chanics of matter, and cares nothing for cause and effect.' We might ask Prof. Du Bois-Reymond which of these it is that does right or wrong, and knows that it is his act, and that he is responsible for it, but we must go on to the other view of the case, which Dr. Stoffkraft alludes to [in the volume under review].

"'I feel myself compelled to believe,' says the learned Doctor, 'that all kinds of matter have their motions accompanied with certain simple sensations. In a word, all matter is, in some occult sense, alive.'

"This is what we may call the 'leveling up' policy, and it has been expounded with great clearness by Prof. Von Nägeli. He can draw no line across the chain of being, and say that sensation and consciousness do not extend below that line. He cannot doubt that every molecule possesses something related, though distantly, to sensation, 'since each one feels the presence, the particular condition, the peculiar forces of the other, and, accordingly, has the inclination to move, and under circumstances really begins to move—becomes alive as it were. . . . If, therefore, the molecules feel something which is related to sensation, then this must be pleasure if they can respond to attraction and repulsion, that is, follow their inclination or disinclination; it must be displeasure if they are forced to execute some opposite movement, and it must be neither pleasure nor displeasure if they remain at rest.'

"Prof. Von Nägeli must have forgotten his dynamics, or he would have remembered that the molecules, like the planets, move along like blessed gods. They cannot be disturbed from the path of their choice by the action of any forces, for they have a constant and perpetual will to render to every force precisely that amount of deflection which is due to it. Their condition must, therefore, be one of unmixed and unbroken pleasure.

"But even if a man were built up of thinking atoms, would the thoughts of the man have any relation to the thoughts of the atoms? Those who try to account for mental processes by the combined action of atoms do so, not by the thoughts of the atoms, but by their motions. . . .

"Personality is often spoken of as if it were another name for the continuity of consciousness as reproduced in memory, but it is impossible to deal with personality as if it were something objective that we could reason about.. My knowledge that I am is quite independent of my recollection that I was, and also of my belief that, for a certain number of years, I have never ceased to be. But as soon as we plunge into the abysmal depths of personality we get beyond the limits of science, for all science, and, indeed, every form of human speech, is about objects capable of being known by the speaker and the hearer. Whenever we pretend to talk about the subject we are really dealing with an object under a false name, for the first proposition about the subject, namely, 'I am,' cannot be used in the same sense by any two of us, and therefore can never become part of science at all.

"The progress of science, therefore, so far as we have been able to follow it, has added nothing of importance to what has always been known about the physical consequences of death, but has rather tended to deepen the distinction between the visible part, which perishes before our eyes, and that which we are ourselves, and to show that this personality, with respect to its nature as well as to its destiny, lies quite beyond the range of science."

Health and Recreation.

Dr. B. W. Richardson, F.R.S., in a recent lecture, at the London Institution, on "Health and Disease," took the ground that there was no difference other than one of sentiment between work and recreation, which latter he held to be a question of sentiment altogether both in the young and old. It had always struck him that in the short and brilliant bloom of Greek history the reason why such excellence, physical and intellectual, was attained was the circumstance that from the beginning to the end of the Greek's career there was no such thing as work or play, but only life. If by some grand transformation we could in our day approach this ideal handed down to us by history, we should, in a generation or two, attain a degree of health which no mere sanitary provisions in the usual sense of the term can ever supply. Perhaps our climate and other conditions of life rendered a joyousness like that of Greece at its best unrealizable here. To the drawbacks of our heavy clothing in winter and our gross food at all seasons is added the unequal struggle for existence, dooming millions to a monotonous round of toil, until the whole body lends itself to the drudgery like an automaton, the movements of which the mind fretfully follows with little hope of any earthly relief. The most striking exception was the small but happy class who find in mental labor of a varied and congenial sort that diversity of work which is truly a recreation of the healthy and vital powers. Dr. Beard, of New York, had found that the life-value of 500 men of the greatest mental activity—poets, philosophers, men of science, inventors, politicians, musicians, actors, and orators—to be 64 years. On comparing this average with that of an equal number belonging to the rest of society, he found the latter to be but 50 years. In both instances the selection was made from those who had reached 20 years of age. A later calculation gave for 100 brain workers 70 years of life. Among the causes for this difference of 14 or 20 years in favor of judiciously varied brain work, Dr. Richardson and others had ascertained the most influential to be the recreative character of intellectual labor. Brain work Dr. Beard describes as the highest of all antidotes to worry. Scientists, physicians, lawyers, clergymen, orators, statesmen, literati, and merchants, when successful, are happy in their work without reference to the reward, and work on in their callings long after the necessity has ceased. Good fortune gives good health, Dr. Beard adds, and nearly all the money in the world is in the hands of brain workers, whose life is one long vacation. No doubt there might be an over-cultivation of mind which, so far from being recreative to the health of the body, would be positively injurious, just as there was often a no less mischievous over-cultivation of muscular power.

Preserving Meats.

In a series of lectures before the British Society of Arts, Dr. B. W. Richardson has been calling attention to putrefactive changes and the preservation of animal substances. One of the most remarkable of the many experiments made by the lecturer was with cyanogen gas. Dr. Richardson does not recommend this poisonous agent for the preservation of substances intended for food, but he calls attention to some of the striking results of the action of the gas.

"In my research," says Dr. Richardson, "I used a saturated alcoholic solution. The mode of procedure was as follows: The specimens of beef and mutton, two pounds each, were placed in glass jars, the jars were charged with coke vapor, and, when quite ready, a measured quantity of the alcoholic solution of cyanogen was introduced from a graduated syringe. The stopper of the jar was immediately inserted, firmly secured, and closely sealed down. After many experiments I found that thirty minims of the alcoholic solution of the gas was the sufficient measure for the perfect result of preventing putrefactive change. Of thirty-six specimens sent out, on a return voyage all came back completely preserved. Of the same number of specimens retained at home in a room heated up to 84° Fahr., all remained in like manner free of putrefactive change. When a specimen so preserved is taken out of the jar it is found to be free of any taint of putrefaction. There is no escape of gas from the bottle; there is no change of color; there is no unnatural softness and no unnatural hardness of the structure. The only peculiarity that is noticed is a faint odor of the cyanogen, which lasts even after exposure of the structure to the air for a long time. Exposed to the air, the meat retains its freshness as long as fresh flesh does, and after it has been cooked it is preserved much longer than ordinarily cooked fresh meat. Two specimens of meat, one of beef, the other of mutton, after being preserved by this plan, and after making the return voyage, were cooked by roasting, and were placed in a larder by the side of other specimens of beef and of mutton of the same size which had been cooked, but in no other way treated. When these last were entirely changed, and were covered with mould, the cyanogen specimens were as fresh as ever. I replaced the changed pieces by others freshly cooked, and when again these were decomposing, the cyanogen specimens continued good. After keeping these cooked specimens eleven days, and finding that they no longer gave forth the odor of cyanogen, I fed a dog with some of the mutton, and, as he was uninjured, I breakfasted myself on the remainder. The meat had been through an extreme test—a return voyage to Rio, exposure to the air uncooked for three days, and exposure after cooking for eleven days—yet it ate as naturally as if it had been killed two days only, and cooked but a few hours. All I can report about it as peculiar is that it had a very slight bitterness, like the bitterness which is tasted sometimes in eating pheasant. It was the taste of cyanogen in an extremely diluted form. In some natural meats, in the flesh of the pheasant specially, the same taste is commonly present."

How the Velocity of Cannon Shot is Measured.

The initial velocity of a shot, or, in other words, the rapidity with which a projectile flies at the outset of its career, is now measured at Woolwich by an electrical instrument, the invention of Major Le Boulengé, a Belgian officer. As in the case of other instruments of a like nature, the shot is made to break through two wire screens, placed at some distance from one another. The interval is usually about 100 feet. The screen is simply a wooden framework with fine wires zigzagging across, and it is these fine wires which the shot cuts. One screen is near the muzzle of the gun, and the other at the distance we have mentioned. No. 1 screen is in connection with an electro-magnet in the instrument house, and No. 2 screen with a second, the two magnets hanging close together. While the wires in front of the screen are perfect, an electric current passes without interruption, and the electro-magnets in connection with them are endowed with power, but this power ceases as soon as the shot cuts the wires of the screen. Before the gun is fired there is suspended to the magnets two rods of iron, which remain, however, only so long as the magnets are magnets. When the shot is fired, No. 1 screen is torn, and down falls the rod suspended to No. 1 magnet; an instant afterward, when the shot has reached No. 2 screen, No. 2 magnet also loses its virtue, and down falls the second rod. The time between the falling of the two rods is so small, that ere the first has fallen half its length the second has dropped upon a trigger, which trigger darts and strikes the side of No. 1 rod. When the latter is picked up, the first thing is to examine the surface for the mark of the trigger, for the position of this mark, whether high or low, tells the operator what he wants to know. The rod, being of a given weight, always takes the same time to fall, and according whether it has fallen half or quarter its length, so the time taken by the shot to travel between the screens has been long or short. In a word, the rod has only to be compared with a prepared scale in order to read off the number of feet per second at which the shot has gone on its way.

The pressure of the gases inside the gun as the shot is being expelled is recorded by the crusher gauge, an American invention. This is a tiny pillar of copper placed loosely in a tube, the end of which, made of steel, stands firm and fast, no matter what the pressure; consequently the soft copper pillar, when subjected to the action of the gas, gets compressed, or crushed, and assumes something of a barrel shape. The pillar and its case, being affixed to the base of the shot, gets the full pressure of the gunpowder gases, and its length afterward denotes how much this pressure has been. To secure more trustworthy pillars of the metal it is the practice to compress them first of all to a certain degree, to remove any honeycomb or imperfection, and, thus uniformly compressed, they may be relied upon to record the strain with accuracy. Comparison of the fired pillar with other pillars which have been subjected to known pressures, at once reveals the degree of force to which the former has been subjected in the gun. The maximum pressure, or strain, to which the 80 ton gun should be subjected is set down as 25 tons on the square inch, and it is with the aid of this crusher gauge that the strain exerted in the various experiments has been ascertained.

The Progress of Dentistry.

Some hopeful results in the practice of dental grafting have been recently brought to the notice of the French Academy by MM. David and Magitot. Two principal forms of such grafting are distinguished—the graft by restitution and the graft by borrowing. In the former a tooth is reimplanted, after having been extracted with a view to certain operations, which would be impracticable in the mouth. M. David has adopted this method for rectifying the direction of teeth, for treatment of caries in the extracted tooth and periostitis, and for stopping, also for facilitating operations on another tooth, or in another part of the mouth. The consolidation of the tooth restored to its socket occurs generally on the tenth or twelfth day. In cases of periostitis the process is somewhat slower. In the graft by borrowing, a sound tooth may be substituted for a decayed one. As regards transplantation from the lower animals, of course no zoological species has hitherto furnished teeth similar to ours in form, dimensions, color, etc. Still, sound roots (from a lower animal) may be substituted for bad ones, and may serve as a solid base for pivoted artificial teeth. The transplantation from one human being to another would generally involve objectionable mutilation. But sound teeth may be utilized for the graft when their extraction has become otherwise necessary. A tooth may be transposed from one part of the mouth to another. Practicing the dental graft by restitution, M. Magitot has operated in sixty-two cases, and fifty-seven of these have been decided cures—a success amounting to ninety-two per cent.

The History of Diphtheria.

It is often said that diphtheria is of modern origin, a penalty for the unsanitary conditions of modern civilization. Dr. Mackenzie, senior physician to the Hospital for Throat and Chest Diseases, in London, finds the disease to be a very ancient one. The first description of it occurs in the writings of an Indian physician, a contemporary of Pythagoras. He next identities it with "askara," a fatal epidemic frequently mentioned in the Talmud. In the seventeenth century diphtheria was widely prevalent in Europe, and extensively fatal. In 1802 Dr. Cullen, of Edinburgh, seems to have described the disease under the name of *cynanche trachealis;* and in 1826 Bretonneau's classical work appeared.

"After this," writes Dr. Mackenzie, "the disease seems to have passed from the minds of English physicians and its very existence to have been almost forgotten." From such forgetfulness the medical profession was thoroughly aroused by the great epidemic of the years 1858–9, since which time diphtheria has not appeared in England with anything like the same malignancy.

PATENTS PERTAINING TO THE HOUSEHOLD.

An improvement in the class of clothes driers having radial arms for supporting the line, invented by Mr. R. E. Rye, of Mount Pleasant, Mich., provides a means of easily raising or lowering the frame that supports the line.

A novel pounder or washing machine, which presses the clothes alternately in opposite directions, is the invention of L. C. White and G. M. Walton, of Cleaveland Mills, N. C.

Mr. F. Mohr, of New York city, has invented a platform rocking chair whose oscillations are limited by a novel arrangement of an arm and rubber covered stop pin.

A dishpan having a hinged cover and a drainer combined, in a novel and convenient way, has been patented by Mr. J. F. Hutchinson, of Portland, Me.

Progress of Steam Engine Economy.

With Smeaton's early Newcomen engines the consumption of coal was 29·76 lbs. per hour per horse power. Afterward, as improved, 17·6 lbs.

In 1811 the Cornish pumping engine required 10·87 lbs. per hour per horse power; in 1842 the improvements had reduced it to 2·90 lbs.

In 1863 the best marine engines consumed 4 lbs. of coal per hour per horse power, but in 1872 only 2·11 lbs. was required.