

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT NO. 37 PARK ROW, NEW YORK.

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

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included. \$3 20 One copy, six months, postage included. 1 60 Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—THE SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

Subscriptions received and single copies of either paper sold by all the news agents.

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.

New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVII., No. 1. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, JULY 7, 1877.

Contents.

(Illustrated articles are marked with an asterisk.) Acids, tests for free mineral. 3 Angle, trisection of an (23). 11 Answers to correspondents. 9 Astronomical notes. 9 Ball thrown on a curve (30). 11 Bank of England notes. 12 Benzine, acidifying (34). 12 Blue glass, seeds under. 9 Boats in shallow water (22). 11 Business and personal. 5 Butter worker, a new. 5 Cancer, Professor Esmarch on. 5 Canes, finishing (12). 11 Centrifugal force and gravity (31). 11 Cold, artificial (4). 11 Correspondence, Washington. 9 Cotton, the Egyptian prolific. 9 Croup due to miasma. 12 Cupro-ammonium (13). 5 Diseases, zymotic. 7 Dust, iron and glue from. 7 Earthquake waves. 8 Electric light, the. 3 Engine, new hot-air*. 6 Engines for boats (25, 28). 12 Encyclopaedia, value of the. 11 Fillet on an axle (10). 11 Fire at St. John, N. B. 3 Flag, the American (29). 12 Fountains at Aranjuez, the. 7 Gauge, new pressure*. 6 Gull, an Australian*. 6 Hanging elevators. 11 Horse power (24). 11 India rubber supply, the. 3 Inventions patented in England. 10 Iron and steel, manufacture of. 4 Iron, preserving, Barff's method. 4 Joint stock company, novel. 7 Justice, a vindication of. 3 Kaleidoscope (11). 11 Lightning accidents. 6 Locusts, the seventeen year. 9 Logs in a current (2, 3). 11 Magnetism and weather. 8 Nail makers, English. 7 New books and publications. 10 Nitrate deposits in Chili. 5 Pain, the nature of. 5 Patent decisions, recent. 10 Patents, American and foreign. 10 Patents, official list of. 12 Penguins, the*. 7 Petroleum storage, system of*. 4 Porotype. 11 Pounding in radiators (2). 11 Practical mechanics No. 29*. 8 Pressure and heat of steam (18). 11 Propellers, dimensions (32). 12 Pulleys, grooves in (30). 12 Quicksilver, treating ores with (15). 11 Quinia in solution, etc. (25). 12 Refrigerator, a talented (35). 12 Sealing wax (5). 11 Shaving soap solution. 1 Shot bag and charger*. 6 Slight-seeing, a tentative. 2 Steam, large and small (37). 11 Steamboat propulsion*. 11 Tarletan, moths in (16). 11 Tinning zinc. 6 Torpedo defence problem, the. 3 Torpedoes, toy (9). 11 Valve, a balanced (27). 12 Wheels for leather (7). 12 Water, gauges (33). 12 Water pipes, iron (36). 12 Water, suction of (1). 11 Waterproof cloth (14). 11 Wheels going up hill (19). 11 Wheels, large and small (37). 12 Zinc ointment for cuts, etc. (6). 12 Zincographs, printing (17). 11

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT, No. 79, For the Week ending July 7, 1877.

I. ENGINEERING AND MECHANICS.—Thornycroft Torpedo Vessels. By Mr. DONALDSON. A full exposition of the Torpedo-boat System, from the earliest efforts. Dimensions and performances of the several sizes built for the various Governments. Highly interesting trials of these boats, and description of torpedoes employed. 1 illustration.—Improved Spar Torpedo. Figures.—Lighting Street Lamps by Electricity. —Jablochhoff's Electric Candle.—Movable Dams. Notes on the Treatment of Sewage at Manchester, Salford, and Birmingham. By P. LE NEVE FOSTER, M.A. Describing the earth closet system, and the utilization of sewage refuse.—Hydraulic Tools.—Engines of the Steamy London Castle. 3 illustrations.—Cutting Out Keyways. By JOSEPH A. ROSE. An excellent practical description of the several methods employed, describing the qualities of various drills; square files and safe-edges, roughing-out, etc. The best tools illustrated in 11 figures. Central Elevator B. St. Louis, Mo. 5 illustrations. II. TECHNOLOGY AND MANUFACTURES.—The Gates Carpet Powerloom. 3 illustrations.—Treatment of Spent Iron-oxide to obtain Sulphur and Prussian Blue.—Design for an Oxidized Silver Coffee-pot. By H. VILLAIN. Hints to Young Machine-Tenders. By an Old Papermaker. Practical Directions for the tending and care of papermaking machinery. How to clean a Band; how to make good Edges; to keep paper from crushing; to stop crimping, etc. III. CHEMISTRY AND METALLURGY.—Phosphor Bronze and its applications. By ALEX. DICK. A series of valuable experiments showing the superiority of Phosphor Bronze over the ordinary. Oxidation of Silver and Platinum. By WILLIAM P. SEKY. Cleaning Iron amalgam.—Nickelization and cobaltization of Iron and Steel.—On the Action of Sea water on Lead and Copper. By WM. H. WATSON, F.R.S.—Chemistry Notes.—Carbon, Hydrogen, and Oxygen.—Determination of Ammonia by Hypobromite of Sodium. By E. FRANCIS. 2 illustrations.—Chemistry of the Potato.—Proceedings of the Russian Chemical Society.—Proceedings of the Chemical Society, London.—Proceedings Deutsche Chemische Gesellschaft, Berlin. Akademie der Wissenschaften, Vienna. The Alkaline and Boracic Lakes of California. A full and interesting description, embracing the geology, analyses of the mineral springs and lakes, and enumerating the useful chemicals and minerals found. A description of borax gathering.—Fish, crustaceans, and other objects of natural history. IV. ASTRONOMY.—Spectrum Analysis. By Professor REDWOOD. A highly interesting Lecture, delivered before the Pharmaceutical Society of Great Britain, explaining the propagation of light; the properties of ether, and showing the wave lengths of light; the causes of refraction, the theory of color, and how the spectrum is accounted for. Characteristic spectra of the several metals.

Terms:—SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, five dollars. One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, seven dollars. CLUBS.—One extra copy of the SUPPLEMENT will be supplied gratis for every club of five SUPPLEMENT subscribers at \$5.00 each. All the back numbers of the SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price 10 cents each. NOW READY.—THE SCIENTIFIC AMERICAN SUPPLEMENT for 1876. Complete in two large volumes. Over 800 quarto pages; over 2,000 engravings. Embracing History of the Centennial Exhibition. New Illustrated. Instructions in Mechanical Drawing. Many valuable papers, etc. Price five dollars for the two volumes, stitched in paper; or six dollars and fifty cents, handsomely bound in stiff covers. Remit by postal order. Address MUNN & CO. PUBLISHERS, 37 Park Row, New York.

Single copies of any desired number of the SUPPLEMENT sent to any address on receipt of 10 cents.

THE NATURE OF PAIN.

As one of the chief determining factors in the struggle for sentient existence, pain impresses itself upon our attention almost momentarily. The ideal perfect life that men imagine is always one in which pain forms no part: yet curiously, in all the life we know, pain is ever the penalty paid for superiority. The higher the organism in the scale of being, the greater its capacity for pain: this is the universal rule. Mutilation, such as an insect bears without apparent inconvenience, will kill a reptile. A fish or a reptile disregards injuries that would be quickly fatal to a mammal through nervous shock. A savage laughs at wounds that would rack the nervous system of a civilized man with acutest agony. Thus in every instance capacity for pain is the measure of development.

The question: What is pain? consequently assumes the highest speculative interest and importance: while the determination of its physical conditions and causes ranks second to no other scientific problem in practical significance. Nothing else promises so much for the alleviation of human suffering, to say the least: and the discovery of no other secret of Nature appeals more strongly to the feeling of average humanity.

Common experience tells us that pain has its source in the physical system. The gulf between nervous movement and sensation is as unthinkable as the gulf between brain movement and thought: yet no one presumes to say that pain is other than the product of material conditions, however obscure those conditions may be; or that pain can be imagined as existing apart from organization.

In his prize essay on therapeutic means for the relief of pain, Dr. Spender makes the strange assertion that "we look for the cause of pain in dead nerves and dead nerve centers; and if we miss the expected result to-day, we do not doubt that it will be found hereafter with more perfect instruments of scrutiny."

Seeing that pain is ever an adjunct of life, and that death and insensibility always go together, the cause of pain must rather lie in some disturbance in living nerve or nerve center; and such is the view of most of the more recent investigators in this field. Even the learned writer just quoted subsequently abandons, albeit unwittingly, the position he had taken, when he assumes "as a positive truth, that pain connects a molecular disturbance in the nerve which carries the idea of pain to the sensorial center;" for surely a nerve which performs in that way its normal function cannot be justly described as dead.

Long ago, Romberg described pain as the prayer of a nerve for healthy blood. The definition is true as far as it goes, but it stops short of the whole truth. Pain is also the protest of a severed, bruised, or poisoned nerve; and not unfrequently an excess of healthy blood in the part traversed by a nerve will result in pain. Indeed, Dr. Chapman has gone so far as to erect a theory of pain on this basis alone, and a method of treatment also.

On the other hand, Drs. Anstie, Ratcliffe, and others hold that pain is usually, if not always, associated with an opposite condition, with deficiency of blood, and impaired nutrition. Dr. Anstie, in his classic work on neuralgia, shows that those neuralgias are most acutely agonizing which occur under circumstances of impaired nutrition incident to the period of bodily decay; and that there are strong reasons for the belief that there is especial impairment of the nutrition of the central end of the painful nerves. From this point of view, pain involves a depreciation of true function. It is due to a perturbation of nerve force; and the susceptibility to this perturbation is in proportion to the imperfection of the nerve tissue, until the destruction of nerve tissue cuts off communication and ends in insensibility.

The perturbation of nerve force, however, does not always result in pain; it may show itself in the motor or the intellectual department as well. When nerve degenerates, the first result is shown in the sensory department, as pain; in the motor, as spasms; in the intellectual, as delirium; and the final results of nerve destruction are shown respectively in numbness, paralysis, and coma. Thus the pain of nerve, the spasm of muscle, and the delirium of brain are described as correlative phenomena; and a similar parallel is held to exist between the numbness of nerve, the paralysis of muscle, and the coma of brain. And these phenomena are often interchangeable, the members of the two series being subjectively identical, though outwardly very different.

Evolution being attended by an ever-increasing complexity and delicacy of nervous organization, it is inevitable that increasing liability to nervous derangement must mark every upward movement in the scale of being. Will the price of elevation ever rise so high as to put an end to progress in this direction? There would certainly seem to be a possibility of such a result, when we consider the fate of those most admirable persons who are, as we say, too finely strung for this rude world. The acuteness and delicacy of their sensibilities make them at once the highest moral and intellectual types of humanity, and physically the most unfortunate. And they rarely or never leave behind them a vigorous family.

Regarded as an independent evil, pain is one of the deepest of life's mysteries; as a necessary condition of sensibility—the mainspring of intelligence—it is no mystery, but an inevitable reality, and therefore, where not to be prevented, bearable. It is only preventable evils that are intolerable.

Religion has pronounced all pain to be the penitential heritage of a sinful world—a dictum as false as it is foolish: false because pain existed long before sin was possible, and

remains with innumerable forms of life which can have no share in sin; and foolish because it discourages the avoidance or mitigation of pain.

Philosophy has done better in finding pain to be a severe but beneficial schoolmaster. But there are pains which do not teach, as for example the pains of parturition, which are purely physiological; while other unavoidable pains speedily bring the sufferer to a state in which learning is impossible, yet convey no instruction to the looker-on.

Another view of pain finds it the grand preserver of existence, the sleepless sentinel that watches over our safety and makes us guard against both present injury and present pleasure that may bring injury in its train. Pain does have this function sometimes, but too often it does nothing of the sort, and can do nothing, since it comes from conditions over which we have not and cannot have any control.

In short, though it may be all three, pain is not in itself a punishment; it is not a schoolmaster; it is not a sentinel; it is not an unfathomable mystery. It is simply an inseparable condition of sentient existence. It does not always destroy, because in the main, with such types of life as have escaped extinction, capacity for enduring pain has not fallen short of capacity for pain; while the average environment of life has never been absolutely incompatible with some type or types of existence. Some time or other it probably will become so on earth, as it already has on the moon: then life and pain will go out together.

SCIENTIFIC SIGHT-SEEING.

Anybody of good character and over 16 years of age, with \$5,000 and two years' time at his disposal, can now go around the world. Mr. James O. Woodruff, Director, and Mr. Daniel Macauley, Secretary, have organized a "scientific" expedition, which is to depart from New York on October 1st next, and to proceed to South America, Pacific Islands, Australia, Japan, China, India, and Europe, traveling a distance of some 50,000 miles—funds payable in advance before the ship sails. As a special inducement, the prospectus of the project says that the vessel will be navigated by officers of the United States Navy, six in all, whose names are given below. A faculty of scientific instructors has been engaged, also "a competent corps of attentive waiters, who will not be permitted to solicit or accept any fee or gratuity whatever." Naval cadets will be taken at half price, and are to be drilled by the officers aforesaid, and to be treated as if on a naval academy practice cruise; but as there is a probability that a class of scientific maidens will likewise be aboard, a disturbing element will, we fear, be introduced, such as does not obtrude itself among the midshipmen when at sea.

The naval officers referred to are Commander J. W. Philip, Lieutenant Commander A. S. Crowninshield, Lieutenants C. T. Hutchins, W. W. Rhoades, and F. A. Miller, and Surgeon J. H. Kinder. On looking over the numerous testimonials appended to the prospectus, we find the scheme to be commended by the following eminent gentlemen: Governor J. D. Williams, and Secretary of State J. E. Neff, of Ohio; Professors Joseph Henry, J. S. Newberry, Asa Gray, James D. Dana, D. C. Eaton, A. E. Verrill, and George J. Brush: Presidents Porter of Yale, Anderson of Rochester University, Angell of Michigan University, Indiana State Geologist Cox, and Acting President Russell of Cornell University. In view of the fact that the names of the naval officers above noted are prominently referred to, both in order to create confidence in the safe navigation of the vessel, and as constituting a part of the scientific faculty, we recently addressed a letter to the Secretary of the Navy, with a view of verifying the statement of the prospectus that "some of these officers have not yet been detached for the purposes of the expedition, but all have been conditionally engaged and will undoubtedly accompany it." In reply, the Secretary informs us that his department has no knowledge of this expedition, except that gained "through your (our) letter, and at the same time the receipt of a pamphlet giving its details." The assertion, then, that the aforesaid naval officers are going, and the promises and assurances based thereon, appear to be untrue and unfounded. The doubt thus cast over the whole scheme leads us to think that the college professors and other eminent gentlemen above named, who have lent it their indorsement, have been imposed upon.

CROUP DUE TO MIASMA.

Dr. Lewis S. Pilcher has recently made a valuable report to the Kings County (N. Y.) Medical Society on the subject of croup. Dr. Pilcher has studied that disease with much care with reference to local conditions. A map of Brooklyn accompanies the report, on which the dwellings wherein cases of the disease have been met with are suitably indicated. It needs but a glance at the map to perceive just where the malady has been most prevalent, and to enable deduction as to the probable influence of the soil, drainage, etc., on its persistence to be readily made.

Under the term "croup," the author includes "all forms of acute inflammatory affections of the larynx or trachea which may produce narrowing of their caliber to such an extent as to occasion serious prolonged dyspnoea." This embraces three conditions, namely, catarrhal croup, membranous croup, and diphtheritic croup. The first two differ in the secretion, in the former case being liquid, and in the latter its giving rise to a false membrane of varying thickness. Diphtheritic croup differs only from membranous croup in being recognized as a part of a general diphtheritic infection.