailed account of the original investigations made in that laboratory for the past six years. The results of nearly, or quite, all of this work were published to the world from time to time as each investigation was completed, but the collection of them together in book form impresses us with the magnitude of the work, and shows how much can be accomplished in a single institution. Of course, many of these investigations are the direct product of Professor Kolbe's fertile brain, and equal results cannot be expected everywhere. But some results like these, though fewer in number and of less importance, ought to be produced in a dozen of our highly endowed American institutions, where to-day the dust lies deep on long unused apparatus.

It may be objected that these investigations have neither lead to startling discovery, nor brought in much money to the investigator. But science can point out so many occasions where the pursuit of knowledge for her own sake has benefited the world at large, that this charge will not avail much among the thoughtful, and especially among intelligent capitalists and inventors. From the time when Priestley discovered oxygen or Liebig prepared chloroform, to the time when Hoffmann discovered the beautiful aniline dyes that bear his name, the most valuable and beneficial chemical inventions have sprung from the study of science for her own sake. Nature can be compared to the wary heiress, who repels each suitor who, as she thinks, is courting her for her money, and bestows her heart only on the true lover who, ignorant of her wealth, adores her for herself alone; and like the cautious heiress too, she often disguises herself as a pauper to test the devotion of her followers. On the other hand, the fortune seeker, who marries the milliner's apprentice in the expectation that she will turn out a millionaire in disguise, deserves the disappointment; and science often thus disappoints her mercenary followers.

### SINGULAR CAUSE OF FIRE.

The works of the Rubber Cloth Company, at Naugatuck, Conn., were destroyed by fire several weeks ago under the following singular circumstances: The building, an old one of wood, was 100 feet or more in length. The cloth is prepared by treatment with alcohol and linseed oil, and, during the operation, is passed over wooden rollers and extended along, for fifty feet or more, into a smaller vulcanizing chamber some thirty feet in length, where it is hung in folds from the ceiling to be dried and heated. The heating is done by steam pipes. Electrical sparks had often been noticed in passing the cloth along over the rollers. On the morning in question, which was exceedingly cold, the sparks had been observed to crackle louder than usual. A snow storm was in progress at the time. The workman, who was engaged in hanging the folds of cloth in the vulcanizing chamber states that suddenly there seemed to come from his hands a sheet of electrical fire, there was an explosion, the whole place was instantly in flames, and himself and others had to run for their lives. The building and contents were soon destroyed. The theory is that the fumes of alcohol and oil formed an explosive gas in the apartment, which the electrical sparks ignited, just as gas ordinarily is fired by electricity.

New works have been put up and the rolling machines have been connected by conducting wires with the earth. We are indebted to Mr. Allerton, the manager of the company, for these particulars.

### VESUVIUS.

About two thirds of the way up the side of Vesuvius, stands a small building, plainly visible from the Naples side of the bay. During cloudy and wet weather, it is shrouded in the dense veil of smoke which settles around the summit; and in times of eruption, the fiery streams seem to encompass it and flow far below its level. In this structure, thus dangerously located, Professor Palmieri, a well known Italian savant, has established an observatory and, with marvellous intrepidity, has remained at his post watching the convulsions of the volcano at times when his house stood between torrents of liquid fire, the heat from which cracked the windows and scorched the solid stone of the walls.

The knowledge obtained at so great a risk has been recently given to the world in an ably written volume, which contains *data* calculated to be of invaluable assistance in the future investigation of volcanic phenomena. Professor Palmieri considers that, to a certain extent, eruptions may be predicted, a belief which he bases upon late observations that the central crater commences the agitation, which is then followed by a series of light convulsions which terminate in the grand outbreak. This concluded, the volcano becomes again quiescent. A vivid impression of the enormous force developed during an eruption is conveyed in the fact that on April 26, 1872, the volume of smoke, ashes, lava fragments and bombs projected upwards from the crater attained the hight of no less than 4,265 feet from the edge.

It is difficult to convey an adequate idea of the appearance of Vesuvius when thus convulsed. It was our fortune to witness the eruption of 1868, which, in point of magnitude, was probably little inferior to that of last year. Pictures of the phenomenon invariably exaggerate it, as they depict a steady column of fire of a hight equal to or greater than that of the mountain. As the latter is over 3,000 feet above the sea level in altitude, the impossibility of a fiery pillar of such proportion is obvious. Red hot stones are occasionally, as we have above stated, thrown to greater hights; but such is by no means of common occurrence. By day, an unceasing flow of white smoke rises like a gigantic plume from the crater, and is visible for miles distant; while at night, the base of the column becomes radiant with a lurid glare. During the hight of an eruption, the smoke is ejected in greater quantities, and the summit of the mountain belches fountains of flame. The latter, however, are by no means continuous. The volcano will often remain quiet for hours and sometimes days, often causing it to be believed that the convulsions are over. Then all of a sudden, the smoke clouds will thicken, a rumbling becomes heard, and a great jet of fire rises for a short distance above the crater and instantly falls back. At the same time, stones and red hot *scoriæ* rise high in the air and add, by their fall, to the noise of the commotion. This goes on at varying periods, sometimes ceasing immediately and again continuing for a day or more. There is a prevalent though mistaken idea that lava, at the time of these great outbursts, pours in rapid torrents down the declivity. In times of repose, it is very seldom that the streak of light due to the red hot mass is seen on the mountain side; though when an eruption first begins, probably after night fall, a jagged lurid line will be remarked reaching below the crater. This extends as the convulsion progresses, and, after several weeks, it expands into several dull red streams reaching down a distance perhaps of two thirds of the slope. The onward movement of the lava is very slow, and of course it is totally unlike the molten rivers represented in popular prints. Its surface soon cools sufficiently to permit of being walked over, though a stick thrust a few inches down becomes quickly charred.

The danger to the villages at the base of Vesuvius does not lie so much from stones or ashes being heaped upon them, as we have recently seen it stated, but from these descending lava streams extending down far enough to reach populated portions. In regard to the mountain throwing ashes, such is often the case when the wind is high; but the quantity ejected is never enough to cause apprehension. The substance which buried Pompeii and Herculaneum, which seems to be nothing more than fine dry pumice, must have been the result of an eruption to which modern convulsions furnish no parallel. We have seen ashes carried to points several miles distant from the volcano; but, during the entire course of the eruption, the aggregate depth to which they fell could not have exceeded from one eighth to one quarter of an inch. The substance was in black friable grains somewhat resembling gunpowder, but very unlike the material which entombed the Roman cities.

Professor Palmieri has produced a very instructive work on Vesuvius. Now, we would suggest that he supplement his efforts by turning his investigations from an intermittent to a constant volcano—from Vesuvius to Stromboli. The latter, situated on an island in the Mediterranean, is in perpetual eruption, and the light from its summit serves as a well known beacon to sailors. For how long the phenomenon has existed, history does not state; but it seems to us that much valuable cosmical knowledge might be gained from the results of such continuous volcanic action.

### THE GREEK NEW TESTAMENT.

The manuscript copies of the Greek New Testament, written before the art of printing was discovered in Europe, are known to differ among themselves in many small points, such as one or two letters in the spelling of a word, which frequently changes the meaning of the word. After the Testament was put in print, in the sixteenth century, different manuscripts were compared with the printed text, and the variations from it noted. The further this comparison, or collation of manuscripts, was carried, the greater was the number of variations discovered; and soon, alarm was excited for the safety and integrity of the text itself. The collation of manuscripts, however, still went on, until a mass of "various readings" was secured, numbering many thousands and constituting in textual criticism what a body of observed facts does in physical science.

About one century ago, Dr. John J. Griesbach began to apply these "various readings" to the actual correction of the text; doing it however in a cautious and sparing manner, yet going far enough to show that the text might be both preserved, and purified and established, by the proper application of scientific principles in the use of the observed facts. But the opinion continued to prevail that the genuine text was to be arrived at by the agreement of the greatest number of readings. As the modern manuscripts far outnumber the ancient ones, this was equivalent to settling the text on their authority, as though, the further you go in time from the original autographs, the nearer you must thus become in fact to the very words and letters in which those autographs were penned. Considering the liability to error in copying, the truth is indubitably in the opposite direction. The nearer we can go to the first century of the Christian era, during which all those autographs were written, other things being equal, the nearer we must get to the actual readings of the autographs themselves.

When our common English version was first put in print, in 1611, the oldest Greek manuscripts available to the translators were written as late as the tenth century. Since their day, manuscripts have been brought to light, and many of them printed, dating back to the middle of the fourth century, and from that point down to the tenth. Two eminent scholars, Dr. S. P. Tregelles, of England, and Dr. C. Tischendorf, of Germany, have also each devoted thirty years to the collection of readings from the ancient manuscripts, and the practical use of them in revising the text. In addition to the testimony of the ancient manuscripts thus secured, they have also developed other principles of criticism, and reduced them to practical rules, so definite in their application that, in most cases, the revised texts of these distinguished scholars entirely harmonize.

Thus through the medium of textual criticism, and by the patient and intelligent application of its principles during long years of toil, we now have the text of the Greek New Testament restored essentially to its original purity, and established on a firm and scientific basis.

Previous to the tenth century, the manuscripts were written in capital letters, and without a space between the words. The three most important and valuable of them are the Sinaitic, the Vatican, and the Alexandrian, many of whose various readings are given by Tischendorf in his Leipsic edition of the English New Testament. The Sinaitic manuscript, critically marked *Aleph*, written about the middle of the fourth century, was discovered by Tischendorf, February 4, 1859, in the convent of St. Catharine, on Mount Sinai, in Arabia, and published by him in facsimile in 1862, and in the common type in 1865. It contains the entire New Testament, and is deposited in the Imperial library at St. Petersburg. The Vatican manuscript, marked B, also written about the middle of the fourth century, has been published only since 1857. It is in the Vatican library at Rome. The Alexandrian manuscript, marked A, written about the middle of the fifth century, was first published in 1786. It is in the British Museum, at London. The Ephraim or Royal Paris manuscript, marked C, of the fifth century, and the Cambridge manuscript, marked D, of the sixth century, are next in value.

As specimens of various readings: In Matt. 7:14, *Aleph* and B have *OTI*, "*because* strait is the gate," putting it on the same ground as the preceding motive for "entering in at the strait gate," and *OTI*, "*because* wide is the gate," etc. But later copyists dropped the *O*, and made it read *TI*, "*How* strait is the gate." In Luke 13:24, *Aleph* and B have *ΘΥΡΑΣ*, "door," corresponding with "the door" spoken of in verse 25. But later copyists changed three letters and made it read *ΠΥΛΗΣ*, "gate," as in Matt. 7:13, 14. The doxology to the Lord's prayer is not found in any of the oldest manuscripts in Matt. 6:13; just as all omit it in Luke 11:4. But in later times, the prayer, having come into general use in the church service, was closed with the doxology, and with that addition was copied into the later manuscripts of Matthew.

In 1862, and 1865, the American Bible Union, of New York city, published a first, and a second revision of the English New Testament, under the direction of Dr. T. J. Conant, following the revised Greek text, so far as it was then settled. That society is now preparing a third revision, from the completed text of Tregelles and Tischendorf, in the current English of the present day. The Canterbury diocese, of England, is also employing revisers for a similar purpose; but they propose retaining the antiquated English of the common version, except where it cannot be readily understood.

### CONTAGIOUS AND INFECTIOUS DISEASES.

Dr. Symes Thompson, a well known English physician, recently lectured on the above topic in London; and from his discourse we glean the following:

It is considered a settled fact that diseases of a contagious nature are caused and spread by influences largely within the sphere of human government and control. Every form of infectious fever has its idiosyncrasy. Enteric fever and cholera tend chiefly to disseminate themselves through water, passing into the wells and fountains of daily supply, and at times traveling from house to house in the milk cans of easy conscienced diarymen. Scarlet fever hibernates in a drawer and, after long months, comes forth with some old and cast aside garment, to be thrown with it around the throat or head of some new victim, and so start thence upon a fresh career. Typhus fever crawls sluggishly from hand to hand and mouth to mouth and is immensely sociable in its spirit, languishing away when condemned to solitary confinement. Typhoid fever generates itself where filth, overcrowding and impure habits of life prevail; and relapsing fever glides in the track of privation and misery.

The means now known of controlling these evil ministrants are, in the main, careful isolation of the sick, the preservation of the water from which daily supplies are derived in uncontaminated purity, the uninterrupted ventilation alike of hospitals and dwelling houses, the immediate removal from the vicinity of active human life of all excretions of the sick and the destruction of their morbific influence by mixing them with antiseptic and disinfecting agents (such as carbolic acid, sulphuric acid, chlorides of lime and zinc, permanganate of potash, and charcoal), temperate living, avoidance of any kind of excess, and above all the cultivation of an intelligent familiarity with natural laws.

In regard to antiseptics and disinfectants, Dr. Thompson states that it should be understood that agents of the character of carbolic acid are properly antiseptics, and operate mainly by arresting the process of fermentation and decomposition, while agents of the nature of Condy's fluid (permanganate of potash), chloride of lime, and especially charcoal, are disinfectants, and act by absorbing the noxious products of decomposition. This he showed by experiment, a few drops of carbolic acid causing a cessation in the evolution of gas bubbles from a fermenting solution of sugar; and the violet color of Condy's fluid was instantly discharged when combined with water in which was a trace of sulphureted hydrogen. The lecturer also exhibited the remains of a rat which had been placed in a jar of charcoal six years ago. Only the bones and a few hairs were to be seen; and although the jar had been covered with but a piece of paper, throughout the lengthened period of decomposition, no trace of disagreeable smell was at any time emitted.

NITRIC ACID IN SPRING WATER.—The water supplied to the city of Munich, Ger., contains nitric acid and saltpeter. Professor A. Wagner states that the amount of water used by the city in one year, by the ordinary water pipes, contains saltpeter, sufficient to make 18,106 cwt. of gunpowder.