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THE SCIENTIFIC AMERICAN SUPPLEMENT,

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For the Week ending August 26, 1876.

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PHYSICAL MAN IN AMERICA.

From time to time every great mercantile or manufacturing firm slackens the work of making and selling to review its position and possessions: as the phrase runs, to take an account of stock. Just now the American people are similarly engaged in taking stock.

We have had a hundred years of general prosperity, a hundred years of rapid growth in numbers, wealth, and power: and very properly we celebrate our Centennial year in reviewing the results of the years that have gone, in trying to learn our relative standing among the nations. Not only in the great sample show of our natural and industrial resources at Philadelphia, but everywhere throughout the land, are manifestations of the same laudable desire to discover just what we are worth as a nation, what the past has done for us, and what the prospect is for the future.

There is danger however that, with our absorbing interest in the things we have invented, discovered, and made, in our mental and industrial achievements, we may forget the more important item of national stability, what we are: in other words, the character and conditions of our physical manhood. How do we compare bodily with the citizens of more homogenious nations? How big are we, on the average: what is our condition as to health and disease: what is our working force, and how long does it hold out?

Questions like these are especially pertinent at this time; for what our country shall be during the coming centuries depends far more upon the physical character of the people than upon the things they have or the machines they use.

It is fortunate that the material for such studies of physical man in America are ready at hand, thanks to the excellent use made by the Provost Marshal General's bureau of the records of examinations for military service during the late war, an elaborate digest of which has just been completed by Dr. J. H. Baxter, late chief medical officer of that bureau, and published by the United States Government. The records cover the physical examinations of more than half a million men, furnishing an amount of data largely exceeding in extent any of a similar nature ever before collected and published. And, as Dr. Baxter justly observes, the value of this enormous mass of statistical matter is hightened by the circumstances that it does not relate to soldiers already in the field, picked men in no wise representing the masses, but to the people: the men engaged in every occupation, professional men, and men of letters, traders and business men of every grade, laborers skilled and unskilled, the rich and the poor, the robust and the crippled: in short, to all the citizens of the country, whether of native or foreign birth.

During the first two years of the war, the armies were recruited by volunteer enlistments, under the control of the State authorities. This method proving inadequate, Congress passed an act, in the spring of 1863, creating a bureau of the war department to be known as the Provost Marshal General's, and to have charge of the recruitment of the armies, by enlistment or by draft as might be necessary. As a preliminary to the latter method, an enrolment of all persons liable to perform military service had to be made; and in order that none but able-bodiedmen should be put in the field, a thorough and systematic medical examination of all drafted men and volunteers was necessary. Four drafts were made, the whole furnishing records of the examination of 605,045 men, of whom 155,730 were exempted, or a ratio of 257·39 per thousand. During the same period there were examined 225,639 volunteers and 79,968 substitutes. Of the former 50,008, or a ratio of 221·63 per thousand, and of the latter 21,125, or a ratio of 264·17 per thousand, were rejected.

Of these and other records, covering the examination of over a million men, nearly half were found more or less incomplete and were thrown out; but as those which could be used seemed to be fair representatives of all, the omissions abridged the work rather than detracted from its value. The records made use of showed for each of the subjects of examination his age, nativity, residence, occupation, hight, complexion, color of eyes and hair, girth of chest at inspiration and at expiration, social condition (married or single), color, general physical constitution and condition, distinguishing natural or accidental mark if any, in case of acceptance, and specification of disease or disability in case of rejection. The scope of the final report is in the main the comparison of each of these elementary conditions with others, and a consideration of their relation to disease. The tables in which nativity is an element of the comparison show the physical condition of the foreign-born citizens of various nativities in relation to each other, and to native Americans, both white and colored.

The first fifteen tables, the anthropological series, treat of physical qualities without relation to disease; the remaining seven are pathological, treating of disease and its relation to the physical qualities of man, to occupation, and to locality. To facilitate the interpretation of the latter a series of charts have been prepared, presenting to the eye the more interesting results deduced from the tables: also a number of maps showing by gradations of color the prevalence of disqualifying diseases together and singly, by congressional districts. In the letter press, the reviews of the tables call attention to what is most interesting and significant of the lessons they teach, and furnish an amount of information with regard to American manhood, physically considered, the relative healthfulness of different parts of the Northern States, the relation of health to employment, and so on, that is truly wonderful.

Another exceedingly valuable portion of the work is the three or four hundred pages of Part III, containing reports of examining surgeons. In these is given, with other interesting matter, a connected and generally graphic account of each congressional district by a resident physician, covering its physical description, its prevalent diseases and their local causes, the general character of the inhabitants, their modes of life and occupations, the fitness of the different classes and nationalities for military service, and so on. From these, in connection with the tables and colored charts, it is our purpose to draw much curious and valuable information for the entertainment of our readers: to sum up, so to speak, our physical assets and liabilities as a nation.

SUMMER SCIENCE.

We have received a periodical bearing the name "Appalachia," a rather mystifying title until one peruses the pages sufficiently to learn that the magazine is intended to be the report of results accomplished, plans proposed, and information gathered by the Appalachian Mountain Club, the object of which association is the thorough geographical, geological, topographical, zoölogical, and botanical study of the mountains of New England and adjacent regions. The required knowledge is to be obtained by systematic exploration conducted by the members individually; and one cardinal aim and object is the publication at some future time of "a detailed and accurate map of the White Mountains, upon a large scale and in the very best style of workmanship."

It seems to us that those who have organized this club deserve credit for a very sensible idea, and one that merits to be widely imitated. Camp life in the summer, as witness the throngs which yearly visit the Adirondack region in this State, is extremely fascinating, and generally a grand restorer of impaired health. Beside it offers to the hunter and fisherman the best opportunities for sport. Now a club with the objects above stated combines all the benefits of outdoor life, besides placing before its members a definite and useful aim, so that each individual mingles with his holiday relaxation work which, from its very novelty and variety, ceases to be labor, and yet is of sufficient importance to stimulate the best endeavors. We cannot imagine anything more enticing to the scientific student than a summer spent with such a club as the Appalachian. If his tastes incline to natural history, he has only to read Professor Sterry Hunt's admirable letter of instruction to know, as Faraday expressed it, just "what to look for." There are floral materials to collect, limits of altitude of trees, plants, and animals to be noted, nature and distribution of rocks to be observed, rare and remarkable vegetable productions to search for, and so on through a long category. Does he desire a summer of practical surveying, Professor Hitchcock tells just what is to be done and how to go about it, gives a list of points to be determined, and even describes the needful instruments. The artist is offered an enchanting sketching tour, and Professor Fay explains how the knight of the brush and pencil can make himself scientifically useful. Professor Pourtales tells where original explorations are needed, and how they are to be conducted: lastly, Professor W. G. Nowell, for the benefit of those who do not care to be pioneers, suggests where paths may be made, record bottles placed, points of view to be cleared, and other improvements accomplished, which will facilitate the general work. It is original investigation conducted under the pleasantest conditions, and certainly well calculated to give those who undertake it a zest for discovery which may stimulate them to higher aims.

Beside, the task projected has a wider utility than is involved in its immediate result. There is a lamentable ignorance all over this country regarding our own territory, an ignorance which across the Atlantic becomes surprisingly dense, even among people otherwise highly educated. Our English contemporaries constantly quote American localities incorrectly; and to the minds of continental writers, our cities, counties, and States seem inextricably confused. In geography, as in all sciences, true knowledge has its foundation in details; and where those are clearly and accurately determined, we may look for generalizations based thereon to be equally correct. In the United States, the youth of the nation, and the fact that there are still portions of our immense territory wholly unexplored, are the obvious reasons why general information has been compiled without the substantial basis we have indicated; and many years will elapse before we shall have that intimate knowledge of our land which the marvelously minute topographical maps of Sweden, exhibited at the Centennial Exposition, prove that the Swedes have of theirs. Still we know of no better means of securing such useful information than by the labors of scientific students, associated as in the present club, which we trust may be but the precursor of others formed in other parts of the country.

ARTIFICIAL GUANO.

The enormous value of the guano deposits of the Chincho and Lobos Islands naturally gave rise to an early and eager search for similar stores of agricultural wealth in other localities. And seeing that sea fowl were not less numerous and voracious on uninhabited islands the world over, there seemed to be no reason why the search might not be successful. But it soon became clear that climate had much to do in the matter. Only in rainless regions where the slowly accumulating layers of excrement, fish bones, dead fowls, and so on could remain undisturbed and undissolved was it possible for true guano to accumulate. The search for it, however, was not without good results On many other islands, especially in the equatorial regions of the Pacific, there were found extensive beds of rock, which differed from the usual coral rock in that it contained a large percentage of phosphate of lime, the mineral base of Peruvian guano At first it was supposed that, by some mysterious chemistry

of nature, the coral carbonate had been changed to phosphate of lime; but subsequent researches proved the phosphatic rocks to have had their origin in the air, not under water. They were simply the remains of what in a more arid climate would have been regular guano beds, their organic matter having been dissolved and washed away by rain.

To convert these phosphatic deposits into commercial fertilizers, it was simply necessary to restore the organic elements which had originally accompanied them, for which purpose nothing seemed so appropriate as the refuse of fish oil factories. All along our northern coast, enormous quantities of menhaden were annually taken for their oil; and the compressed fiber and bone remaining after the extraction of the oil afforded a vast quantity of nitrogenous matter, similar to that produced in the digestive organs of fish-eating sea fowl. The company which had undertaken to utilize the phosphatic deposits of the Pacific islands set up their works at Wood's Hole, Mass., at the heart of the menhaden fishery, and there the fish of the Atlantic were made to supply the wasted elements originally drawn from the fish of the Pacific.

A model of these works is shown in the Government Building, at Philadelphia; and in the company's special pavilion are models of their other works, with a full exhibit of the processes employed, the materials used, and the products obtained.

The exhaustion of the richer beds of Pacific phosphates (and only the richer would pay for transportation) led to a search for like deposits nearer home, resulting in the discovery of the extensive deposits of Great Swan Island, in the Caribbean Sea, about a hundred miles from the coast of Honduras. But this source was soon eclipsed in value and interest by the rich phosphatic deposits along the South Carolina coast. Though known for nearly a century, the fertilizing character of these beds was not detected until 1867, when Dr. Ravenal discovered that their characteristic nodules of supposed marl rock were really composed almost entirely of phosphate of lime, and immediately made arrangements for their collection and conversion into commercial fertilizers, in the place of the Swan Island phosphates he had hitherto been using.

Previously, the interest attaching to these beds had been chiefly scientific, arising from the strange revelations of ancient life made by their fossil remains—revelations of a time long anterior to the historical period, when our familiar domestic animals, once supposed to have originated with man in Asia, horses, sheep, bulls, and hogs—were living here with animals peculiarly American, as certain deer, musk rats, beavers, hares, opossums, and the South American tapir.

The phosphatic nodules in question are found along the water courses of the Sea Island region between Charleston and Savannah, the largest development occurring on Chisolin's Island, about midway between these two cities, at the junction of the rivers Coosaw and Bull. The island, about six miles long by two miles wide, is underlaid with strata of nodules varying in thickness from one to three feet. At the diggings of the Pacific Guano Company, to whom the island belongs, the phosphatic stratum lies from two to five feet below the surface, and is about three feet thick. Nodules are also found in quantities in the beds of adjacent creeks. Properly treated, they yield an average of phosphoric acid equal to sixty per cent of phosphate of lime. The Swan Island's phosphates are less rich, except in the deeper deposits, some of which yield as high as eighty per cent of lime phosphate.

In the conversion of these phosphatic rocks into soluble fertilizers, they are first dried and pulverized; then, after being reinforced by the richly nitrogenous fish fiber, the whole is digested with sulphuric acid, producing an artificial guano analogous in nature and composition to the purest Peruvian guano, and equally efficient for the nutrition of growing crops.

By this industry, one of the most abundant and uneatable of our coast fishes, the menhaden, is made one of the most valuable. During the past year, upwards of twenty-six hundred men, with three hundred and forty-three vessels, nine of them steamers, were employed in the menhaden fishery. The capital involved was nearly three million dollars, and over five hundred and sixty million fish were taken. Besides the 2,681,487 gallons of oil obtained for commercial purposes, these fish yielded over fifty thousand tuns of compressed fiber and bone, carrying more than seven and a half million pounds of ammonia in the best possible organic form, the equivalent of 26,000 tuns of Chincha Island guano, and over 1,000,000 lbs. of phosphate of lime, readily convertible into agricultural products.

THE STRUCTURE AND AGE OF THE ROCKY MOUNTAINS.

From the Missouri river westward, the whole country gradually rises, at an average grade of barely ten feet to the mile, until about the meridian of 105½° W. is reached, and then the Rocky Mountains rise abruptly from the plain. Thence to somewhat beyond 108° W. the country is traversed by numerous mountain ranges, separable into two series. The first series comprises two complex axes of elevation, the front or eastern and the Sangre de Christo, whose trend is from N. 10° W. to N. 30° W. The second series is made up of the San Juan, Los Piños, La Plata, and San Miguel ranges, which have a trend of N. 30° W. to N. 45° W. Each series shows a parallelism in its ranges, and the whole system terminates *en échelon* southward, most of the axes ending in Colorado.

The eastern range, which consists of several closely packed parallel axes, and rises sharply from the plain, is composed of metamorphic rocks, badly fissured by dykes of lava, and not unfrequently capped by lava overflows. The schists are much torn and faulted, and side throws of mineral veins are not uncommon. Along the median line of the axis, exposed here and there by deep cuts, a compact granite, more or less syenitic, appears to prevail. The sedimentary rocks occur as "hog backs" along the eastern base, and curve round the southern terminations of the several axes.

The second range, provisionally named the Sangre de Christo by Dr. Stevenson—to whom (Report of Engineer Department, Wheeler Expedition, 1875) we are indebted for these particulars—is in the main almost parallel with the eastern range, but is much more complex in its structure. Its width is about twenty-five miles in the northern part, diminishing to twelve miles at Sangre de Christo Pass. With its extension, the Spanish range, it is, in Dr. Stephenson's opinion, but the southern portion of a magnificent group which once covered the whole region from East River to South Park. It remains for future explorations to solve the many problems which its complicated structure involves. In the main portion no rocks have been found of later date than the carboniferous.

The third great axis is the San Juan, for the most part buried under a great mass of volcanic rocks, which almost conceal those of sedimentary origin. Wherever exposed, a marked unconformability is seen between the carboniferous and the overlying rocks. The older formations are inclined at a very high angle, while the cretaceous and (doubtfully) the triassic, which are conformable to each other, have a very small dip.

The next great axis toward the west is the one termed by Dr. Newberry the Los Piños, in part the divide between the Rio de los Piños and the Rio Piedra. The only rocks involved are the carboniferous and (probably) the Silurian. On each side of the range, which is not more than five or six miles wide, the cretaceous rocks are seen forming mesas and dipping only two or three degrees.

The next axis, the La Plata (Newberry) forms in part the divide between the Rio de la Plata and Rio de los Animas. The course of the uplift is almost northwest, and the dip is very gentle where the strata have not been locally disturbed by lava dykes. The only rocks involved are the palæozoic, against which the triassic and the cretaceous abut at a slight angle.

The San Miguel axis is still farther westward, and, like the La Plata, involves only palæozoic rocks, those of mesozoic times forming mesas around it. Beyond, to the westward, extends a cretaceous plateau separating the Rocky Mountains from the Great Basin.

From his admittedly partial explorations, Dr. Stevenson finds it sufficiently evident that the Rocky Mountains are not the result of a single grand upheaval, and that the several axes are not wholly synchronous in origin. The general diminution of disturbance westward, as shown by the diminishing steepness of dip, together with the general trend of the several axes, shows that the disturbing force was propagated from the east or east of northeast.

The relations of the strata of the several periods make it easy to determine the era and the comparative energy of the successive upheavals. The first was at the close of the carboniferous period. The Silurian and the carboniferous are everywhere conformable, showing that, during the time of their deposition, there must have been either comparative quiet or continued subsidence. The line of continuous action thereafter seems to have been that now occupied by the eastern range. In this region there was a subsidence during the trias, which but slightly, if at all, affected the interior

The second epoch of elevation began toward the close of the triassic, and was marked by an exceedingly energetic action along the eastern line, accompanied by a grand eruption of igneous rocks. The conformability of the trias and the cretaceous in the San Juan area shows that the energy of the convulsions diminished westward and southwestward from the main line of disturbance. After the second upheaval there was an extensive subsidence, the record of which appears in the prevalence of cretaceous deposits over the whole Rocky Mountain area.

The third epoch of elevation followed hard upon the cretaceous period. The action is generally violent, in some parts terrific, resulting in a perfect maze of cross faulting. Everywhere north and east of the Rio Grande, the volcanic disturbance was excessive, a vast area being buried under a sheet of lava from two thousand to three thousand feet thick; and enormous dykes, stretching from the Sangre de Christo southeastward far out into the plain, remain to attest the widespread effects of the disturbance.

During the tertiary age, another but much slighter elevation took place, giving the rocks of that age a dip of five degrees. Of the four upheavals, the first and third were much the most general in their effects. The first was synchronous with that during which the Appalachian chain was completed.

INCENDIARY LOCOMOTIVES.

Conflagrations produced by sparks and fire from locomotives are by no means of unusual occurrence. It only necessary to observe after nightfall the fiery shower, with which every engine not supplied with proper spark arresting devices liberally besprinkles the track and its immediate vicinity, to discover why wooden buildings, oil in tanks, and hay ricks are constantly being destroyed, and in autumn to feel some wonderment that the adjacent fields of ripe grain or sun-dried prairie grass are not more frequently kindled. It cannot be doubted that many a fire is ignited in cities, as well as in country villages through which an express train rushes at fifty miles per hour, the unknown cause of which is the locomotive, scores of miles away before the fire breaks forth.

We are exceptionally patient people, however, and individually at least prefer suffering the loss of a burnt barn than to become involved in legal proceedings *versus* a huge and wealthy corporation. But on the other hand, immunity on the part of the railroads in this respect begets carelessness likewise on their part, notably in the provision of the devices, easily obtainable, which will prevent their locomotives being perambulating incendiaries. The consequence is an increase of the evil; so that not only has a loser a private end to gain in seeking prompt redress from the railroad company, but he has a public duty to perform in enforcing his right. The railroad, it should be remembered, enjoys its privileges by the sufferance of the people, and it is conditioned not only to serve the public in certain ways but to exercise diligence not to work injury to the public. It is therefore responsible for its negligence; and generally it is incumbent on the railroad to show conclusively that the person injured actively contributed by his individual neglect to effect the result, if it would save itself from being cast in damages. The tendency on the part of courts and juries is to hold all corporations with great strictness to their duties; and in this rigid enforcement of the law is found the safeguard of the people against the abnormal exactions which great controlling monopolies would otherwise too often be in position to demand.

The manner in which the law regards fires produced by locomotives is cogently stated in a decision recently reached by our highest tribunal, the Supreme Court of the United States. The case was that of R. M. Richardson *vs.* the Grand Trunk Railway Company of Canada. Certain buildings for freight purposes and for his individual benefit had, by Richardson, been erected, with the company's permission, on land owned by the railroad. These were destroyed by fire from a locomotive, and the action was brought to recover. In its opinion, the court said that the issue to be determined was whether the defendants had been guilty of negligence—that is, whether they had failed to exercise that caution and diligence which the circumstances demanded, and which prudent men ordinarily exercise. Hence the standard by which their conduct was to be measured was not the conduct of other railroad companies in the vicinity, certainly not their usual conduct. Besides, the degree of care which the law requires, in order to guard against injury to others, varies greatly according to the circumstances of the case. When the fire which caused the destruction to the plaintiffs' buildings occurred, it was a dry time, and there was a high wind. At such a time greater vigilance was demanded than might ordinarily be required. The usual practice of other companies in that section of the country sheds no light upon the duty of the defendants when running locomotives over long wooden bridges in near proximity to frame buildings, where danger is more than commonly imminent. Evidence was held admissible as tending to prove the possibility and a consequent probability that some locomotive caused the fire, and as tending to show a negligent habit of the officers and agents of the railroad company. It was further held that it made no difference that a large part of the property destroyed was wrongfully on the railway, the court sustaining the ruling in a case cited that the company in such a case was bound to exercise ordinary care to avoid injury, even to a trespasser.

The Arrival of Professor Huxley.

Professor Huxley, the celebrated English scientist, has arrived in this country. He is at present traveling privately, and will devote the greater part of his brief visit to the Centennial Exposition. It was not his intention to deliver any lectures here, but he has lately reconsidered his determination, and has consented to give three discourses during the latter part of September, in this city. The topics are not yet announced, but this is immaterial, as there is sufficient curiosity to see an investigator, whose name and works are as familiar to us as to his own countrymen, to fill the largest hall New York possesses. Meanwhile, until our people shall have the promised opportunity of collectively greeting the eminent gentleman, we take the liveliest pleasure in extending to him, on the part of the scientific workers, the inventors, and the mechanics of this country, a most cordial and hearty welcome.

Preventive of Hydrophobia.

In a letter published in a recent number of Professor Gubler's *Journal de Thérapeutique*, another addition is made to the already formidable list of prophylactics against hydrophobia. Dr. Grzymala, of Krivoe Ozeroe, Podolie, reports that during the last ten years he has treated at least 100 cases—in human subjects as well as beasts—of bites by hydrophobic animals with the powdered leaves of *xanthium spinosum*, with success in every case except one, although cases of bites inflicted at the same time, but treated in other ways, had terminated in death. The drug is described as possessing sudorific, sialagogue, and slightly diuretic properties, but less pronounced than those of jaborandi. The dose for an adult is 9 grains of dry powder of the leaves, repeated three times a day and continued during three weeks; to children under 12 years, half the quantity is given.

TO BLEACH SPONGE.—Soak it well in dilute muriatic acid for twelve hours. Wash well with water, to remove the lime, then immerse it in a solution of hyposulphate of soda, to which dilute muriatic acid has been added a moment before. After it is bleached sufficiently remove it, wash again, and dry it. It may thus be bleached almost snow white.