

storm waves which have submerged the country for over 3,000 square miles.

The cyclone, which occurred on October 31 last, arose in the Bay of Bengal, and took a northward course, wrecking several large vessels which lay in its track. It just missed Calcutta, but struck Chittagong, which lies in the most northeasterly corner of the bay, stranding every vessel in the harbor and nearly destroying the town. Meanwhile the storm waves submerged the great islands of Hattiah, Sundep, and Dakhin, lying in one of the mouths of the Ganges, covered several smaller islands, and then flowed over the land for five or six miles toward the interior.

It appears that the immense waves were projected with astonishing velocity. Up to 11 o'clock on the night of October 31, Calcutta despatches reporting the storm said that no especial danger was anticipated, but before midnight the waters had overrun the land to a depth of 20 feet.

An examination of the map shows that the islands mentioned are situated near an estuary of the river Megna, and they owe their origin to the deposition of soil washed down by the Ganges. They constitute part of the Sunderbunds, as the low, marshy land thus produced is called, from its being covered with the "sunder" tree; and the district is not only the hottest but probably the most unhealthy portion of British India. Malaria reigns everywhere, and the forests and jungles abound with tigers and other ferocious beasts. The English Government for some time past has labored to reclaim the islands, and has offered strong inducements to settlers to cultivate the ground, which is rich and extremely fertile. These efforts have resulted in the clearing of a large portion of the territory, and the raising thereon of valuable crops of cotton, rice, sugar cane, mulberry trees for silkworm food, and timber: while the population of Dakhin, the largest island of about 800 miles in extent, has increased to 240,000, and those of Hattiah and Sundep together number some 100,000 inhabitants.

Of course the devastation in this district has been complete. The country is dead flat; and the people, when the wave burst upon them, had no place of safety but in the tree tops. And there such as were able found their way, sharing their refuges with the wild beasts, birds, and serpents. Houses by the thousand were utterly swept out of existence, and the only relics of human habitations afterwards found, were cast up on the Chittagong shore, ten miles distant.

The Calcutta *Government Gazette* says that, "wherever the storm wave passed, it is believed that not a third of the population survived. The islands have barely one fourth of their former inhabitants." All the cattle were destroyed, and the stench of the decomposing remains has already generated an outbreak of cholera which it is feared will prove general. The British Government is taking steps to relieve the distress which prevails.

AN INDIAN DUST STORM.

In his clever account of Bannu, a district in the Punjab, Thorburn describes a dust storm on the great plain of Marwat, a phenomenon of such imposing force and grandeur as to be well deserving of the important position lately accorded it, by American scholars, among the great geological agents.

Marwat, the bed of an ancient lake, is now a vast treeless plain of undulating, sandy down, bordered by a region of soft loamy clay, deeply furrowed by watercourses, and overlaid by a layer of gravel and smooth, rounded stones, called "hell stones" by the people, because of their black and scorched appearance, the effect, probably, of natural sand blast attrition. Seen in autumn or in a year of drought, it appears a bleak, howling wilderness, fit home for the whistling, heat-laden dust storms that often sweep across its surface in the hot months; but in late spring, after a few timely showers, it presents an interminable sea of wheat, the vivid green of which gives place here and there to streaks and patches of darker shaded grain.

The approach of a dust storm over this place in the dry season, and witnessed from one of its boundary hills, is a grand and impressive sight. At first but a speck on the distant horizon, it rapidly elongates until it stretches from east to west, a mighty, threatening wall a thousand feet high and thirty miles in length. Nearer and nearer it comes, phantom-like, its rushing noise being inaudible to the spectator. Now one wing is pushed forward, now another, nearer still: and now the birds—kites, vultures, and a stray eagle or two—circling its front are visible, and one by one the villages at the foot of the hill are enveloped and hidden from the eye: a few minutes more and the summit of Shekhubudin, till then bathed in sunshine and sleeping in the sultry stillness of the June morning is shrouded in yellow, scudding clouds. Vanished is the grandeur of the scene in a moment, and nought remains but the stifling, begrimed dust, flying and eddying about in all directions, penetrating everywhere. Outside nothing can be seen but a darkness which can be felt, and nothing is audible but the whistling of the wind and the flapping of bungalow chicks: but inside the lamps are lighted, and a quarter of an hour is idly passed, until the storm, which generally expends its fury on the hillsides, subsides or passes on.

LOW FLYING BALLOONS.

In his very excellent report, recently made, on the progress of aeronautics, to the British Aeronautical Society, of which he is secretary, Mr. Francis W. Brearey says:

"It is singular that no one has taken advantage of an ascertained fact to put the balloon to more pleasurable, because more prolonged, use than has hitherto been attempted." After instancing how a boat may be caused to travel with the current of a stream by simply using a pole

to push it clear of the banks, he adds: "There is every probability that, with a balloon so balanced, a push with a long pole would send it up spinning for fifty feet or more, and one might traverse a few hundred yards before it neared the earth and required another push."

Shortly before undertaking the ascension in which he lost his life, Mr. Donaldson, the well known aeronaut, described to us his experience in just such balloon sailing. He stated it as his belief that, if ever the time came when people would step into balloons as readily as they now do into railroad cars, the air ships would not sail above the clouds, but would skim close along the surface of the ground. He gave many reasons for this view—notably increased safety and economy, since balloons could be made much smaller, as they would not require a large amount of gas to keep them afloat, and there would be little difficulty in stopping to replenish the supply when exhausted. He had found no trouble in balancing a balloon at four feet above the ground, and at keeping it accurately at that height for hours. He told us, further, that he frequently traveled along country roads in this way during calm weather, using a pole to push himself along when there was no wind, or to guide himself when being wafted by a breeze. As an instance of how exactly a balloon can be balanced, he stated that, while thus sailing over a road, he carelessly dropped overboard about a quarter of a loaf of bread, whereupon the air ship sprang aloft a hundred feet or more. We asked him how he avoided wagons and similar obstacles in his path without discharging ballast, and so losing equilibrium? "Jump over them" was his answer. "A good strong push downwards on my guiding pole has sent me flying over many a tree in which I thought I was sure to be entangled." This flea-like mode of progression was a favorite mode he had of astonishing rustics.

Mr. Brearey's paper is published in full in *SCIENTIFIC AMERICAN SUPPLEMENT*, No. 50; and among other remarkable facts, it notes that a one horse power engine can be made to weigh only thirteen pounds. There are also descriptions of Moy's steam flying locomotives and others of the most nearly successful efforts toward solving the problem of aerial navigation.

THE RADIOMETER NOT A LIGHT MOTOR.

The immense quantity of evidence in the shape of experiments on the radiometer, which has been accumulated by the principal physicists of Europe, leaves no reasonable doubt but that the claim that the apparatus is driven by light is unfounded. It is maintained by our correspondent, M. Desaulx, that the radiometer is an electrical engine; a majority of observers pronounce it simply a machine driven by heat. So long as it is decided that the radiometer is actuated by forces which are intrinsically perfectly well understood, leaving the problem merely one of determining how the same are applied, the whole subject sinks at once to secondary importance. It was only because the apparatus appeared to demonstrate the ponderability of light, and hence was an apparent serious contradiction to the undulatory theory, that it has excited the close attention of the scientific world.

Dr. Frankland's recent experiments on the radiometer are among the most conclusive that have been made, as showing the true source of its motion. The disks of his instrument were of aluminum, polished on one side and blackened on the other. They were extraordinarily sensitive, and continued rotating often for twenty minutes after the sun had descended below the horizon. Placing this radiometer in a room where the conditions were such that it remained motionless, Dr. Frankland enclosed its globe in his hands so as to cut off light from the disks. Yet they at once began to rotate, polished side in advance. On withdrawing his hands, the motor, after the lapse of two or three minutes, stopped: then after another brief interval, it resumed in the opposite direction for a short time. There was rotation set up without the aid of light, and clearly due to the temperature of the investigator's hands.

The next experiment was exactly the converse, and involved testing the apparatus under light destitute of heat. It is well known that the moon, although reflecting the sun's rays, sends but a very small amount of heat to the earth. With a lens 3 feet in diameter, concentrating the lunar rays on a thermoscopic pile, Melloni proved that the deviation of the needle was from 0° 6' to 4° 8', according to the phase of the moon. This indicates so extremely small a heating power that it is practically inconsiderable, and is destitute of any known effects upon the earth. Dr. Frankland therefore exposed his radiometer to bright moonlight, but it did not stir. Then, with a powerful lens, he rendered the intensity of the rays 200 times greater, and directed the brilliant image of the moon, produced at the focus, directly upon one of the disks of the radiometer. Not the slightest movement was appreciable, although the light was kept unaltered for over a quarter of an hour.

Dr. Frankland's conclusions sum up the true facts regarding the radiometer in brief terms. He says: that light is not necessary to the motion of the instrument: that light does not contribute to its motion unless (by absorption) it be transformed into heat, which did not take place (or occurred in an unappreciable degree) for moonlight: that the movement of the disks is due to the unequal heating of the two faces of each disk, the cooler face always preceding the hotter one. When the globe is taken in the hands, the blackened face of each disk absorbs heat rapidly, while the bright side reflects it. Thus the surfaces of the black disks remain hotter than the metal situated below, but soon communicate their heat to said metal. If the hands be withdrawn, the thermal conditions are reversed: the black face, being a better absorbant and at the same time a better radi-

ator, cools much more quickly, and hence the opposite motion of the mill already described.

THE LIMITS TO PHYSICAL CULTURE.

We have frequently had occasion to dwell upon the fact that, while moderate physical culture is a great benefit, indeed a necessity, to ensure a proper balance of mental and bodily powers, and consequent health and longevity, physical overculture is a great evil, leading to results diametrically opposite to those sought to be attained. At one end of the series is a constitution weak and unfitted to resist disease or the effects of labor, on the other an organization strained to its utmost and ready to yield under the slightest addition to the stress. Obviously between these extremes there must be a mean up to which all culture is beneficial, and beyond which all is overculture. The question is, however, whether that mean is in the nature of a personal equation for every one, differing for each individual constitution, or whether it is possible to formulate general laws, true for all systems. The tendency of modern investigation, in all cases relating to the science of life and of living, is favorable to the latter view. Mr. Charles Darwin sends out his formulated questions the world over, and deduces results from the replies proportionally considered. Candolle does the same in his elaborate investigations into the antecedents of scientific men; the statistics relative to the recruits for our army we have shown, in recent articles, to admit of valuable deductions relative to our national characteristics; and we might add numerous examples, all showing that that which is proved true, on the average, for a large number of persons, may with reason be assumed to be true of an entire class, or even a race, when surrounded by generally similar conditions of life.

Now in the case of physical culture, the point specially to be determined by actual physiological investigation is to what extent the body may be benefited. This known, any one may easily discover for himself when the limit is reached, and will understand that to carry his training still further is a positive disadvantage and injury. Such an investigation has lately been made by Dr. Burcq of Paris, in the *École de la Faisanderie*, a gymnasium where are drilled the soldiers who are destined to be the gymnastic instructors of the French army. No better set of men could be selected for examination, for the reason that each individual is virtually intended hereafter to serve as a model for others, and therefore his physical culture is brought to the best possible state. Dr. Burcq continued his investigations with the utmost care and minuteness, for six months, during which period the progress of over a thousand men was closely watched and criticized. As a general result, he tells us now that gymnastic exercises:

1. Increase the muscular forces up to 25 and even up to 38 per cent, at the same time tending to equilibrate them in the two halves of the body.

2. Increase the pulmonary capacity at least one sixth.

3. Increase the weight of men up to 15 per cent, while on the other hand diminishing the volume. This augmentation exclusively benefits the muscular system, as is demonstrated by its elevated dynamometric value.

And Dr. Burcq further observes that, during the first half of the six months' course at the school, the increase of force was most markedly noted.

To Dr. Burcq's admirable studies upon this body of trained gymnasts may be added those of M. Eugene Paz, who for a long period has been observing the results which methodical physical exercise produces in certain invalids and in a large number of people of various callings, notably artists, literary and business men, and others whose muscles are normally less voluminous than those of the picked soldiers at the *Faisanderie* School.

By means of a variety of ingenious mechanical apparatus, and by a course of investigation wholly different from that of Dr. Burcq, M. Paz reaches precisely the same results. He notes especially the increase in weight and decrease of volume of the body, above referred to, and also the augmentation of pulmonary capacity. Three operatic singers who were rigorously trained for a year attained a maximum lung power corresponding exactly to an increase of one sixth. It follows, therefore, that Dr. Burcq's results may be considered in the light of a general law, and likewise as a guide to what is correct physical culture. In this view, we commend them to the attention of college authorities and students.

English Views of our Silk Industry.

At a meeting of silk weavers at Macclesfield, England, the headquarters of British silk manufacture, considerable dissatisfaction was expressed that no steps had been taken to exhibit English silks at the Centennial, the speaker stating that, were the United States once made aware of the excellence of the goods, the 60 per cent duty on them, imposed by our laws, would probably soon be removed. The Centennial correspondent of the *Macclesfield Courier*, himself an expert in silk, denounces their expressions as "false and foolish." After mentioning that the reduction in cost of labor is fast removing the chief obstacle with which American manufacturers have to contend, he says to his countrymen: "We shall find that the ample labor saving appliances and greater intelligence of the work people will bring us face to face with a competition such as we have never yet dreamed of, and I venture to say that before long England, mother of free trade as she is, will find herself compelled to impose a duty on the importation of American silks, in order to protect her manufacturers from being beaten in their own markets."