request of the mother, she was taught how to apply electricity, and recommended to do so daily, in addition to shampooing. The treatment has been carried out almost daily for sixteen months with a result that is surprising. There is now little difference in the appearance of the two limbs; there is reaction in all the muscles but the anterior tibial muscles, and a large amount of voluntary power has returned.

NEW YORK ACADEMY OF SCIENCES.

The regular monthly meeting of the Academy wa. held at 64 Madison Avenue on March 5, 1877. After some routine business and the election of several new members, Mr. T. O'Conor Sloane, E.M., read an interesting paper on a new and accurate method of

DETERMINING SULPHUR IN ILLUMINATING GAS.

After describing and illustrating the methods usually employed, Mr. Sloane proceeded to exhibit his apparatus, which, he claimed, possessed the following advantages: First, the air which supports the flame is purified to remove any sulphur contained in it, an important precaution when performing an analysis in or near the place where the gas is made; second, no aspirator is required. The burner employed is made by unscrewing and removing the base of the ordinary Bunsen burner, closing all the openings but one, and inserting it in a brass tube 1 inch in diameter. A tapering or funnel-like tube is screwed to the lower end of the latter, thus reducing its diameter to half an inch, so that it can be inserted into the perforated cork of a large bottle. Another tube about 2 inches in diameter and 2 inches long is screwed on the upper end of the latter, and filled with water to form a water joint about the chimney of the burner. A large bent tube of glass leads all the products of combustion into a large tubulated bottle, placed horizontally and containing a solution of permanganate of potash and hydrochloric acid. From the tubulus of this bottle another tube leads into a second bottle containing the same mixture. About 5 cubic feet of gas are burned in a small thin flame. The air which supplies the burner passes through a bottle filled with broken glass and marbles, which are moistened with a solution of permanganate of potash. The sulphur compounds in the gas are burned, forming sulphurous and sulphuric oxides; by contact with the chlorine and permanganate of potash they form sulphate of potash. At the close of the operation the liquid should still have a violet color. The excess of permanganic acid is destroyed by boiling, or by adding alcohol. The sulphuric acid is then precipitated by means of a barium salt, and weighed as sulphate of barium.

The chemical section met at the same place on Monday evening, March 12, 1877, Professor Martin in the chair.

Mr. Amend exhibited a fine specimen of scapolite.

Dr. Bolton then read a paper by Professor Lupton,

ON THE FISHLIKE ODOR OF POTABLE WATERS.

Professor Lupton ascribes the fishlike odor of some of the waters of Nashville, Tenn., to the presence of *algæ* and other low plant forms in the water, since he found that the residue left on filtering the water, and consisting for the most part of *algæ*, developed a strong odor of fish when treated with warm water. During the discussion, which arose after the reading of this paper, Mr. Cox was of the opinion that no proof had been adduced to show that the odor arose from *algæ*. Professor Leeds rei arked that the researches of a French chemist had shown tuat, as the amount of oxygen dissolved in the water decreased, the amount of lower vegetable life increased. Professor Seely thought it would have been well to have ascertained if the odor did not really arise from the presence of putrefying fish in the water.

Dr. P. Townsend Austen then read a paper by Drs. Cech and Schwebel, of Berlin, on

A NEW FORMATION OF ISOBENZONITRILE.

In the course of some introductory remarks, Dr. Austen said that the organic cyanides are particularly useful, since they form the stepping stone from the organic halides to the acids. Thus we are able to pass from marsh gas into acetic acid by a series of typical reactions:

$$CH_4 + Cl_2 = \underset{\text{methyl-chloride.}}{CH_3.\ Cl} + HCl$$

$$CH_3.\ Cl + KCN = \underset{\text{methyl-cyanide.}}{CH_3.\ CN} + KCl$$

$$CH_3.\ CN + 2H_2O = \underset{\text{acetic acid.}}{CH_3.\ COOH} + NH_3$$

These same cyanides or nitriles, as they are also termed, may be derived by dehydration of the ammonium salt of the acid:

$$\begin{array}{ll} CH_3.\ COONH_4 & \text{ammonium acetate.} \\ \underline{\quad\quad\quad O\ \ H_2} & \\ CH_3.\ \ CONH_2 & \text{acetanide.} \\ \underline{\quad\quad\quad O\ \ H_2} & \\ CH_3.\ CN & \text{aceto-nitrile.} \end{array}$$

If we examine the constitution of the lowest member of the nitrile series, the nitrile of formic acid, hydrocyanic acid—

$$\underset{\text{ammonium formiate.}}{H.\ COONH_4} - {}_2H_2O = HCN,$$

we shall see that it contains a tetravalent carbon united with a trivalent nitrogen and a monovalent hydrogen, H – C = N. Knowing, however, that nitrogen often appears in the *rôle* of a pentivalent element, we can suppose the possible existence of a compound isomeric with hydrocyanic acid, and having the formula H – N = C. Although this acid is not known, several of its derivatives are. The first member of this series was discovered by Hofmann, who obtained it by treating aniline with chlorotorm and an alkali. The reaction is $C_6H_5.\ NH_2 + CHCl_3 = C_6H_5.\ NC + 3\ HCl$. This compound is called isobenzonitrile and is isomeric with the benzonitrile derived from benzoic acid:

Benzonitrile........................$C_6H_5.\ CN$.
Isobenzonitrile......................$C_6H_5.\ NC$.

Lately the class of isonitriles has received the generic name of "carbylamines." The isonitriles of the fat series have in many cases been obtained by treating an organic halide with silver cyanide. The silver cyanide seems to consist of a mixture of Ag CN and Ag NC. Finally, small amounts of isoacetonitrile are obtained in the preparation of the real nitrile by treating potassium ethylsulphate with potassium cyanide. The reactions of the nitriles and isonitriles are different and characteristic. On boiling the acetonitrile, for instance, with an alkali, ammonia is evolved and acetic acid is obtained. On subjecting aceto-isonitrile to the same treatment, methylamine and formic acid are formed.

The paper of Drs. Cech and Schwebel was then read. The authors described the production of dichloracetic ethyl ether by the treatment of potassium cyanide with chloral hydrate. The dichloracetic acid was obtained from this ether by treatment with hot concentrated hydrochloric acid under pressure. On boiling aniline dichloracetate with a dilute solution of caustic soda, the odor of isobenzonitrile was detected. The authors found the products of this decomposition of aniline dichloracetate were isobenzonitrile, hydrochloric acid, and formic acid.

Cast Steel Without Flaws.

We find in the report of a recent session of the Society of Mineral Industry, of St. Etienne, France, a very interesting communication from M. Pourcel on the fabrication of cast steel without flaws. M. Pourcel stated that, from the day when the different phases of the Bessemer process were explained *à priori*, the means of casting steel without flaws were discovered. It being known that silicon hinders the formation of carbonic oxide, it remained to determine the extent of the applications of the principle; and these are the analytic methods which, at Terre Noire, have led to the production of flawless cast steel. The following are the facts observed:

In the Martin furnace, on softening a gray silicious pig iron by means of successive additions of malleable iron or steel, it is found, by examining samples of the metal after each addition, that at a certain moment the metal is full of flaws. And further, if there be submitted to analysis a sample abstracted immediately before ebullition, silicon is found in combination with the metal exempt from flaws, while the metal may contain interposed scoriæ, but not free silicon. Such is the analytic result, the effects of which may be reproduced synthetically, thus: If silicon in the form of silicate of iron be added to a bath of steel entirely formed, the flaws are caused completely to disappear. It is true that this steel is generally red short, a condition attributed to the presence of silicon, not only by steel makers but by many eminent chemists. M. Pourcel, however, doubts the conclusion, and believes that silicon, in the proportions in which it is usually found, does not abstract from the steel any valuable qualities, and does not render it brittle, either when hot or when cold. The flaws which exist in cast steel—as Bessemer pointed out and demonstrated several years ago—are due to the carbonic oxide which is generated in the liquid metal by an intermolecular reaction between the carbon of the metal and the oxide of iron formed during the melting. When the metal remains liquid for a long period of time, the gases escape; but generally, the temperature of steel when run off being but little superior to that of its solidification, the carbonic oxide remains imprisoned, and causes flaws or silvery alveolæ disposed symmetrically and perpendicularly to the major axis of the ingot.

Silicon hinders the formation of these flaws, because it is more oxidizable than carbon through intermolecular combustion, the oxidizing body being either peroxide of iron or carbonic acid; but then, in place of the product of oxidation being a gas, it is a solid body which is produced in the mass of the metal, and is found uniformly disseminated among its molecules. It is a silicate of iron, a scoria interposed between the molecules, which renders the metal fragile when hot. The means of removing this scoria is to add a base, which causes it to liquefy; and for this purpose M. Pourcel uses manganese.

Manganese serves in the Bessemer process to remove from the molten metal the peroxide of iron which it holds in solution. It reduces it to its minimum of oxidation by taking one equivalent of its oxygen; and the combination of the oxide of manganese with the silicate of iron which is produced yields a very fluid scoria which liquates.

In lieu of silicide of iron, M. Pourcel has used a double silicide of iron and manganese. The two reducing agents, silicon and manganese, act simultaneously in the mass in fusion to reduce the peroxide of iron, and to prevent the formation of carbonic oxide; and the result of their oxidation is a silicate of protoxide of iron and of protoxide of manganese, very fluid at the temperature of solidification of steel, and which liquates easily. With regard to the silicide in excess, M. Pourcel thinks its effects are not deleterious.

While the process we have described is apparently quite simple in practice, its application is found to be both delicate and complex. Still the difficulties attendant upon it have been in great part resolved, and there is now produced at the Terre Noire founderies cast steel having nearly all the gradations of forged steel, from the hardest to the softest. The perfect homogeneity of these cast steels, a result of their chemical composition and the equilibrium of their molecules (which is produced by a reheating or hardening or varied nature), may, in M. Pourcel's opinion, lead to other results, such as have never been obtained with forged steels.

Transplanting Evergreens.

A correspondent says:

"I am aware that the general opinion and advice are that the time to transplant evergreens, whether trees, shrubs, or vines, is in the spring. I fell in at one time with this idea, and stated that in spring, just as the new growth was forming—just as soon as the buds began to swell—was the time to make a sure thing in the transplanting of an evergreen, no matter what the variety. In a long life of practice in the laying out of gentlemen's places, public grounds, etc., in my way as a landscape gardener, it has come to me that error existed in the aforesaid advice to plant only in the spring. I reason in this way: 1. It is not possible for a large number of those who plant evergreens to have them in the spring just when they should. 2. There is always more hurry of work in the spring than in autumn, and consequently the work of planting is not as thoroughly done as it should be. 3. In the month of September and early October the nurserymen are comparatively at leisure, and can give more and better attention to the digging and shielding the roots from the sun and cold dry winds, before they pack. 4. In the autumn, say from the 1st of September for three months, the evergreen is as near in its dormant state as ever; the ground is warm, and from fall rains is usually moist, without being really wet, as in the spring, and, being warmer than the atmosphere, Nature does what our best gardeners do when they propagate by bottom heat: she furnishes a bottom heat and moisture in sufficiency to cause new roots or rootlets (fibers, if you will) to grow from the wounds made in the work of digging, by which many of the supports of life, to the tree or plant, are lost. This renewal of new roots made in autumn not only aids the tree or plant to support itself during winter, but it goes to work in spring, and supplies food for growth; when the roots of trees planted in spring are struggling to make new fibers in a cold soil with the atmosphere twenty degrees above, and calling through the leaves for food.

"I write not from theory, but based on practical theoretical knowledge, and from practice in removal of thousands of evergreen trees and shrubs in the autumn months. Here let me say, that I prefer from the 10th of September to the 20th of October to do the work; but with due care never to leave the roots half an hour exposed to the sun or dry coid winds. There is no fear of want of success—provided the planter has the ground prepared for planting as it should be, and at the same time knows how to do the work."

A Colossal Organ.

We recently explained M. Montenat's new pyrophone, which consists of tubes of copper in which incandescent pieces of charcoal inclosed in wire gauze are introduced, to create an upward current of air and so to cause the pipes to sound. It is now proposed to construct an instrument on this principle on an enormous scale for the French Exposition of 1878, the tubes being large enough to receive small charcoal furnaces. The inventor points out that his device may be used as a fog signal, as it produces a loud noise and requires scarcely any machinery to operate it.

A New Use for Asbestos.

Some experiments have recently been successfully made in Italy on a new way of burning petroleum under steam boilers. The method consists simply in pouring the oil over a thin layer of asbestos. The petroleum burns with an intense heat; while the asbestos, being incombustible, is not affected, and thus not only serves as a means of retaining the oil, but, being so good a non-conducting substance, the prevention of fire from the volatile oil is obvious. In the experiments, sheets of paper placed beneath the furnace were not injured, despite the fierce incandescence of the oil above.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY AND THE ELECTRIC TELEGRAPH. By George B. Prescott. Illustrated. New York city: D. Appleton & Co.

We have already published in the columns of both SCIENTIFIC AMERICAN and SUPPLEMENT copious extracts from the advance sheets of the above work, from which our readers have doubtless ere this arrived at an idea of the thorough and complete manner with which it deals with some of the branches of the great science to which it relates. Familiar as we are with the progress which has been made in electrical knowledge of late years, we cannot but feel genuine astonishment at the immense advancement evidenced by the volume before us over what was known hardly ten years ago. Here is a book of nearly one thousand pages replete with engravings of devices of marvellous ingenuity, and yet this large volume does not exhaust a subject of which three times ten years ago the world understood scarcely more than a few empirical facts; and even regarding those, few who had studied them agreed. If the 19th century becomes memorable for nothing else, it certainly will be known as the age during which the science of electricity was developed. We have nothing but praise for Mr. Prescott's book. It is the best on its subject not merely in virtue of its being the latest modern work there on, but because it is written by a thorough electrical expert. Mr. Prescott writes whereof he knows, and knows well. He gauges inventions by the rigid rule of practicability and susceptibility to useful ends, and is chary of commendation when he fails clearly to see utility. He is therefore a safe and cautious guide, and the student who follows him will never be landed in doubtful theory or left in perplexity over questionable matters of practice.

A BEAUTIFUL CATALOGUE.—We have received from Messrs. B. K. Bliss & Sons their "Illustrated Gardener's Almanac, and Abridged Catalogue of Garden, Field. and Flower Seeds," for 1877. This is one of the most complete catalogues issued in this country, and valuable both to the practical farmer and florist, as well as to the gentlemen farmers and florists who seek merely to beautify their homes and raise vegetables and flowers for their households. Any one desiring a dollar's worth for 35 cents should remit the last named sum to 34 Barclay street, New York, and obtain a copy free by mail.