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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 242,

For the Week ending August 21, 1880.

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DR. TANNER'S FASTING EXPERIMENT.

Of all the exhibitions which have attracted the attention of the people in and around New York city, the forty days' fast of Dr. Tanner is not the least remarkable. If his aim was to draw public attention and be extensively noticed, he has fully attained it, as no daily paper can be taken up which does not contain a full account of his doings and feelings of the last twenty-four hours, while he is watched by the physicians of the allopathic as well as of the eclectic school, and in addition to this always by a *Herald* reporter, to make sure that there is no deception practiced, as has been so frequently the case with other pretended fasters.

That his experiment is not altogether useless, as is maintained by some, we will try to elucidate, notwithstanding we agree that the sacrifice and danger he exposes himself to appears so great that it is doubtful if they will be compensated for by the physiological and pathological lessons to be learned by it.

His fast has, in the first place, proved the mistake of those who judged all men alike, and reasoned that, because a weak, hysteric, and ill fed girl of 18, perhaps consumptive besides, died within two weeks from starvation, as soon as she was carefully watched, therefore nobody could be without food for a period of forty days, forgetting that the case is quite different where we have a man of between 40 and 50, the age of maximum resistance, a man well fed, of whom the weight is far above the average for his size, and who was provided with a copious layer of adipose tissue around his body, a man who had practiced fasting for sanitary purposes, finding it the best way for him to cure gastric derangements, for which he had a liability, and who had gradually increased the time of fasting until, at his last fast in Minneapolis, he had extended it to forty-two days. This was not believed and deception suspected, hence a challenge for $1,000 if he succeeded when carefully watched. Dr. Tanner accepted, but the challenger backed out under some pretext, and Dr. Tanner, to save his reputation and prove his theory, came on and submits for nothing to the task under the eye of careful watchers.

It must be conceded that few persons would possess such a strong will and determination to persist in subduing all appetite, and disregard the no doubt exceedingly disagreeable and perhaps distressing feelings consequent to total abstinence from food; but Dr. Tanner possesses this determination in the highest degree, and he never thought of cutting the fast short, whatever may sometimes have been the opinion of his watchers.

In order to understand what may be learned from this experiment we will, for the benefit of the non-professional reader, remind him of a few physiological principles.

The chemical constituents of the human body have to be constantly renewed, and the waste has to be supplied by the food. Some of these constituents are wasted rapidly, others slowly, and in case of starvation the elements rapidly wasting away must be present in the body in sufficient quantity to keep the functions of life in operation. These rapidly wasting constituents may be divided in three classes, those in which carbon prevails, those in which nitrogen, and those in which phosphorus is the prevailing element.

The carbonaceous compounds are wasted in keeping up the animal heat. This is accomplished by a slow combustion, that is, a combination of the carbon with the atmospheric oxygen, which is continually going on in the capillaries through the whole body, the oxygen being furnished by the blood, which absorbs it in the lungs, and which by the arteries is sent through the body. The product of this combustion, the carbonic acid, still absorbed in the blood, is by the veins sent to the lungs, where it is given off and escapes in the act of respiration. After having stripped Dr. Tanner, when he commenced his fast, for the double purpose of ascertaining his physical condition and leave no doubt that he had no food about him, it was seen that he had plenty of fat in and around his body to furnish carbon enough to last him more than forty days.

The second element of rapid consumption is nitrogen; it proceeds from the waste of the muscular tissue, which is always going on, even during sleep, as the heart is a muscle continually contracting, and respiration is kept up by muscular action. The blood takes up this waste in the form of a compound, of which the chemical name is cyanate of ammonia, but which by physiologists is called urea. It is the function of the kidneys to secrete this from the blood, and numerous experiments have settled the nature and amount of this secretion, which in healthy persons consuming food varies from 25 to 35 grammes every twenty-four hours. When Dr. Tanner began his fast it was secreted at the rate of 29 grammes, and as the nitrogen in any excess of nutrition is similarly changed and secreted, it was expected that a large reduction would be observed as soon as the fast began to have effect on the system. This expectation was realized, and the amount soon fell off to 23, 20, 17, 16, and finally 13 grammes, at which it remained stationary, with slight oscillations beyond. This amount of nitrogenous substance represents, therefore, the waste necessary to sustain the functions of life, and would at once be increased in case food was taken by the experimenter, at least nitrogenized food, such as beef extract or its equivalent, albumen, casein, milk, etc., the only substances which would be of benefit to him. Analytical chemistry, therefore, acts here as a reliable detective, and to the credit of all concerned it must be said that never the least suspicious increase of urea was observed, it remaining very nearly constant, and will no doubt become double and more as soon as after the fast food is again taken.

The third element of rapid waste is the phosphorus; it proceeds chiefly from the waste of the brain and nervous tissues. It is so important in these functions that a great German chemist has formulated the expression, "without phosphorus, no thought." Every mental act and every nervous excitement is accomplished by a consumption of phosphorus, which, combined with different bases in the body, especially soda, magnesia, and lime, is secreted by the kidneys as a soluble salt, not only easily detected as crystals by the microscope in the sediment, but even an approximate estimate may be had of its reduction or increase by the number of crystals seen in the field under the same circumstances.

This third element did not at first show any reduction in quantity, but, to the contrary, for a few days some increase. It was at the occasion that Dr. Tanner had been unjustly accused by a physician present that he had surreptitiously accepted food from one of the watchers; this appears to have preyed upon his mind. Attention was therefore called to the danger in this direction, a danger proceeding from the more rapid waste of the nervous system. Relaxation was therefore devised, and daily carriage rides, which eased his mind and were followed by a more sound sleep, soon reduced the phosphates secreted, and at the same time reduced the irritability and temper of the experimenter.

This observation tallies perfectly with what has been observed in the case of such clergymen who have every week the periodical labor of preparing and delivering two sermons on Sunday. Chemical analysis has proved that at that time they secrete more phosphates than in the middle part of the week, after the rest of Monday and Tuesday.

We will only add that the suspicions occasionally expressed by those who cannot realize the possibility of so long a fast are utterly unfounded. All those who have taken the trouble to watch long enough, especially if they became acquainted with Dr. Tanner, came to the conviction that he is too high minded, upright, and honest to deceive any one with so mean a device as to take food secretly; while in regard to the responsibility of the watchers it must be considered that Dr. Tanner can any time obtain what he wants. If he asked, for instance, for a beefsteak it would be procured at once, but this of course would end the watch, being the close of the experiment.

He told us that some years ago he was married, but became disgusted with his wife, who, he says, continually stuffed her stomach with all kinds of food. He could not stand this, and when remonstrance did not improve her he obtained a divorce.

OUR POTTERY INDUSTRY.

Among the special industries of the country which but seldom attract general interest is that of the manufacture of China and other earthen ware for table use. Thirty years ago there was but one pottery in the country, but some thirty kilns have been built during the past year, increasing the annual production to about $4,000,000. The imports for the last fiscal year were $4,082,787, and they have averaged about this figure since 1873, although in that year they amounted to $6,015,925, and in 1872 were $5,270,785. For the eleven months to June last the imports of earthen, stone, and china ware, were valued at $5,101,504.

At the last meeting of the United States Potters' Association, which was the sixth annual convention of that body, the members were congratulated that "American manufacturers were rapidly gaining, and foreign manufacturers fast losing, the control of the American market." As the business was then said to be in a generally healthful condition, we suppose manufacturers here have shared in the increased trade to an even greater extent than the imports have been augmented, but still our business in this department seems small when compared with the extensive pottery industry which is carried on in Great Britain. The British exports in this line from 1869 to 1879 amounted to £17,748,028, equal in round numbers to $8,850,000 annually. The business in this specialty has formed an important department in British manufactures since Josias Wedgwood, in 1763, made some of the most valuable improvements in the art, and from that time the reputation of the Staffordshire potteries has been worldwide. With the excellent supplies of crude materials we have, however, the aid of a very considerable duty, and constant accessions to our labor supply from the immigration of skilled English workers, it would seem that this industry should continue to meet with a healthful development here until its productions are at least sufficient for the supply of the home market.

In a report of the committee on raw materials of the Potters' Association, it was suggested that funds be appropriated for making analyses of the different clays, feldspar, and quartz found in various parts of the United States, so that each member might have the results of an authoritative examination, instead of being dependent, as at present, upon their individual experiments, which were described as "crude, costly, and empirical." The ordinary methods of testing clays employed by potters were said to be very imperfect; "one clay is unctuous, another refractory; one dries hard, another crumbles; one burns pure white, another yellow; one is short, another tough," etc., few if any of the members knowing the real causes of such differences. The same difficulties were said to exist in relation to spars and quartz, which were ground without an exact knowledge of their nature, and mixed with many foreign substances and impurities. The want of proper care and system in opening and working clay pits was also the subject of considerable

criticism, as this made it difficult for the potter to obtain just the kind or grade of clay he needed, the different qualities frequently being mixed, so that there was no uniform standard. To remedy this it was said that clay miners must work their beds on a broader scale, so as to obtain a more even grade, as, even in the best strata, there were variations every few feet, and, by working in a small way, it was impossible to prevent the mixing of the different qualities.

The interesting archæological discoveries of Dr. Schliemann and General Di Cesnola have, of late years, drawn more particular attention to ancient accomplishments in the ceramic art, but, while so much interest is being developed in the purely artistic side of the question, we hope the practical department—that which tends to develop and enlarge an important home industry—will not be lost sight of.

ANOTHER RAIN CONTROLLER.

Several schemes for the artificial production of rain have been noticed in recent issues of the SCIENTIFIC AMERICAN. Mr. Geo. H. Bell, of this city, goes further, and sends us the plan of a rain tower, by which he would not merely produce rain when it is needed, but prevent rain when nature is disposed to grant that blessing too liberally.

Mr. Bell's rain tower is a charming little structure of stone, one hundred feet in diameter at the base, and tapering to sixty feet diameter at a height of one thousand feet. Above this rises a tubular tower of wood or iron, say five hundred feet. It would not often be necessary to go above one thousand five hundred feet, Mr. Bell thinks, though that altitude might be exceeded if necessary. Of course there would be no risk of such a tower being blown down or crushing its foundation by its own weight.

The interior hollow of the tower would have a diameter of twenty feet; and through it a vast volume of saturated air could be blown into the upper atmosphere by means of proper machinery at the base of the tower. In case that might not suffice to secure the desired precipitation of rain, an additional up-rush of air around the tower is obtained by means of numerous tubes leading upward and outward from the interior of the tower at an angle, say, of 45°. Similar tubes descending from the inside to the outside of the tower serve as inlets, the air let in through them being sucked in by the ascending current within the tower; then, after it has received "the upward impetus of the inside force," it will be ejected upward through the ascending tubes. "Thus," in the words of the inventor, "through every stratum of air pierced by this mammoth rotunda, the air surrounding the outside walls will be agitated by an upward influence," making the exterior ascension indefinitely exceed the interior.

The inventor adds: "While these tubes, discreetly located at meteorological centers, would doubtless become reliable agencies for the formation of clouds, it should be their faculty also to prevent rain; for by reversing the motion of the fan or blower, a descensional flow of air would begin, which might annihilate the clouds overhanging, by bringing them to earth in aeriform and holding them here [securely bottled of course!] until they be wanted in precipitation on some locality, then instituting the ascensional flow and send them up to be condensed."

Mr. Bell suggests that a single timely rain would pay the cost of building a tower of this sort, "and a nation furnished with a reasonable number might prove them her wealth and grandeur."

REMARKABLE EXPLOSIONS OF GAS.

An explosion of gas of a magnitude unprecedented in the history of gas illumination, occurred in London, July 5. The district in which the disaster happened had been supplied with gas through a system of small (three and four inch) mains, which had become inadequate. Accordingly preparation had been made to increase the supply by laying down a new thirty-six inch trunk main. This work had nearly been completed, only a single length of pipe having to be put down before the gas could be turned in. The point of junction was in an open trench, where the end of the main had been plugged and fitted with a half inch stand pipe.

Just before the explosion workmen had been engaged in cutting out the plug from the end of the pipe. The foreman was standing on the main near the stand pipe, from which he had removed the pressure gauge with which he had tested the main, and ascertained that there was no pressure in it. He then smelt the stand pipe to ascertain whether any gas was issuing therefrom, and finding none came out, he applied a light, and almost immediately a dull rumbling sound was heard, followed by an explosion, which blew one of the workmen a considerable distance into the open pipe on the opposite side of the trench, killing him instantly, and so injuring the other man that he died shortly after his removal to the hospital. The foreman escaped unhurt. There was a quantity of dust and smoke, but no flame was seen.

Almost simultaneously another explosion occurred some yards away, and was followed by five or six more explosions at varying distances along the line of the main. The streets were much torn up, many buildings were wrecked or more or less seriously injured, and several persons were hurt. At the second point of explosion something like a dozen lengths of main were upheaved; at others, from three to six lengths were blown out; while in two places the explosion was limited to one length. At each point of explosion the paving stones were hurled into the air, causing great destruction of surrounding property, and peril and injury to passers-by.

At the coroner's inquest, the foreman of the pipe layers testified that the point of first explosion was nearly two miles from the "live" main containing gas. The new main —technically "dead" main—was shut off from the live main by means of a valve and cap, the cap being bolted on so that there was no flow of gas from the live main to the dead one. Everything was ready, however, to turn the gas into the new main when the lacking length at the west end had been laid. How the gas got into the main which was broken up is a mystery. In his testimony, the chief inspector of the gas company said:

"I was certainly not aware of there being gas in the main; but it did not occur to me to test it. I did not think gas had come there. The valve in Howland street was put in under my superintendence, and I know that it was sound and proper. I have no doubt that the explosion was caused through there being gas in the main to the westward. About five per cent of gas combined with atmospheric air would be sufficient to create an explosive mixture, but ten per cent would be more dangerous. The main had not been tested with a view to seeing whether gas was present. It is my belief that gas had got mixed with the air in the main, but I cannot account for it. The theory I have formed is that gas must have escaped from a fracture in one of the smaller pipes, and found its way into the main."

Another theory was that the passage of some heavy vehicle over the valve in Howland street might have loosened it enough to let a sufficient quantity of gas into the "dead" main to make the mixture of gas and air explosive. The explosion not only tore up the streets in places, but broke in the sewers, and so damaged the gas and water connections of the houses as to leave the district for some hours without water or light.

Though this accident was pronounced unprecedented by gas engineers, it was quickly followed by a similar but fortunately less disastrous one of the same sort. A number of workmen were engaged in enlarging a gas main at Bilston, near Wolverhampton, England, when, through an incautious use of a light, an explosion occurred, and a portion of the roadway and pavement was upheaved. The explosion traveled underground, and burst at some distance from its origin. The amount of damage done, however, was not great, and no lives were lost. A second explosion occurred some hours after the first.

THE TEXAS HYDRAULIC MINERAL BELT.

A correspondent, writing from Round Rock, Texas, announces the recent discovery of a valuable and very extensive deposit of hydraulic earth, which crops out along a belt many miles in length. At Del Valle, on the Colorado River, eight or ten miles from Austin, it shows a stratum from sixty to eighty feet thick, above the river. At Round Rock, twenty miles northeast of Austin, it lies two feet below the surface, and is of unknown depth. At this point it is easily converted into quicklime by burning. Mixed with from two to four parts of sand it produces a hydraulic building mortar or artificial stone, said to be equal to that made with the best English Portland cement. By similar treatment with three parts fine sand through one-eighth mesh sieve, and three parts coarse gravel through one-fourth sieve, it produces a concrete which, when moulded and pressed, gives a hydraulic stone brick of superior quality, suitable for all common building uses. The presence of such an inexhaustible supply of material for making cheap and strong artificial stone cannot fail to be of great benefit to Texas.

ARSENIC IN WALL PAPERS.

A law suit concerning the use of arsenic in colors was lately tried in the High Court of Justice, London. Steinhoff, a color maker, sued Woollams & Co. for a small bill for colors furnished. Woollams refused to settle because the colors were found to contain arsenic; they not only refused to pay, but claimed damages against Steinhoff to the amount of nearly two thousand dollars. It was proven on the trial that Steinhoff, when he sold the colors, which were the "imitation azure blue," guaranteed that they contained no arsenic. Woollams showed that his reputation in business was to a great extent founded on the fact that his wall papers were made without arsenic. Believing that the colors of Steinhoff contained no arsenic, he made up a lot of wall papers therewith. Subsequently it was found that the colors contained arsenic to the large extent of fifty per cent. The jury allowed the claim for damages. So the plaintiff, instead of obtaining a judgment in his favor, had a heavy judgment rendered against him, and had to pay the costs on both sides in addition.

THE MAGNET IN MEDICINE.

Some recent researches undertaken under the direction of Prof. Charcot, in his laboratory at the Salpêtrière, have attracted attention anew to a therapeutical agent which has been known for a long time, but which at the present time has fallen into disuse. We refer to the application of the magnet in the treatment of certain diseases. It is claimed by the believers in the efficacy of this mode of treatment that magnetization has fallen into discredit on account of the absence of precise rules for the application of the remedy, and also because of the air of mystery which seems to be connected with it. To Prof. Maggiorani, it is said, is due the credit of calling attention again, in 1869, to the value of magnetic medication, and of endeavoring to establish it on a rational and strictly scientific basis. The first experiments were made at the Salpêtrière in order to verify the facts collected together by M. Burq under the generic title of metallotherapy. After the results obtained by metallic applications, it was natural to endeavor to throw some light on these phenomena by varying the conditions of experimentation. It was found that patients (especially those afflicted with nervous diseases) were not only acted upon by plates of different kinds of metals, but that like results were obtained by the majority of physical agents, such as weak currents, static electricity, sonorous vibrations, differences of temperature, magnetized bars, etc. It was soon found that magnetized bars were remarkable for the consistency of their action and the facility with which they could be employed. It is not claimed that magnets are endowed with specific properties, but that they form part of a group of physical agents which, in varying degrees, possess the same power as the above-named of affecting the nervous system and giving rise to biological phenomena. The Salpêtrière researches have provoked a lively discussion. The facts announced have been confirmed in Germany, Italy, England, etc., but have been boldly attacked likewise in the last-named country.

A medical writer in *La Nature*, who has been a witness of Prof. Charcot's experiments, says that the action of the magnet is in some respects so surprising that it might *a priori* excite mistrust. The application is not direct. The magnet is not placed in contact with the skin of the subject experimented on, but its action takes place at a distance. To influence the organism and to produce the same effects as with metals it only suffices to place the poles of the magnetized bar at one or two centimeters' distance from that portion of the body upon which it is desired to act. It is thus that all the experiments have been made at the Salpêtrière. It is not necessary that the magnet should be a large one, but merely that the magnetic force should be appreciable. It is alleged by the writer in question that this mode of treating disease should be ranked of equal value with other methods now in use, such as that of electricity, etc.

The Growth of our Export Trade.

During the year just closed both the value of the imports of merchandise into and the value of the exports of merchandise from the United States were larger than during any preceding year in the history of the country. According to the annual report of the Chief of the Bureau of Statistics, just issued, the value of the exports of merchandise during the year ended June 30, 1880, exceeded the value of the exports of merchandise during the preceding year about $125,000,000, or 18 per cent, and the value of the imports of merchandise during the year ended June 30, 1880, exceeded the value of such imports during the preceding year about $222,000,000, or 50 per cent. The increase of the value of imports of merchandise exceeded the increase in the value the exports nearly $97,000,000.

The value of the imports and exports of merchandise during the fiscal year just closed exceeded the value of such imports and exports during the preceding year about $347,000,000—an increase of 30 per cent. The rapid growth of the foreign commerce of the country is strikingly exhibited by the fact that the value of the imports and exports of merchandise during the fiscal year just closed amounted to $1,503,679,489, being about 81 per cent greater than the value of the imports and exports of 1870, and nearly 119 per cent greater than the value of the imports and exports for 1860.

The exports of coin and bullion during the year ended June 30, 1880, were about $7,800,000 less than during the preceding fiscal year, and the imports of coin and bullion during the year ended June 30, 1880, exceeded the imports during the preceding fiscal year about $72,700,000. During the year just closed, for the first time since 1861, the imports of coin and bullion exceeded the exports of the same.

Wanted—An Easy Place.

Rev. Henry Ward Beecher some time since received a letter from a young man, who recommended himself very highly as being honest, and closed with the request, "Get me an easy situation, that honesty may be rewarded." To which Mr. Beecher replied: "Don't be an editor, if you would be 'easy.' Do not try the law. Avoid school keeping. Keep out of the pulpit. Let alone all ships, stores, shops, and merchandise. Abhor politics. Keep away from lawyers. Don't practice medicine. Be not a farmer nor a mechanic; neither a soldier nor a sailor. Don't study. Don't think. Don't work. None of them are easy. O my honest friend, you are in a very hard world! I know of but one real 'easy' place in it. That is the grave."

Injurious Effects of the Buttonball.

Les Mondes states that a French medical journal has recently called attention to the injurious effects that are apt to follow a residence near the common shade tree, the buttonball or plane tree. The fact has long been known, even from the time of Pliny, that a stay near these trees is often followed by an irritation of the air passages, followed by a disagreeable and sometimes persistent cough. This is due to the fact (familiar to botanists, though perhaps not to the general public) that the young shoots, leaves, and stipules are covered with a fine thick down composed of minute branched rigid hairs, which falls off as these parts become older, and often floats in the air in large quantities. It is the inhalation of this that causes the throat difficulties. It often causes serious annoyance to employes in nurseries where the tree is raised, and who fail to take precaution against it.