MIGHT AND MAGNITUDE.

Little by little the belief is gaining ground that fat is not force, nor size strength, nor plethora power. If we are to trust the most modern deductions of science, Goliath ought to have been a monster of weakness, while Samson, whose feats proclaim his prowess, can hardly have reached the middle hight. Hercules, too, must have been quite a small man. "Long and lazy, little and loud," are proverbial expressions physically accounted for. The Pygmæi of Thrace, who went to war with the cranes, were indeed a valiant race, if only three inches high.

The bodily frame of any animal is as much a machine as a steam engine is a machine. Now the more carbon a machine consumes, the more force it is capable of producing.

We must be careful to avoid forgetting that, in strict fact, at the present epoch, not a single thing in nature is either created or annihilated. It is transformed, and that is all. Thus, you may *burn* a piece of paper; but you do not *destroy* it. You simply make it suffer a metamorphosis. If such be your desire you can find it again, and collect its substance, weight for weight. Instead of retaining its primitive shape, the greater portion has passed into a gaseous state. It has become partly gas, which mingles with the atmosphere, and partly ashes, which fall to the ground.

Force undergoes similar transformations. *We* do not generate our own strength, as we are apt, in our pride, to fancy we do. We receive it ready generated, and then we transform it or displace it. Charcoal, for instance, in obedience to our will, supplies us with heat, that is, with force. Do you think that it really creates that force? Indeed it does not. It derives it from the sun. And when, in the depth of winter, a bright sea-coal fire is blazing in the grate, all the light and heat it gives are bestowed at the expense of the solar heat.

In truth, every vegetable substance has been actually built up, bit by bit, organ by organ, by rays of light and heat from the sun. The materials so grouped remain together; but only on one condition, namely, that the solar force, which originally assembled them, shall not quit them.

Coal is a mass of vegetable matter, which has been buried in the earth for a considerable lapse of time. It is solar light and heat put into a savings bank ages upon ages ago. It is power and action from the sun, imprisoned in the bowels of the earth. To us nineteenth centurians falls the lucky task of making it our slave, by setting it at liberty from its primeval trammels. Throw a piece of coal or wood into the fire; it is absolutely as if you took a small quantity of sun heat in your hand, to manipulate it according to your requirements. And this is not a mere form of speech; it is a correct expression of the real fact.

When an animal exerts his strength, do you also believe that *he* creates that strength? Not more than the coal creates the steam engine's strength. Here again it is entirely derived from the sun. The animal eats. *What* does he consume to keep himself alive? Alimentary substances, composed, in few words, of carbon, oxygen, azote, and hydrogen.

In an animal organism, those elements undergo a veritable transformation. Outside the animal, before they were eaten, they were combined, aggregated, united together, and in that state constituted food. Inside the animal, they are disunited, decomposed; the force which held them together quits them, allows them to separate, and so is free to do other work. It causes the creature's body to grow; endows it with vital and muscular force; and, in short, produces all the phenomena of life.

Who created the aliment? The Sun—himself created by the Great Maker of all things. Here again, therefore, the life and strength possessed by an animal are actually engendered by the sun.

Throughout your whole existence you will find, by following up the same reasoning, that your most trifling act, your most thoughtless movement, has derived its origin from the sun. A blow with the fist, a breath, a sigh, can be exactly estimated in rays of sunshine. Whether you trifle or whether you work, to make such an effort you have been obliged to expend so much strength; and that strength had already been stored in you by the sun, through the agency of a series of transformations. Your clothing is all borrowed from the sun. It is he who has spun every thread of your linen, and fed every fiber of your cloth and flannel. He either bleaches it snowy white, or dyes it purple and scarlet with indigo and madder. He furnishes leather for useful service, and furs and feathers for finery and parade. He gives you your bedding; whether you repose luxuriously between eider down and wool, or stretch your weary limbs on straw, chaff, Indian corn husks, seaweed, or even on a naked plank, as is the lot of not a few, it is the sun who gives both the one and the other. And what do we receive from regions where the sun, as it were, is not—from the immediate neighborhood of either pole? We receive just nothing. We cannot even get to them. The absence of the sun bars our progress with an impenetrable zone of ice and snow.

In like manner, your fine cellars of hock, burgundy, and claret are nothing but bottled sunshine from the banks of the Rhine, the slopes of the Cote d'Or, and the pebbly plain of the Medoc. Your butter and cheese are merely solid forms of sunshine absorbed by the pastures of Holland or Cambridgeshire. Your sugar is crystallized sunshine from Jamaica. Your tea, quinine, coffee, and spice are embodiments of solar influences shed on the surfaces of China, Peru, and the Indian Archipelago. It is the sun's action which sends you to sleep in opium, poisons you in strychnine, and cures in decoctions of tonic herbs. You taste the sun in your sauces, eat him in your meats, and drink him even in your simplest beverage—water. Without the sun, no blood could flow in your veins; your whole corporeal vitality, your very bodily life, is the result of the overflowings of his bounty.

Nor is this all we owe to our great central luminary. The physical forces with which we are acquainted—heat, light, electricity, magnetism, chemical affinity, and motion—dancing their magic round, and alternately assuming each other's form and action, and now believed in all probability to be one in their common birth and origin—are direct emanations from the sun.

But how grand and beautiful is the theory that *all* material blessings here below come to us entirely and alone from the sun! Its simplicity and unity are completely consistent with the attributes of the Maker. Given motion, and given matter, all the rest follows as an inevitable consequence. All nature, from the simplest fact to the most complex phenomenon, is nothing but a work of destruction or reconstruction, a displacement of force from one point to another, according to laws which are absolutely general.

With this much said about might, let us now look at the question of magnitude. From the foregoing statements, it may easily be conceived that the more an organized being is capable, in consequence of its physiological structure, of assimilating a given amount of aliment, the more effective force it will set at liberty, or, in other words, the more strength it will have at its own disposal.

Now, the solar forces, thus rendered active within the frame of a living creature, have, by determining its growth, to construct the animal itself. They have to generate its own proper vitality, as well as the result of vitality, its muscular power. It may therefore be asserted that the effective force at the disposal of every living creature will increase in proportion to its alimentation, and will diminish in proportion to its weight. Otherwise expressing the same idea: The more food an animal consumes and the less it weighs, the more muscular strength it will possess.

These deductions have lately been confirmed by curious experiments instituted by M. Felix Plateau, who has determined the value of the relative muscular power of insects—power of pushing, power of drawing, and the weight which the creature is able to fly away with.

It had already been remarked that animals of small stature are by no means proportionally the weakest. Pliny, in his "Natural History," asserts that, in strength, the ant is superior to all other creatures. The length and hight of the flea's leap also appear quite out of proportion to its weight. No very definite conclusion, however, had hitherto been arrived at. M. Plateau has settled the question by employing exact science as the test. Insects belonging to different species, placed on a plane surface, have been made to draw gradually increasing weights.

A man of thirty, weighing on an average a hundred and thirty pounds, can drag, according to Regnier, only a hundred and twenty pounds. The proportion of the weight drawn to the weight of his body is no more than as twelve to thirteen. A draught horse can exert, only for a few instants, an effort equal to about two-thirds of his own proper weight. The man, therefore, is stronger than the horse.

But, according to M. Plateau, the smallest insect drags without difficulty five, six, ten, twenty times its own weight, and more. The cockchafer draws fourteen times its own weight. Other coleoptera are able to put themselves into equilibrium with a force of traction reaching as high as forty-two times their own weight. Insects, therefore, when compared with the vertebrata which we employ as beasts of draught, have enormous muscular power. If a horse had the same relative strength as a donacia, the traction it could exercise would be equivalent to some sixty thousand pounds.

M. Plateau has also adduced evidence of the fact that, in the same group of insects, if you compare two insects, notably differing in weight, the smaller and lighter will manifest the greater strength.

To ascertain its pushing power, M. Plateau introduced the insect into a card-paper tube whose inner surface had been slightly roughened. The creature, perceiving the light at the end through a transparent plate which barred its passage, advanced by pushing the latter forward with all its might and main, especially if excited a little. The plate, pushed forward, acted on a lever connected with an apparatus for measuring the effort made. In this case also it turned out that the comparative power of pushing, like that of traction, is greater in proportion as the size and weight of the insect are small. Experiments to determine the weight which a flying insect can carry were performed by means of a thread with a ball of putty at the end, whose mass could be augmented or reduced at will. The result is that, during flight, an insect cannot carry a weight sensibly greater than that of its own body.

Consequently, man, less heavy than the horse, has a greater relative muscular power. The dog, less heavy than man, drags a comparatively heavier burden. Insects, as their weight grows less and less, are able to drag more and more. It would appear, therefore, that the muscular force of living creatures is in inverse proportion to their mass.

But we must not forget that it ought to be in direct proportion to the quantity of carbon burnt in their system. To put the law completely out of doubt, it would be necessary to determine the exact weight of the food consumed, and the quantity of carbonic acid disengaged in the act of breathing. Some chemist will settle it for us one of these days. —*All the Year Round.*

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

SILK FROM FISHES.

The epidemic which has of late years wrought such ravage among the silkworms has led to a vast amount of searching for substitutes for silk, and M. Joly, a well-known chemist of La Rochelle, conceives that he has at length found one likely to become of practical importance. He has found it, singularly enough, in the sea—that is to say, within the bodies of certain marine fishes. The exterior envelope, he tells us, of the eggs of the fishes in question consists of a very fine tissue composed of an immense number of exceedingly delicate filaments, which admit of being readily separated, and then exactly resemble those of ordinary silk. The eggs are twenty-five centimeters in diameter one way by thirteen the other, and weigh 240 grammes each, and in their interior is a white albuminous matter, which M. Joly believes can be utilized in calico printing, and a yellow coloring matter, which he imagines may prove valuable as a dye. The obtainment from the envelopes of the eggs of a material for textile fabrics, closely resembling ordinary silk, he declares to be economically practicable on any scale.

PHOTOGRAPHIC ENGRAVING.

The great advantage of the process for obtaining photographs on copper plates, which we described last week, consists in the circumstance that photographs so obtained may be readily "bitten in," so as to enable the plate to be printed from just as though they were ordinary engraved plates—the result, however, being a far more perfect reproduction of the original photographic picture than could be obtained by the most skillful mechanical engraving. When it is desired to etch a photographic picture obtained on a coppar plate by this process, the plate, after having been dried must be varnished on the back and sides, but not on the face, must have all the black dust composing the shadows of the picture carefully removed, must next be well washed under a strong jet of water, and must then, without first drying, be plunged into the liquid to be employed as a mordant. A suitable mordant is one consisting of one part of nitric acid, two parts of a saturated solution of bichromate of potash, and five parts of water. Where more convenient, the nitric acid may be replaced by sulphuric acid. The quantity of this mordant used in the first instance should be simply enough to completely cover the plate, but from time to time, as the liquid turns blue, more should be added, the action of the mordant being continued for a whole day, or for even longer, according to the temperature. The mordant acts only on the bare copper, and does not affect those parts of the plate which are covered by silver, so that the result is an incised engraving, fit for printing from. If, instead of treating the plate as thus described, the black dust composing the dark parts of the original picture be not rubbed off, and the mordant used consist of iodine associated with either bichromate of potash or nitric acid, an engraving in relief will be obtained, the iodine acting only on the parts of the plate on which there is a deposit of silver, and from this engraving in relief a reversed proof, suitable for printing from, may be procured by the galvano-plastic process.

PEROXIDE OF HYDROGEN.

Professor Schonbein has discovered a new and very ready method of procuring the peroxide of hydrogen. It consists simply in agitating, in a large flask, to which air has access, amalgamated zinc, in powder, with distilled water. Oxygen is then absorbed by both the zinc and the water, with formation of oxide of zinc and peroxide of hydrogen. The peroxide of hydrogen obtained by this method, unlike that obtained by the ordinary process, is quite free from acid, and so may be kept for a long time without decomposition. It does not contain, moreover, a trace of either zinc or mercury, but is absolutely pure. This new process has therefore great advantages over the old process of preparing peroxide of hydrogen, both as being far simpler and more expeditious, and as yielding a much purer product; but it is almost as far as the old process from yielding peroxide of hydrogen cheaply enough for use in the arts.—*Mechanics' Magazine.*

GLEANINGS FROM THE POLYTECHNIC DISCUSSIONS.

THE GALVANOMETER—MEASURING MAGNETIC CURRENTS—TELEGRAPH INSULATORS—DEEP GULLIES.

Prof. Tillman:—There is a great want for means of measuring the stength of magnetic currents. Every current will deflect a magnetic needle which it passes near, and the stronger current will deflect the needle more; but a current twice as strong will not deflect a needle twice as much. Now what is the law? There is room for invention here. The various European savans have attacked the problem, but as yet the world is without a galvanometer which will give mathematically the proper relations. Gen. Lefferts and Mr. Farmer, of Boston, have succeeded in manufacturing coils of small wire which will give uniform amounts of resistance to currents passing through. Dr. Bradley, of Jersey City, has recently combined a very compact and effective instrument, using a quantity of these coils or spools of wire.

Dr. Bradley:—Weak currents, which deflect the needle a little, produce deflections which are proportional to their force; a current twice as strong, producing twice the deflection. This law holds good only for small angles of deflection. As the angles increase, it requires a greater addition to the current to add an equal amount to the deflection. A magnetic needle points to what we call the magnetic pole, near the north pole of the earth. The artificial current to be measured is carried under such needle in the direction parallel to it. The tendency of all currents is to induce the needle to stand at right angles thereto. A weak current will produce a deflection—it will pull the needle to one side—but no current can be made so strong as to pull it quite around at right angles to the magnetic meridian. De La Rive conjectured that the tangent of the angle of deflection of the needle was an approximate measure of the force of the currents. There are strong reasons for believing that the tangent of the angle is an exact measure of the force of the currents. But the speaker had based his instrument on no such supposition. It was well determined that an equal force would produce an equal deflection. The Bradley instrument is constructed on that principle alone.

The series of Leffert's and Farmer's resistance spools were arranged like a grocer's weights so as to give any resistance desired. The unit of resistance was that due to the traversing of a mile of number eight galvanized-iron wire, well insulated. By switching a number of these spools together he could make a resistance of six hundred miles, or could subdivide it down to hundredths of a mile.

The chief practical importance in the present state of the arts of an exact measure of resistance is to select and adjust telegraph instruments Send the current through one, and measure the deflection of the needle produced by the current which passes that resistance. Then send the current through the resistance measure, and switch on or take off the resistance spools until the needle is deflected the same. Then read the result on the switch levers, as accurately as you weigh a lot of hay on the best Fairbank's platform scales.

Actual telegraph lines always impose more resistance and loss than the theoretical standard miles; but are rarely if ever so bad as to offer double the standard resistance.

Mr. Stetson:—Bad insulation in wet weather is another great difficulty to be met by inventors in telegraphy. The webs of insects extending across, become so good conductors when wetted by storms as to seriously impair insulation. This is the main cause which prevents the success of otherwise excellent inventions, for insulators. Who can overcome the mighty obstacle imposed by a spider's web to the progress of invention in this line?

Dr. Stevens:—The wearing or gullying away of the earth by the action of streams is familiar to all; but the immensity of this influence in modifying the surface of our globe is rarely appreciated except by the professed geologist. The Niagara has excavated a valley or narrow ditch with perpendicular sides, so deep that the surface of the water for about twelve miles below the falls is some three hundred and fifty feet below the adjacent country. The Ohio river between Pittsburgh and Cincinnati, runs some seven hundred feet below the natural level. It has excavated a valley to that depth. But such instances of the sinking of streams much below the general level of the country through which they pass, though comparatively rare east of the Mississippi, are very common in the great territories of the West; there they are the rule. Canons of immense depth seem to be the natural accompaniements of the water courses. The most remarkable instance in the world is the Black Canon, where the Colorado river flows through the Black Mountain region. The land lies in elevated plateaus. For a little distance the general level of the land immediately adjacent is six thousand feet above the surface of the river. At one point there is a perpendicular precipice forming one bank of the river which is one mile high as measured and verified with ordinary care by repeated observations by the anaeroid barometer.

Lacquers.

Lacquers are used upon polished metals and wood, to impart the appearance of gold. As they are wanted of different depths and shades of colors, it is best to keep a concentrated solution of each coloring ingredient ready, so that it may at any time be added to produce any desired tint.

1. *Deep Golden-colored Lacquer.*—Seed lac, three ounces; turmeric, one ounce; dragon's blood, a quarter of an ounce; alcohol, one pint. Digest for a week, frequently shaking. Decant and filter.

2. *Gold-colored Lacquer.*—Ground turmeric, one pound; gamboge, an ounce and a half; gum-sandarach, three pounds and a half; shell lac, three-quarters of a pound (all in powder); rectified spirits of wine, two gallons. Dissolve, strain, and add one pint of turpentine varnish.

3. *Red-colored Lacquer.*—Spanish anatto, three pounds; dragon's blood. one pound; gum-sandarach, three pounds and a quarter; rectified spirits, two gallons; turpentine varnish, one quart. Dissolve and mix as the last.

4. *Pale Brass-colored Lacquer.*—Gamboge, cut small, one ounce; cape aloes, ditto, three ounces; pale shell lac, one pound; rectified spirits, two gallons. Dissolve and mix as No. 2.

5. Seed lac, dragon's blood, anatto, and gamboge, of each a quarter of a pound; saffron, one ounce; rectified spirits of wine, ten pints. Dissolve and mix as No. 2.

The following recipes make most excellent lacquers:—

1. *Gold Lacquer.*—Put into a clean four-gallon tin 1 pound ground turmeric, 1½ ounces of powdered gamboge, 3½ ounces of powdered gum-sandarach, ¾ of a pound of shell lac, and 2 gallons of spirits of wine. After being agitated, dissolved, and strained, add one pint of turpentine varnish, well mixed.

2. *Red Lacquer.*—2 gallons of spirits of wine, 1 pound of dragon's blood, 3 pounds of Spanish anatto, 4½ pounds of gum-sandarach, 2 pints of turpentine. Made as No. 1 lacquer.

3. *Pale Brass Lacquer.*—2 gallons of spirits of wine, 3 ounces of cape aloes, cut small, 1 pound of fine pale shell lac, 1 ounce of gamboge, cut small, no turpentine varnish. Made exactly as before.

But observe that those who make lacquers frequently want some paler, and some darker, and sometimes inclining more to the particular tint of certain of the component ingredients. Therefore, if a four-ounce vial of a strong solution of each ingredient be prepared, a lacquer of any tint can be procured at any time.

4. *Pale Tin Lacquer.*—Strongest alcohol, 4 ounces; powdered turmeric, 2 drachms; hay saffron, 1 scruple; dragon's blood in powder, 2 scruples; red saunders, ½ scruple. Infuse this mixture in the cold for 48 hours, pour off the clear, and strain the rest; then add powdered shell lac, ½ ounce; sandarach, 1 drachm; mastic, 1 drachm; Canada balsam, 1 drachm. Dissolve this in the cold by frequent agitation, laying the bottle on its side, to present a greater surface to the alcohol. When dissolved, add 40 drops of spirits of turpentine.

5. *Another Deep Gold Lacquer.*—Strongest alcohol, 4 ounces; Spanish anatto, 8 grains; powdered turmeric, 2 drachms; red saunders, 12 grains. Infuse and add shell lac, etc., as to the pale tin lacquer; and when dissolved add 30 drops of spirits of turpentine.

Lacquer should always stand till it is quite fine, before it is used.—*Larkin's "Brass and Iron Founder."*

ENGLISH engineers have found out that one of our monitors, the *Monadnock*, made an excellent voyage to Valpariso, that she encountered the ordinary gales and behaved as well as any ship in the squadron. The monitor carried two 15-inch guns in each turret and her sides are but 15 inches out of water. It appears that the new English turret vessel *Monarch* has sides 14 or 15 feet high, which makes some grumbling among engineers; they do not seem to like such exalted structures.

THE following opinion of Mr. Solly was sent to Rome by telegram, by one of the late Mr. Gibson's friends. It is a curious sign of the times in two ways: first, in the mere fact of such a means of transmission of medical advice; and, secondly, in the extraordinary dread of bleeding a patient which exists out of, as well as in, the profession, at this present time. The message was: "Mr. Solly thinks no blood-letting is required, unless the head be hot and painful. Quiet and nourishment are indicated."

WE understand that Capt. John Ericsson is to be paid $13,930 as his reward in full for planning the United States war steamer *Princeton*, and superintending the construction of machinery of the vessel. Mr. Ericsson has realized a large fortune by his improvements and inventions during the war, which we rejoice to hear, as his services and skill have been exceedingly valuable to the Government.

A NEWSPAPER in Californiasays they are so much annoyed out there with mosquitoes and bed bugs, that a physician advises, first a bath in a solution of soft soap and molasses, then a sprinkle of saw dust on the head, after which the patient should take to his bed and maintain perfect repose.