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WHAT IS MATERIALISM?

Those advanced scientists of the present day who have abandoned the old and easy way of explaining every obscure physical phenomenon by asserting a supernatural cause (such as vital force in the organic kingdom, or a separate creation for each species of plant or animal) are denominated "materialists" by the adherents of the supernatural or spiritual. Those who use this word so profusely confound, however, two very different things, which have nothing in common, namely, the scientific materialism and the immoral materialism. The scientific materialist maintains that all the phenomena we see on our earth take place by natural means, that every effect has its cause, and that every cause will produce its effect. In his view, law regulates the sum total of all physical phenomena, which depend on the necessary relations of cause and effect. He rejects, therefore, most emphatically, the belief in miraculous interferences, and every conception, of whatever form, based on a belief in the so-called supernatural. In his view, there do not exist, anywhere in the whole range of human cognition, real metaphysics, but everywhere only natural physics. For him, the inseparable connection of matter, form, and force is self-evident. This scientific materialism has long since been accepted in the realm of the inorganic natural sciences, physics, chemistry, mineralogy, geology; and no one, however poorly educated, has now the least doubt in regard to the correctness of basing these sciences on such materialism. Only savages believe now in the spirit of a cataract or of a storm, some supernatural power which presides over such phenomena; and this can arise but from utter ignorance of the whole system of natural laws, by which we are able to explain the existence of cataracts and storms: and not only this, but we can at present, thanks to our materialistic system of research, even predict the appearance of a storm, so as to guard against its disastrous effects.

This ignorance of the natural laws on which the development of the organic kingdom is based—which laws form the science called biology—is the cause that this department of Science has hitherto been generally looked upon as beyond all laws, and dependent upon supernatural agencies. Hence came the invention of the metaphysical spook "vital force," a mere theological dogma. If, however, we can now prove that all Nature, as far as subject to human cognition, is a unit, and that the same eternal, stern, and grand laws prevail in the life of animals and plants as in the growth of crystals or in the power of steam, we shall reach the same natural and mechanical standpoint in all the realms of biology, zoölogy, and botany, no matter whether we are suspected of materialism or not. In this sense, the whole realm of the positive natural sciences, and the fundamental laws of causes and effects, are pure "materialism."

A very different thing from this scientific materialism, however, is the immoral materialism, which, as we have stated, has nothing in common with the other, except its name. This materialism, in its influence on practical life, leads to nothing but material enjoyment and the indulgence of sensual passions. It lives under the sad illusion that indulgence to mere natural pleasures can give satisfaction to man; and under this illusion, it drives its votaries from one indulgence to another, while rest and peace are never reached. It is a grand and profound truth that the proper value of life does not reside in material enjoyment, but in moral acts, and that true happiness cannot be found in exterior appearance, but in virtuous conduct: this is, however, unknown to the votaries of the immoral materialism. For this reason, such a materialism cannot be found among the investigators of Nature; and philosophers, whose highest pleasure is the intellectual enjoyment of Nature, have for their highest aim the knowledge of Nature's laws. This immoral materialism was found especially among the religious pretenders of the middle ages, who, under the mask of a pious exterior, aimed at nothing but an hierarchical tyranny and a material exploitation of the possessions earned by the labors of their fellow men. Blind to the supreme nobility of what they called, and what their successors still call, "common matter," and to the magnificent phenomena produced thereby, as well as to the inexhaustible charms of Nature, and without any knowledge of her laws, they treated the whole field of natural science and all the civilization derived therefrom as an heretical and sinful materialism: while they themselves practised immoral materialism in its most abhorrent forms. To avoid confounding such immoral materialism with the scientific materialism, Haeckel proposes to call the latter "monism," or (with Kant) "the principle of mechanism," without which, Kant declares, there can exist no science of Nature; and this principle lays at the base of the theory of evolution, and distinguishes it forcibly from the theologic belief in miracles, or in a series of separate and supernatural acts of creation.

INFUSORIAL EARTH AND ITS USES.

It is one of the paradoxes of Nature that the smallest creatures contribute most to the structure of the earth. The higher forms of life are barely traceable in the rocky strata; the lowest make up the bulk of vast formations, thousands of miles in area, thousands of feet in depth. The gigantic labors of the minute but multitudinous coral polyps are proverbial: but these are surpassed by the remains of still more microscopic creatures which swarm in all waters, arctic as well as tropical, fresh as well as salt, and whose cast-off shells fall like a ceaseless rain of solid matter on every part of the ocean's bed, on the beds of every inland sea and lake, every river, and marsh, and roadside pool. And minute though they be, the bulk of matter they contribute to the earth's strata every year is quite incalculable. The celebrated microscopist Ehrenberg, the first to realize their importance, estimated that in the single harbor of Wismar, in the Baltic Sea, as much as eighteen thousand cubic feet of these silicious organisms accumulated annually. The deep sea explorers of the Challenger expedition found them everywhere above the depth of two thousand fathoms; and below that their insoluble remnants made up thousands of square units of "red clay" deposits, apparently the stuff from which the azoic bases of the continents were formed. The limestones and chalks derived from calcareous infusoria are still more abundant and important: and by no means insignificant are the unconsolidated silicious strata of modern origin, to which the name infusorial earth has been applied. The stratum at Bilin in Bohemia, in which Ehrenberg found the enormous number of forty thousand millions of individuals to the square inch, is eighteen feet thick, and extends over a large area. At Lüneberg is another deposit, nearly twenty-eight feet thick; and less important strata are found in other parts of Germany and throughout Europe. In Lapland and Sweden it constitutes the well known "mountain meal," used to swell the bulk of certain foods. Many deposits of considerable magnitude are known in England, and the Irish beds are celebrated, especially those of the county of Down. Africa for a long time monopolized the supply for use in the arts, and furnished the familiar name Tripoli. The material is now abundantly supplied by other parts of the African continent, by Asia, Australia, New Zealand, South America, our own country—indeed every part of the world. In South America, the natives count it in some parts an essential portion of their diet, using it as food mixed with fat. Along the Amazon, beds of this useful earth are numerous; and since the organisms which produce it are universally distributed, the deposits of it will doubtless be found more or less abundant everywhere when sought for. Such at any rate appears to be the case in this country. The extensive deposit at Drakeville, N. J., which so conveniently supplies a demand originally met by material imported from Germany, for the manufacture of dynamite, is a case in point. Perhaps the most extensive deposit in this country is the one underlying the city of Richmond, Va., a deposit which Professor Rogers traced from a point on Chesapeake Bay, in Maryland, to beyond Petersburg, Va., where it is thirty feet thick Beds of similar character have been found in California, Oregon, and elsewhere on the Pacific Coast; and smaller deposits occur at West Point, at Wrentham and Andover, Mass., and in Connecticut and Rhode Island.

Infusorial earth, or tripoli, is best known as a polishing powder for gold, silver, etc., for which purpose it has no rival. Mention has already been made of its use in the manufacture of blasting powders, in which it serves the useful purpose of holding the explosive nitroglycerin. But these will ultimately be counted among the least of its uses. Already it plays an important part in the manufacture of cements and artificial stones, especially in Ransome's process. Combined with carbonate of magnesia, it forms the excellent cement known in Germany as albolite. With borate of lime, it forms a valuable glazing for furnaces, pottery, etc., and is found very useful as an enamel for iron and slate. Fused with borate of magnesia, it forms a beautiful and durable porcelain which can been cast and even blown like glass. A multitude of minor uses have been suggested, and many more will no doubt follow as our artisans become acquainted with its properties. Its lightness, indestructability by fire, and slowness of heat conduction are qualities of very great value. Bricks of it, with a little clay, are nearly as strong as common bricks, yet so light as to float on water. At the same time they are infusible, and such poor conductors of heat that they may be held at one end while the other is heated to redness. As an experiment, an Italian engineer constructed the powder magazine of a wooden vessel with such bricks, and when set on fire the vessel burned till she sank, without exploding the powder. The lightness of such fireproof bricks makes them specially valuable for such uses. They have also been used to advantage in the construction of reverberatory furnaces, pyrometers, etc. The heat-resisting quality of infusorial earth makes it not less useful as a protection to ice bins, ale cellars, etc., and as a lining for fireproof safes and the like, for which purposes it is rivaled only by asbestos. Agriculture furnishes another promising field for the use of infusorial earth. Professor Wilson, who has the honor of discovering the use made of this form of silica by plants, pronounces the application of it to fertilizing purposes the most important adaptation of matter for the reproduction of vegetation that has ever been discovered. There can be no question of the importance of such assimilable silica to soils like those of Bermuda, where the silicious element is nearly if not entirely wanting.

THE HELL GATE BLAST.

The result of the great blast at Hell Gate, or Newton's Channel, as the locality is now termed in honor of the successful engineer, is in every way satisfactory. The rock has been shattered much more than was expected, and the work of dredging is consequently greatly lessened. Soundings are still in progress, and divers are at work surveying the bottom and locating the larger fragments of rock. Vessels drawing 18 feet of water and over cannot pass within 300 feet of the shore; at 180 feet, there is a clear depth of 8 feet of water. Of course, the results are merely preliminary, and the channel will be gradually improved as the stone is removed. The pilots say that navigation is bettered already. In some localities eddies have been replaced by true tides, and the current has materially decreased in swiftness, while about 200 feet more room is afforded for passing the strait.

The observations of the shock wave generated by the ex

plosion were made by General Abbott and his assistants stationed at distant points, with whom telegraphic communication was held. At West Point, fifty miles away, no shock was perceptible even by the delicate instruments employed. At Springfield Junction, Long Island (not Massachusetts, as was at first reported) at a distance of twelve miles, the shock was noted in 13 seconds after the time of explosion. General Abbott is preparing a paper giving all the results of his observations, which will be read at the next session of the American Academy of Sciences.

Apart from the dredging, work at Hell Gate is by no means yet finished, and the operations are but fairly in progress on Flood Rock, the demolition of which is to leave a clear channel 1,200 feet in width. This rock forms a reef of about 7 acres in extent, and lies in the middle of the river, about 1,000 feet from Hallett's Point. Work was started on this obstruction in July, 1875, and continued steadily until May last, when the fear of its interference with the Hell Gate tunnels, through its growing proximity to them, together with the lack of necessary funds, determined its suspension. At the present time, two tunnels are partially finished. These are about 65 feet apart, aggregate in length 229 feet, and from them 1,462 yards of stone have been removed. Other tunnels have been begun' There is no coffer dam, as the point at which the main shaft is sunk is above high water mark. It is estimated that about two years of continuous labor will be required to complete the excavation, and that to blow it up 100,000 lbs. of explosive will be needed.

THE CENTENNIAL AWARDS.

The awards made to exhibitors at the Centennial Exposition were publicly announced on September 27. Some simple exercises, consisting of music and brief speech making, by Hon. D. J. Morrell, of the Centennial commission, Director General Goshorn, and others, took place in the Judges' Hall, after which General Hawley delivered the lists of successful competitors to the various national commissioners. General Hawley, in his remarks preceding the distribution, explained that the system which had been followed in granting these distinctions is different from any hitherto adopted at international expositions. The main features are the absence of any graded scale of merit and of distinctive prizes, the reduction in number of the judges, and the payment of the latter for their services. Medals of bronze are awarded, and each is accompanied by a brief report stating why the exhibit is deemed worthy of distinction. This report is of more intrinsic value to the exhibitor, as indicating the relative merits of his exhibits over others, than the possession of the medal. A copy of the report signed by a judge who is individually responsible for the opinions set forth (which views are further attested by the signatures of as many of the examining group as concur therein) is furnished to the exhibitor with authority to reproduce it in any way deemed, most to his advantage. It will be observed that the written professional opinion of a paid expert is here substituted for the anonymous verdict of a jury; and therefore in that opinion, and not in the mere bestowal of a medal, the value of the award lies. Of course under this plan several awards may be given in the same class of articles, based upon the same or differing qualities.

The American awards number several thousand, and the mere list occupies twenty-eight closely printed columns of the New York *Times*. It is manifestly impossible, therefore, for us to publish all of them. We note, however, a few of the firms best known to our readers, upon whom well merited honors have been bestowed: In the mining and metallurgy group, the Blake Crusher Company, for their ore and stone breaker; P. H. & F. M. Roots, for pressure blower; B. F. Sturtevant, for fan blower; the Loiseau Pressed Fuel Company, for artificial fuel; Jones & Laughlin, for cold rolled shafting; in the cotton and linen fabric group, Messrs. J. & W. Lyall, for the positive motion loom, which we recently described; and the same firm obtain another award for a sewing machine, which presents some points of remarkableingenuity which are not generally known. It is a double thread lock stitch shuttle apparatus, capable, when driven by steam power, of making 2,500 stitches per minute, something, we believe, hitherto unparalleled in machines of its class. Mr. James Short is awarded a medal for his carpet loom; the Dixon Crucible Company, one for lead pencils. Among the printing presses, the Campbell and Cottrell & Babcock are both distinguished. Among the pumps, those of the Valley Machine Company, the Gould Manufacturing Company, L. J. Knowles, the Silsby Manufacturing Company, Bagley & Sewall, and the Niagara Works gain medals. Other successful competitors in the machinery groups are Nathan & Dreyfus, lubricators; Chalmers Spence Company, boiler and pipe covering; Branch, Crookes & Company, stone saw, countershaft, belt tightener, etc.; John A. Roebling's Sons & Company, wire rope; John T. Noye & Son, turbine wheel; Frick & Company, engines; Utica Steam Gage Company, gages; Babcock Manufacturing Company, fire extinguishers; Bolen, Crane & Company, hydraulic press; Ward B. Snyder, small steam engines; Buckeye Engine Company, engines; Lidgerwood Manufacturing Company, rotary engines; Stillman B. Allen, governor; I. B. Davis, Berryman feed water heater and purifier; Morris, Tasker & Company, wrought iron tubes, Burleigh Rock Drill Company, air compressors; Stillwell & Bierce Company, turbine wheel, feed water heater, etc.; Jerome Wheelock, piston packing; Hugh Young, stone saw; Emerson Steam Stone Saw Company, same; Union Stone Company, emery wheels; C. & S. Burt, shingle machine; J. A. Fay & Company, woodworking machinery; E. & B. Holmes, barrel machinery; H. B. Smith, woodworking machinery; Stiles & Parker, drop presses, etc.; Fitchburg Machine Company, machine tools; Trump Brothers, scroll saw; Campbell & Clute, knitting machines; Hull & Belden Company, drop forges, etc.; R. S. Newbold & Son, shearing machine; Richards, London & Kelley, woodworking machinery; Bentel, Margedant & Company, same; Pratt & Whitney Company, metal working tools; Brown & Sharpe Company, same.

The completion of the awards at this early day is a substantial triumph for the new jury system. The whole board of judges numbered but 250, and they were called upon to examine the contributions of over 30,000 exhibitors. When it is remembered that, at the American Institute and local fairs in general, the judges' reports are rarely finished till after the close of the exhibition, to the dissatisfaction of exhibitors, the advantage of employing paid experts is manifest. The judges at the Centennial were allowed compensation, obviously small in comparison with the duties imposed; but it was sufficient to fulfil its purpose and render the judicial labors a business transaction instead of one resting on mere favor and obligation. We commend the result to the notice of present and future fair managers. Exhibitors go to considerable expense to attend local fairs, in hopes of obtaining valuable reports on their productions, and it is but right that they should have them before the fair closes. At the Centennial it has been proved that this can be satisfactorily accomplished.

A CIGAR SCIENTIFICALLY DISSECTED.

A polite visitor, who, during his interview with us, had rendered our sanctum redolent with the fumes of a fragrant Havana, has just left a cigar on our table with the laughing request that we smoke it. Despite the fact that it is an exceptionally fine cigar, we are unable to gratify our friend's desire, seeing that we don't smoke; but the thought occurs that we can show our appreciation of the gift by applying the light, not of a match but of science, to it, and thus giving our friend and his brother smokers something to ponder over next time "the blue up-curling smoke" leads them to reverie.

To the world in general a cigar is merely a tightly rolled packet having brittle fragments of dry leaves within, and a smooth silky leaf for its outer wrapper. When it is burnt, and the pleasantly flavored smoke inhaled, the habitual smoker claims for it a soothing luxury that quiets the irritable, nervous organism, relieves weariness, and entices repose. Science, scouting so superficial a description, examines first the smoke, second the leaf, third the ash. In the smoke is discovered water in vaporous state, soot (free carbon), carbonic acid and carbonic oxide, and a vaporous substance condensable into oily nicotine. These are the general divisions, which Vohl and Eulenberg have still further split up; and in so doing have found acetic, formic, butyric, valeric, and propionic acids, prussic acid, creosote, and carbolic acid, ammonia, sulphuretted hydrogen, pyridine, viridine, picoline, lutidine, collodine, parvoline, coridine, and rubidene. These last are a series of oily bases belonging to the homologues of aniline, first discovered in coal tar. Applying chemical tests to the leaves, other chemists have found nicotia, tobacco camphor or nicotianine (about which not much is known), a bitter extractive matter, gum, chlorophyll, malate of lime, sundry albuminoids, malic acid, woody fiber, and various salts. The feathery white ash, which in its cohesion and whiteness is indicative of the good cigar, yields potash, soda, magnesia, lime, phosphoric acid, sulphuric acid, silica, and chlorine. Our friend has kindly left us a fine cigar; had it been a poor and cheap one, the ingredients we should extract would be fearful and wonderful to contemplate. Here is the list from an English parliamentary report on adulterations in tobacco. Sugar, alum, lime, flour or meal, rhubarb leaves, saltpeter, fuller's earth, starch, malt commings, chromate of lead, peat moss, molasses, burdock leaves, common salt, endive leaves, lampblack, gum, red dye, a black dye composed of vegetable red, iron, and liquorice, scraps of newspaper, cinnamon stick, cabbage leaves, and straw brown paper.

Returning now to the smoke, or rather its ingredients, Dr. B. W. Richardson, in his "Diseases of Modern Life," considers the effect of the same on the body at considerable length, basing his conclusions on actual investigation. He tells us that water, of course, is harmless; free carbon acts mechanically as an irritant, and tends to discolor the secretions and the teeth. Ammonia bites the tongue, exercises a solvent influence on the blood, excites the salivary glands, and thus causes a desire to drink while smoking. The tendency of carbonic acid is to produce sleepiness, headache, and lassitude. When a cigar is smoked badly, that is, when the combustion of the tobacco is slow and incomplete, carbonic oxide is produced in small quantities, and is an active poisoning agent, resulting in irregular motion of the heart, vomiting, convulsions of the muscles, and drowsiness. The nicotine tends to cause tremor, palpitation of the heart, and paralysis. The volatile empyreumatic substance produces a sense of oppression and taints the breath and surroundings of the smoker with the well known "stale tobacco smoke" smell. The bitter extract causes that sharp nauseous taste peculiar to a re-lighted cigar or an old pipe.

By trying the effect of tobacco smoke on lower animals, we can obtain an idea of its influence on ourselves. Small insects are stupefied rapidly, but recover in fresh air. Cold-blooded animals succumb slowly to the smoke, birds rapidly. Some animals, such as the goat, can eat tobacco with impunity; but none escape the effects of the fumes. Persons suffer most from tobacco while learning to smoke. Dr. Richardson says that the spasmodic seizures are sometimes terrible, especially in boys. There is a sensation of imminent death, the heart nearly ceases to beat, and sharp pains shoot through the chest. Examination of inferior animals under such conditions shows that "the brain is pale and empty of blood; the stomach reddened in round spots, so raised and pile-like that they resemble patches of Utrecht velvet." The blood is preternaturally fluid, the lungs are as pale as those of a dead calf, and the heart is feebly trembling: such is the primary action of one's first cigar.

After a time, however, the body becomes accustomed to the influences of the poison; and with the exception of constant functional disturbances (owing to the excretory organs, notably the kidneys, being compelled to do work not essential to their duties), no distressing results are felt. There are numerous instances where the evil effects are scarcely appreciable, the physical and nervous constitution of the smoker being capable of resisting the influence. In many cases copious salivation attends smoking, and in this circumstance the opponents of tobacco have found a strong argument. Still, either to expectorate or not to do so is a choice of two evils. In the latter case, the result is to swallow the saliva charged with poisonous matter; in the former, the saliva needed to prepare food for digestion is lost, and besides, as it contains salts of lime in solution, the effect is to produce large formations of tartar on the teeth. "Smoker's sore throat" is a special irritable state of the mucous membrane induced by cigar smoking, which soon disappears when the habit is broken off. Tobacco smoke does not produce consumption or bronchitis, but it tends to aggravate both maladies. Its effect on the organs of sense is to cause, in the extreme degree, dilation of the pupils of the eye, confusion of vision, bright lines, luminous or cobweb specks, and long retention of images on the retina, with other and analogous symptoms affecting the ear, namely, inability to define sounds clearly and the occurrence of a sharp ringing sound like that of a whistle or a bell. Its effect on the brain is to impair the activity of that organ and to oppress it if it be duly nourished, but to soothe it if it be exhausted. It leads to paralysis in the volitional and in the sympathetic or organic nerves, and to over-secretion from the glandular structures. Science was not wise enough to prepare so formidable an indictment of the nicotian weed as the above in King James' time, else that monarch might have had better ground than his personal dislike for stigmatizing the habit of smoking as a "custom loathsome to the eye, hateful to the nose, harmfull to the braine, dangerous to the lungs, and in the black stinking fume thereof, neerest resembling the horrible Stigian smoake of the pit that is bottomlesse."

And yet, despite all that Science can say, the habit is increasing. Two centuries ago the Turks regarded smoking as a religious offense, and paraded a smoker through the streets of Constantinople with his pipe stuck through his nose as a warning to others. Who can disconnect the Turk now from the ideas of chibouque or nargileh, or fragrant Latakia? Look at the best cigar wrappers the world can produce, raised on tobacco fields in the heart of New England, where the Puritan fathers once visited the direst of blue law vengeance on the wretch who profaned His Maker's handiwork by "making a chimney of his nostrills." The value of our tobacco crop last year reached nearly $30,000,000. We consume annually some 75,000 hogsheads of the leaf; we imported about 83,000 bales of cigars, etc., from Cuba in 1875.

What is the end of it all? Effects on individuals likewise affect communities, these in turn influence the nation. No person that smokes can be in perfect health, and an imperfect organism cannot reproduce a perfect one. Therefore it is logical to conclude that, were smoking the practice of every individual of a nation, then that people would degenerate into a physically inferior race. It would follow, moreover, that, in those countries where smoking is most practised, a lower physical, and a consequently lower intellectual, development must be found. Such, we think, will be conceded to be true of Spain, of Cuba, of Portugal, of Turkey, of Greece, and of the South American countries, where those who are addicted to the habit vastly outnumber those who do not smoke.

Passage of Electricity through Gases.

The author inserted in the circuit of an induction current a variable spark interval, a strong resistance in form of a tube with blue vitriol solution, which could be shortened or lengthened, and a galvanometer; and observed each time how much the liquid resistance had to be changed, in order, after determinate change of the spark interval, to obtain the same deflection of the galvanometer. The spark path was inclosed in a glass sphere in which the gas and the pressure could be varied. The conclusions arrived at are stated briefly thus:

1. Gases conduct electricity, in the glowing state, like metallic conductors. The induction spark is a suitable means for the comparative experiments. 2. The conductivities of gases at ordinary pressure are not inconsiderably different from each other. Perhaps this difference may be attributed to differences of temperature of the spark interval in the separate gases. 3. With decreasing pressure, the conductivity of gases increases very considerably. At small pressure, the gases differ very little from each other. 4. With less strength of the current, there is a decrease of the conductivity, probably due to the less temperature of the gas. 5. The conductivities of gases for electricity and heat stand in no close relation to each other. 6. The values found for the specific resistances investigated are to be distinguished from the resistances at the beginning of the discharge, which have before been investigated by other physicists.—*M. Oberbeck.*