Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, APRIL 14, 1883.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 380,

For the Week ending April 14, 1883.

Price 10 cents. For sale by all newsdealers.

PETER COOPER.

In the death of Peter Cooper New York loses a most valued citizen, whose noble life endeared him to every inhabitant almost as a personal friend. He was to this city what Benjamin Franklin was to Philadelphia; and there were various points of similarity in the general characteristics of these illustrious men.

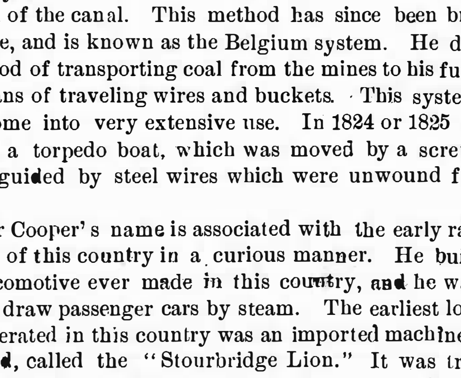
Peter Cooper was born on the 12th of February, 1791, in the city of New York, and died on the 4th of April, 1883, at his residence, No. 9 Lexington Avenue, in the 93d year of his age. He was a man of exemplary habits of life, to which is due, doubtless, the prolongation of his years. At the age of seventeen he was apprenticed to the business of coach making, for which, it is said, he received $25 a year. After that he worked for $1.50 a day at the business of making machines for shearing cloth. Having saved money enough to buy a right in the patent to manufacture these machines, he went into business on his own account, and was patronized by Mr. Vassar, the founder of Vassar College. From him Mr. Cooper received at one time $500 for machines that he had made, and this may be said to be the principal capital, financially, on which his subsequent operations were based. From an early age he developed a great taste for mechanics, and was constantly inventing something new. When a lad he made a machine to utilize the power of the rising and falling tides. In early life he was led into the purchase of a glue factory in this city, which he carried on with such success that in due time Cooper's name for supplying the best article of glue to be had in the market became quite widely known, and the business grew into one of great importance.

Another portion of his attention was directed to the manufacture of iron. He built a rolling mill and iron furnaces in Baltimore, and from these sprang several very large iron rolling establishments in different parts of the country. He was among the first to roll iron girders for fireproof buildings.

Many years ago he devised a method for propelling canal-boats by a series of endless chains laid in the water on the bottom of the canal. This method has since been brought into use, and is known as the Belgium system. He devised a method of transporting coal from the mines to his furnaces by means of traveling wires and buckets. This system has also come into very extensive use. In 1824 or 1825 he designed a torpedo boat, which was moved by a screw propeller guided by steel wires which were unwound from a reel.

Peter Cooper's name is associated with the early railway history of this country in a curious manner. He built the first locomotive ever made in this country, and he was the first to draw passenger cars by steam. The earliest locomotive operated in this country was an imported machine from England, called the "Stourbridge Lion." It was tried at Honesdale, Pa., on the road of the Delaware and Hudson Canal Co., August 8, 1829, Horatio Allen being the engineer who worked the locomotive. The English engines, owing to long wheel base, were not well adapted to turn short curves, such as had been built on the Baltimore and Ohio road—then a horse railroad.

Peter Cooper at this period owned some land in Baltimore, the enhanced value of which depended on the successful operation of the Baltimore and Ohio road; and, to demonstrate that a locomotive could be built which would run on the short curves of that road, Mr. Cooper, in 1829, built the "Tom Thumb," shown in our cut. This engine had an upright boiler 20 inches diameter by 5 feet high fitted with gun barrels for flues. It had a single cylinder $3\frac{1}{4} \times 14\frac{1}{4}$ inches. The engine drove a large gear which meshed into another smaller gear on the axle. The fire was urged by a fan driven by a belt. The driving wheels were $2\frac{1}{2}$ feet in diameter. On the 28th of August, 1830, the first railroad car in America propelled by a locomotive was tested on the Baltimore and Ohio road. The wheels



PETER COOPER'S LOCOMOTIVE, 1829.

were "coned," and this was the first use of this principle as applied to car wheels, and was suggested by Mr. Knight, chief engineer of the road.

This engine (Cooper's) was coupled to a car in front of it containing a load of $4\frac{1}{2}$ tons, including 24 passengers. The trip of 13 miles was made in 1 hour and 15 minutes, the best time for a single mile being $3\frac{1}{4}$ minutes. The return trip of 13 miles was made in 57 minutes. While this engine of Mr. Cooper's was built for experiment solely, it was the first locomotive built in America.

Mr. Cooper's name is also prominently associated with the telegraphic history of this country. He had the foresight to discern the extraordinary importance of the electric telegraph to business and to all the concerns of life when but few could see it. He boldly advanced large sums in the establishment of telegraphic lines in the infancy of the business, when it was very difficult to find capitalists with sufficient confidence to take the risk. He was President of the North American Telegraph Company when it controlled more than half the lines in the country; as President of the New York, Newfoundland, and London Telegraph Company, he was associated with Marshal O. Roberts, Moses Taylor, Wilson G. Hunt, Cyrus W. Field, and others. They steadily paid out money for fourteen years, without return, in the confident hope of ultimately perfecting telegraphic communication between Europe and the United States. Peter Cooper was strong and ardent in his support of the enterprise, which was finally crowned with brilliant success.

One of the most prominent of the various benevolent enterprises with which Peter Cooper's name is associated is the institution known as the Cooper Union for the Advancement of Science and Art. The building occupies the whole of the small square at the junction of Fourth Avenue, Eighth Street, and Third Avenue. Mr. Cooper's avowed object in making this munificent gift was to supply to the industrious poor of New York what he had felt the need of himself—the opportunity for instruction in the industrial arts free of cost. He had attended school only half of each day in a single year, and he knew all the disadvantages under which the children of the poor are placed when they are kept out of school to assist in the support of the family by their labor. His plan, therefore, was to have an institution where most of the teaching should be done at night. He began the work when he was over sixty-four years old, and he lived to see many thousands of people filled with gratitude for his philanthropic efforts in their behalf. These efforts cost him about a million and a half of dollars. He was not unfamiliar with the educational needs of the city. He early became a trustee of the Public School Society, and was its Vice-President when it was merged in the Board of Education. He was subsequently a School Commissioner, and saw how often the promising children of the poor were launched into active life without the preparation which would enable them to use their powers to advantage.

The cost of the building was $630,000. The total cost of building and education has been about $2,000,000. The work accomplished by this institution is comprehensive. It comprises regular courses of instruction at night, free to all who choose to attend, on social and political science, on the application of science to the useful occupations of life, and on such other branches of knowledge as will tend to improve and elevate the working classes. It includes, also, a school of design for females, which is now attended by over 300 pupils, a free reading room and library, galleries of art, collections of models of inventions, and a polytechnic school. The evening schools are attended by thousands of young men, who are mostly mechanics. They study engineering, mining, metallurgy, analytic and synthetic chemistry, architecture, drawing, and practical building. The institution includes a school of art for women, a school of wood engraving, and a school of photography, all of which are free. There are thirty instructors employed. During the past year 3,334 pupils passed through the different classes, many of whom came to New York from distant parts of the United States for the purpose of attending the institution. The expenses of keeping up all the departments last year were $50,973.

MOSQUITOES VS. MALARIA.

In a paper read before the Philosophical Society of Washington, Feb. 10, 1883, Dr. A. F. A. King endeavored to sustain the thesis that malarial disease is produced by the bites of insects inoculating the body with malarial poison, the mosquito being considered in this country the most active agent.

Whatever value may be ascribed to mosquito bites as a cause of disease (and there are several very strong and, to our mind, fatal objections to the theory, and especially the fact that malaria prevails at seasons when no mosquitoes occur), it is interesting to observe how the properties and phenomena usually ascribed to malarial vapors become susceptible of explanation on the above insect theory, and how easily coincidences are made out. In the course of his remarks he presented the following series of twenty statements culled from leading medical authorities, in relation to malaria, and which, he maintained, are explicable on the mosquito theory.

1st. Malaria affects by preference low and moist localities. Such localities are the natural abode of mosquitoes.

2d. Malaria is seldom developed at a lower temperature than 60° F.; neither are mosquitoes.

3d. The active agency of malaria is checked by a temperature of 32° F. The same may be said of the mosquito.

4th. Malaria is most abundant and most virulent as we approach the equator and the seacoast. So, under specified conditions, are mosquitoes.

5th. Malaria has an affinity for dense foliage, which has the power of accumulating it, when lying in the course of winds blowing from malarious localities. Trees accumulate mosquitoes in the same manner.

6th. Forests and even woods have the power of obstructing malaria and of preventing its transmission under these circumstances. So of mosquitoes.

7th. By atmospheric currents, malaria may be transported to considerable distances, probably as far as five miles. Mosquitoes also.

8th. Malaria may be developed in previously healthy places by turning up the soil, as in making excavations for the foundations of houses, tracks for railroads and beds for canals. Such excavations when containing stagnant water may also serve as mosquito nurseries.

9th. In certain localities malaria seems to be attracted and absorbed by bodies of water lying in the course of such winds as waft it from miasmatic source. Such bodies of water may also arrest the passage of the mosquito, under certain circumstances, as in the absence of a strong wind to waft them over.

10th. Experience alone enables us to determine the presence or absence of malaria in any given locality. Conversely, the absence of the mosquito, it was claimed by Dr. King, appeared to prevent malarial disease.

11th. In proportion as countries previously malarious are cleared up and thickly settled, periodical fevers disappear. The consequent better drainage, disappearance of underbrush, and the more free play of fly catching birds may also contribute to lessen mosquitoes.

12th. Malaria usually keeps near the surface of the earth; it is said to "hug the ground." The same is true of mosquitoes.

13th. Malaria is most dangerous when the sun is down, and seems to be almost inert during the day. The mosquito is active at night; at rest by day.

14th. The danger of exposure to malaria after sunset is greatly increased by the person exposed sleeping in the night air. Persons while awake brush away mosquitoes; those asleep submit to being bitten.

15th. Of all human races the white is most sensitive to marsh fevers, and the black least so. The black man is less easily seen by the mosquito, and the odor and greasiness of his cutaneous secretions are assumed to be offensive to the insects.

16th. In malarial districts the use of fire, both indoors and to those who sleep out, affords a comparative security against malarial disease. Mosquitoes, attracted by the light, fly into fires and lamps at the cost of life.

17th. The air of cities in some way renders the malarial poison innocuous, for though a malarial disease may be raging outside, it does not penetrate far into the interior. Mosquitoes also, during their nocturnal flight, will be arrested by the houses, fences, lamps, and fires of the suburbs, so as to be prevented from penetrating far into the interior of cities.

18th. Malarial diseases are most prevalent toward the latter part of the summer, and in the autumn. Mosquitoes are more plentiful during those seasons.

19th. Malaria is arrested not only by trees, but by walls, fences, hills, rows of houses, canvas curtains, gauze veils, mosquito nets, etc. So are mosquitoes.

20th. Malaria spares no age, but it affects infants much less frequently than adults. Infants, however, from the care with which they are housed and covered with gauze to keep off house flies, and also shielded from mosquito bites. C. V. R.

THE EXTERMINATION OF VENOMOUS SERPENTS.

The appalling destruction of life by snake bite in India has for many years caused the minds of learned and ingenious men to be exercised in quest of some remedy which shall effectually cope with so terrible an evil. That their efforts have hitherto been directed rather toward discovering an antidote for the venom than to what is proverbially better than cure, viz., prevention, or, in other words, the extermination of the reptiles themselves, is not to be wondered at when collateral circumstances are taken into account—the exuberance of vegetation and smaller forms of animal life which afford the creatures shelter and sustenance, even in the immediate vicinity of human habitations; the intense susceptibility of the natives, both to the accident of the bite and its fatality, from various causes; their religious prejudices, which, at the outset, greatly hamper the success of Government rewards for the slaughter of certain species, as proposed by Sir Joseph Fayrer; and the fact that the multiplicity of venoms as well as species has only recently been recognized. The dense population, tolerance if not encouragement of the cobra, the habit of walking barefoot and consequent liability to be bitten on the ankle (the most dangerous situation in the body, owing to the large size and superficial position of the veins in that region), the low *physique* and apathy of the Hindoo, which cause him to lie down and die or trust to "charms" instead of resorting to prompt and vigorous measures—all these and many other conditions contribute their influence in keeping up the enormous death rate in India. As to the serpents themselves, many western species, especially among the *Crotalidæ*, are to the full as deadly as the krait, cobra, or daboia.

In a recent number of the SCIENTIFIC AMERICAN, it was suggested that the snakes might be lured to their own destruction by means of traps or the bait of poisoned food; or that some snare might be devised wherein they could be captured alive and so handed over to the authorities for killing by those castes whose tenets do not permit them to practice serpenticide. With regard to the first two proposals, it is to be feared that they offer little prospect of success. When we consider the character of their natural haunts—dense jungle or the crevices of rocks—and the difficulty of setting traps there, their uncertain rovings, and the special reasons which militate against the ordinary mechanical principles of such instruments (as the great distribution of their bodily weight, peculiarity of movement, and possibility of egress as well as ingress through small apertures), it will be seen that a specimen secured in this way would be as great a curiosity as the occasional sea gull which is reported as being caught by an oyster. Mr. Frank Buckland, however, has put on record a story which he heard about a cobra de capello being drawn from underneath the flooring of a bungalow by a fish hook and line, baited with a small frog.

Any scheme involving the administration of poison is even less hopeful, seeing that they can rarely, if ever, be persuaded to take any but living food. In the very doubtful event of some powerful drug thrown into a pond to which they are known to resort proving fatal to them, for every snake so destroyed there would be hundreds of other animals scattered around. Not only would it be next to impossible to get them to swallow poison, but they are extremely tolerant of its action when it is taken. Some time ago the writer wished to kill a captive rattlesnake (*Crotalus horridus*) by this method, and with that intent poured two drachms of Scheele's prussic acid down its throat. Scheele's preparation contains four per cent of the anhydrous gas, and the quantity was sufficient to kill at least twelve men in a few seconds. On the reptile it produced no apparent result whatever; the box, small and compactly made of thick wood with a tightly fitting slide, was closed directly the dose was swallowed, so that the occupant had the full benefit of the intensely sedative fumes. Four drachms more only served to make it a trifle dull and lethargic, and an ounce of chloroform in addition was given before it succumbed. I should mention that this rattlesnake was rather cold and torpid at the time, in which state it would be less receptive of toxæmic influences.

Possibly a pitfall of some sort would be the most likely institution to diminish the number of serpents in its neighborhood appreciably. A friend of mine, living in Brazil, had a large disused cistern near his house. The masonry was cracked, and allowed the water to leak away, but sufficient moisture remained at one end to provide for a colony of frogs and to form a drinking trough for birds and small beasts. Into this tank snakes often found their way, perhaps attracted by the prospect of food, perhaps simply overbalancing themselves at the edge, and were unable to scale the smooth plastered walls and make their escape. One morning between twenty and thirty little new-born jararacas (*Craspedocephalus atrox*)—a most venomous species—were discovered in the prison. The mother must have been a huge specimen, for she had taken advantage of an inequality of surface high up on the side of the cistern to aid her in getting out. Now, a structure of this kind sunk below the level of the ground in an infested district, and furnished with water, frogs, and a cage of rats, or some such small deer—necessarily protected by a cage to preserve them from other than ophidian marauders—might usefully co-operate with the active endeavors of the Government snake hunters, whose establishment is proposed, and who would visit the inclosure daily and add its nocturnal harvest to their spoils. This, again, would meet the views of those sects who are prohibited from killing; but it should be noted that the mild Hindoo is already fully alive to the desirability of reaping the proffered annas without prejudice to his spiritual welfare, and hatches all the snakes' eggs he can find by means of artificial warmth in earthen pots, feeding the young ones until they are big enough to earn the tariff reward.

For every one that may be expected to find its way into a trap, however arranged, a dozen might certainly be taken, living or dead, by those who would make a business of pursuit; and for capturing them alive there is no safer or better appliance than the "twitch." This consists of a simple loop of string passed through an eye at the end of a long crooked stick, and controlled by the hand. Directly a snake is seen it is hooked out into the open, if need be, away from all shelter, the noose dropped over its head and drawn up tight, and in that way it can be carried, powerless to do harm, or deposited in any receptacle which is ready for it. Collectors, too, would find this little apparatus far more practicable than the net or tongs. Places likely to form a resort for the deposition of eggs—situations which combine warmth, moisture, and protection, as a rule—should be diligently explored; and rocks or other fastnesses known to be their favorite breeding grounds should, if possible, be frequently disturbed by blasting. Catlin relates that near Wilkesbarre, in Pennsylvania, there was a cavern in the mountains inaccessible to man known as Rattlesnake Den by reason of the enormous numbers of those reptiles which made it their abode. To such an extent did they swarm in that locality that, although five or six hundred would sometimes be slain in a day by the expeditions organized for the purpose, in which the author took part, the bulk of the Crotaline settlers always managed to reach their lair in safety. On one of these *battue* days a happy thought struck Catlin. He had caught a rattlesnake uninjured, and while one of his companions pressed its head to the ground with a stick, he tied his powder-flask to the creature's tail and attached a slow match thereto. As soon as it was released the serpent immediately sped away to the cavern, dragging the flask behind it. A tremendous explosion presently followed, and death reigned triumphant in Rattlesnake Den.

In all probability, the acclimation or encouragement of certain animals which seek out snakes as their favorite food will do more toward effecting their extermination than anything else. The mongoose enjoys a reputed pre-eminence in this respect which is quite undeserved—it need hardly be said that the "antipathy" which it is supposed to entertain toward its prey is a chimera born of an argument by analogy to human prejudices. The ichneumon hunts snakes to eat them; so do various foxes, tayras, rats, civets, grisons, weasles, genets, paradoxures, and other members of the *Viverridæ* and *Mustelidæ*. Still more addicted to an ophidian diet are pigs; it is said that Mauritius was cleared of venomous species by a number of wild hogs turned loose there. Toads, frogs, fish, lizards, newts, and even slow worms devour young snakes; indeed, it is only their popularity as an article of food that serves to restrain their increase, for they are produced in broods of from twenty to a hundred or more. But their greatest enemies are birds. Peacocks, in particular, will desert the home where they are fed in a district abounding with snakes; not long ago, six pairs of pea fowl were employed to get rid of the vipers on an island off the west coast of Scotland, which they rendered almost uninhabitable by their abundance. Storks, pelicans, cassowaries, sunbitterns, cranes, falcons, and some vultures are also perpetually on the lookout for snakes, while the scientific title of the secretary bird, *Serpentarius reptilivorus*, sufficiently indicates its proclivities.

ARTHUR STRADLING, C.M.Z.S.

Watford, Herts, Eng.

Running as an Exercise.

Among the means which nature has bestowed on animals in general for the preservation and enjoyment of life, running, says Mercurialis, is the most important. Since, then, it is pointed out to us by nature, it must be in a high degree innocent. It is very singular that we should apparently do all we can—which, fortunately, is not much—to make our children unlearn the art of running. Our earliest physical treatment of them seems calculated to destroy their aptitude for it; in a little time, it is too often the case that the city boy scarcely dares look as if he wished to run, we prohibit it so strongly as vulgar, and when he is more grown up gentility steps in and prohibits it altogether. Medical prejudices and our own convenience contribute likewise their share, and never allow our children, boys and girls, to acquire an art innocent of itself and necessary to all. It is possible that a person may get injury from running, but the fault is not in the exercise, but in the person who runs without having had proper training and practice.

Negroes and Indians in a state of nature run daily in pursuit of game for food with a facility at which we are astonished, but they are not more liable to consumption on this account than those beasts that are so famed for swiftness. The body of no animal seems better adapted to running than man's. The nobler parts, which might be injured by an immoderate reflux of blood, are uppermost, and the laws of gravitation assist in propelling the runner forward. He has little to do but to strengthen his limbs by practice and concentrate his mind on the effort, and there is nothing severe in this, as experience has shown. Indeed, running may be made very beneficial to the lungs, and perhaps there is nothing better calculated to strengthen these organs, in those who are shortwinded, than gradual, careful training in this almost lost art. "As soon as children are expert in walking, turning, and the like," says the sagacious Frank, "running races under proper precautions is an excellent exercise for them." The principal objects of this exercise are to strengthen the limbs, develop the lungs, exercise the will, and promote the circulation of the blood.

Running was so highly esteemed by the old Greeks, that Homer observed that no man could acquire greater fame than by being strong in his hands, feet, and limbs; Plato recommends running, not only to boys and girls, but to men; Seneca, who expresses strong disapprobation of athletics, recommends running to Lucilius for exercise. The following rules may be observed:

Running should only be practiced in cool weather; as, for instance, in the late fall, winter, and early spring months.

The clothing should be light, the head bare, and the neck uncovered. As soon as the exercise is finished, warm clothing should be put on and gentle exercise continued for some time. It is not necessary to have a race course. The teacher of a school may take his pupils into the fields and find suitable ground for them. Then his pupils may exercise their bodies in other ways, acquire strength, agility, health, and the capacity of continued exertion; the will is brought into play vigorously, which is a great aid in the battle of life.

Care must be taken not to overdo, and thus, perhaps for life, weaken or injure the heart. The race, at first, should be short and frequently repeated, rather than long, and full speed should not be attempted for some time.

Running is well adapted to young and middle aged persons, but not to those who are fat. Sedentary persons may find great benefit in it after the day's work is ended. If they live in cities, a quiet spot in the park may be selected, and short trials adapted to the strength entered into. Invalids may do the same thing, only they must be more careful than the robust never to over-exert themselves.

Girls may run as well as boys, and, while they cannot go so fast, they can race much more gracefully and beautifully. Indeed, there can be few more attractive sights than that of a race between beautiful girls from ten to twelve years of age. After puberty, the change in the formation of the bones of the pelvis in girls renders running less easy and graceful. In ancient Greece girls were trained to run races as well as boys, and to their superb physical culture was in great part due the grandeur and beauty of Greek life during the years of their ascendency. The modern style of dress for girls after puberty is also entirely unsuited to running.—*Herald of Health.*