c. c., and let ferment for forty-eight hours at a medium temperature. Aluminum hydroxide is then added and the mixture made up to 250 c. c.; 200 c. c. of the clear filtrate are concentrated to 50 c. c. and polarized in a 200 mm. tube. A deflection of more than 1° (Wild) proves that starch sugar has been added. 25 c. c. of the liquid used for polarizing are then mixed with 25 c. c. water and 5 c. c. strong hydrochloric acid and heated for an hour in a boiling water bath, neutralized, made up to 100 c. c., and any sugar formed is determined by Allihn's method in one-quarter of the liquid. The sugar thus found, multiplied by 40, gives the quantity of sugar which comes to the fermentation residue from 100 grms. of honey. If this exceeds one per cent., starch sugar has been added.

A NEW METHOD OF DETERMINING LITHIUM BY MEANS OF FLUORIDES.

THE spectroscopist gives valuable indications for the qualitative detection of lithia, but a comparison of the intensity of the spectral rays gives merely a doubtful approximation as to the proportion of the metal, especially if more than a few milligrammes per liter are present. The reagent used is ammonium fluoride. As the commercial salt is often contaminated with fluosilicate, it is purified as follows: Some grammes of the salt are dissolved in a small volume of water, a double volume of ammonia is added, the whole is boiled for a few seconds, let cool, filtered, and washed with ammonia. The silica is thus eliminated, and we have the fluoride in a strong ammoniacal solution, which is preserved in a covered platinum crucible. If we have in solution a few decigrammes at most of a salt of lithium with quantities of other alkaline salts not more than ten or fifteen times greater, we operate as follows: The solution is reduced to a few c. c. in a tared platinum capsule; ammonium fluoride and an excess of ammonia are added up to a volume of 15 to 20 c. c. The whole is well mixed and let settle, when there is formed a white gelatinous precipitate, scarcely visible, of lithium fluoride, which partly adheres to the bottom of the capsule. The next day it is complete, when we decant almost all the liquid upon a very small filter and pour in its place a few c. c. of ammoniacal water and ammonium fluoride, stir up with a platinum spatula and let settle. Soon afterward we make a second and a third decantation, and wash the filter with a few drops of the same reagent. Thus we remove all the soluble alkaline salts, and we have, partly on the filter and partly in the capsule, all the lithium salt imbued merely with ammonia and ammonium fluoride. The volatile matter is expelled at a very gentle heat, the filter is burnt, the ash treated with a few drops of dilute sulphuric acid, and all the liquid is collected in the tared capsule. It is evaporated and ignited gently until all acid vapors have completely disappeared and the residue is weighed as neutral lithium sulphate. To take account of the solubility of lithium fluoride in the ammoniacal liquid, its total volume is measured, ranging from 30 to 50 c. c. According to former results, and remembering that the washing waters remained in contact with the precipitate for a short time only, we may admit that 10 c. c. of the liquid contains approximately 2 milligrammes lithium fluoride = 4 milligrammes sulphate or 1 milligramme lithia. The quantity thus calculated is added to that weighed directly.—A. Carnot.

ON RHINANTHIN.

By Dr. T. L. PHIPSON, F.C.S.

IN my *Journal of Medicine*, etc. (No. 100, p. 66), I noted that I had discovered a glucoside similar to digitalin in the leaves of the *Antirrhinum majus*, which flourishes abundantly in the sandy soils of Surrey. Further investigation of this substance has shown me that it is *rhinanthin*, a glucoside extracted twenty years ago by an Austrian chemist, H. Ludwig, from the seeds of *Rhinanthus hirsutus* and *R. crista-galli* (Rattle).

I find that rhinanthin exists rather plentifully in the leaves and stalks of the *Antirrhinum majus* (snapdragon), and that it shows a reaction by which it can be recognized, even when present in very minute quantity in an aqueous solution. According to my experiments, rhinanthin can be extracted from the plant either by means of methyl alcohol or by cold water. The former process gives the larger yield, but the latter gives a purer product, and is in every respect easier and more economical. The plant, when fresh, is very brittle, and can be easily broken up or cut into small fragments, leaves and stalks, and allowed to remain in water in a closed vessel for a few days. The liquid is then filtered, treated with a small quantity of subacetate of lead (which does not precipitate rhinanthin), filtered again, and the slight excess of lead having been separated from the filtrate, the latter is evaporated carefully (on a water bath) almost to sirupy consistency, and then the vessel is allowed to remain in a warm, dry place for a few days. In these circumstances rhinanthin forms transparent colorless rhombic crystals, which are very brilliant; it can be purified by a second crystallization from water. It has a peculiar sweetish acid taste, and is very soluble in water and in alcohol.

The aqueous solution of rhinanthin, to which a few drops of hydrochloric acid are added, and then heated, gradually turns brown, finally deposits an amorphous dark brown precipitate (*rhinothogen*), and the supernatant solution contains glucose.

This reaction is very sensitive, and precisely similar in appearance to the brown tint developed in solutions of glucose heated with soda (for instance, diabetic urine), only in the present case the color is produced by acid. A perfectly clear, colorless solution of rhinanthin in water, placed in a test tube with a few drops of HCl and heated, turns gradually brown, and in a few moments, just after the solution has reached its boiling point, it is quite dark and opaque. A copious precipitate of rhinanthogen results, in the form of a dark reddish brown amorphous powder, which can be filtered off and washed. The filtrate contains glucose.

This rhinanthin dissolves in hot concentrated sulphuric acid, forming a greenish black solution. It is also attacked easily by nitric acid.

Ludwig has given to rhinanthin the formula $C_{22}H_{32}O_{10}$; my analyses of this substance do not

exactly correspond with his single analysis, but lead to the formula—

Nevertheless, I have not had sufficient of the product at my disposal to pursue this subject further at present.

In treating the decoction by subacetate of lead, it is well to employ as little as possible; the slight excess of lead can be removed either by carbonate of soda, phosphate of soda, or sulphureted hydrogen. I prefer the latter, though it leaves a small quantity of acetic acid free in the liquid to be evaporated; for I have found by direct experiment that dilute acetic acid will not convert the glucoside rhinanthin, as dilute HCl does, even after boiling for a considerable time; and on the water bath the presence of a minute quantity of free acetic acid is not, in this case, prejudicial. It is best not to evaporate to a thick sirup, but to stop as soon as indications of crystallization occur at the edge of the liquid. The capsule is then removed to a warm, dry place, where it remains for several days; the crystals thus formed are very white and brilliant.

The genera *Rhinanthus*, *Antirrhinum*, and *Digitalis* all belong to the same family of plants, and probably rhinanthin will be found to possess toxic properties; perhaps the toxic properties of *Linaria* (another closely allied genus) are due to it. But whatever may be its physiological properties, it is probable that rhinanthin, like digitalin, is very liable to allotropic changes and decomposition or oxidation. I believe that most of the substances extracted from *Digitalis* are really derived from allotropic or isomeric changes and from the decomposition of digitalin, and that these changes occur during the elaborate processes of extraction.—*Chem. News*.

A New Catalogue of Valuable Papers

Contained in SCIENTIFIC AMERICAN SUPPLEMENT during the past ten years, sent free of charge to any address. MUNN & CO., 361 Broadway, New York.

THE SCIENTIFIC AMERICAN Architects and Builders Edition.

\$2.50 a Year. Single Copies, 25 cts.

This is a Special Edition of the SCIENTIFIC AMERICAN, issued monthly—on the first day of the month. Each number contains about forty large quarto pages, equal to about two hundred ordinary book pages, forming, practically, a large and splendid Magazine of Architecture, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Costs, Bills of Estimate, and Sheets of Details.

No other building paper contains so many plans, details, and specifications regularly presented as the SCIENTIFIC AMERICAN. Hundreds of dwellings have already been erected on the various plans we have issued during the past year, and many others are in process of construction.

Architects, Builders, and Owners will find this work valuable in furnishing fresh and useful suggestions. All who contemplate building or improving homes, or erecting structures of any kind, have before them in this work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

Many other subjects, including Sewerage, Piping, Lighting, Warming, Ventilating, Decorating, Laying out of Grounds, etc., are illustrated. An extensive Compendium of Manufacturers' Announcements is also given, in which the most reliable and approved Building Materials, Goods, Machines, Tools, and Appliances are described and illustrated, with addresses of the makers, etc.

The fullness, richness, cheapness, and convenience of this work have won for it the Largest Circulation of any Architectural publication in the world.

MUNN & CO., Publishers;

361 Broadway, New York.

A Catalogue of valuable books on Architecture, Building, Carpentry, Masonry, Heating, Warming, Lighting, Ventilation, and all branches of industry pertaining to the art of Building, is supplied free of charge, sent to any address.

Building Plans and Specifications.

In connection with the publication of the BUILDING EDITION of the SCIENTIFIC AMERICAN, Messrs. Munn & Co. furnish plans and specifications for buildings of every kind, including Churches, Schools, Stores, Dwellings, Carriage Houses, Barns, etc.

In this work they are assisted by able and experienced architects. Full plans, details, and specifications for the various buildings illustrated in this paper can be supplied.

Those who contemplate building, or who wish to alter, improve, extend, or add to existing buildings, whether wings, porches, bay windows, or attic rooms, are invited to communicate with the undersigned. Our work extends to all parts of the country. Estimates, plans, and drawings promptly prepared. Terms moderate. Address

MUNN & CO., 361 BROADWAY, NEW YORK.

THE

Scientific American Supplement.

PUBLISHED WEEKLY.

Terms of Subscription, \$5 a year.

Sent by mail, postage prepaid, to subscribers in any part of the United States or Canada. Six dollars a year, sent, prepaid, to any foreign country.

All the back numbers of THE SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price, 10 cents each.

All the back volumes of THE SUPPLEMENT can likewise be supplied. Two volumes are issued yearly. Price of each volume, \$2.50 stitched in paper, or \$3.50 bound in stiff covers.

COMBINED RATES.—One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, \$7.00.

A liberal discount to booksellers, news agents, and canvassers.

MUNN & CO., Publishers,

361 Broadway, New York, N. Y.

TABLE OF CONTENTS.

	PAGE
I. ARBORICULTURE.—Fruit Growing in the West Indies.—The export of bananas and oranges to this country.—The quantity of the crop.—Illustration.	10632
The Cultivation of Palms.—How to propagate these trees, and care to be bestowed on them while young.	10632
The Forests of the United States.—An eloquent plea for preservation of the forests and suggestions of what measures should be taken by the government.	10632
II. ARCHEOLOGY.—Evidence of the Antiquity of Man in Eastern North America.—A paper of surmises, suggested by the discovery of flint implements.—An American Association paper by Mr. CHARLES C. ABBOTT.	10632
III. ARCHITECTURE.—History of the Dwelling.—M. Garnier's work at the 1878 exposition, and what he proposes for the coming one.—The houses of all epochs.—31 illustrations.	10633
IV. CHEMISTRY.—A New Method of Determining Lithium by Means of Fluorides.—Precipitation and separation of lithium as fluoride.	10646
Cheap Apparatus for Generating Sulphureted Hydrogen.—By J. MARTIN.—1 illustration.	10645
Examination of Honey.—By K. KAYSER.	10645
On Rhinanthin.—By Dr. T. L. PHIPSON, F.C.S.—Notes on the chemical reactions of the glucoside and its analogies.	10646
V. CIVIL ENGINEERING.—The Need of the Southwest.—A Deep Water Port for Texas.—By LEWIS M. HAUPT, C.E.—A graphic and accurate review of this important problem, with a review of the conditions of Aransas Pass.	10638
VI. ELECTRICITY.—Electrical Action Due to an Intervening Medium.—By Prof. G. F. FITZGERALD, M.A., F.R.S.	10644
Telegraphing without Wires.	10645
VII. GEOLOGY.—The Iron Ores of the United States.—By JOHN BURNETT.—A most exhaustive and elaborate paper, treating of all the varieties of ores, their characteristics and modes of occurrence, and economic importance.	10636
VIII. MECHANICAL ENGINEERING.—Improved Gas Motor for Street Railways.—The Connelly motor and its adaptation to street railroads.—4 illustrations.	10638
IX. MISCELLANEOUS.—An Ancient Geographer.—Johann Schoner of Carlsbad and his work in the 16th century.—His account of Magellan's voyage.	10631
Ballooning Mishaps.—The rescue in the North Sea of M. Coulet and party, military aeronauts of Belgium.—4 illustrations.	10631
Note on Linseed Gum as a Substitute for Gum Arabic.	10631
X. NAVAL ENGINEERING.—Types of Marine Signals.—Light-houses, fog horns, sirens, buoys, and other forms of sea signals discussed.—23 illustrations.	10642
XI. PHOTOGRAPHY.—Best Methods of Making Instantaneous Photographs During both Day and Night. Illustrated by Experiments and Projections.—By D. E. P. HOWLAND.—An American Association paper giving a very practical discussion of the time of exposure and of artificial light for night work.	10641
Gadecke's New Sodium Light for the Dark Room.—A substitute for the trying ruby light.—A valuable adjunct in dry plate making and developing.	10640
Progress of Photography.—By W. H. CLARK.—A very concise and interesting review of the present position of the art.—A paper read before the Photographers' Association of America.	10641
XII. TECHNOLOGY.—Non-Crocking Blue on Cotton.—A valuable contribution to the dyer's art.	10641
The Scrubbing, Washing, and Condensing of Coal Gas.—By WILLIAM KEY.—Rotary apparatus for treatment of coal gas, and the results attained by its use.—3 illustrations.	10643

Useful Engineering Books

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published, for free circulation, at the office of this paper. Subjects classified with names of author. Persons desiring a copy have only to ask for it, and it will be mailed to them. Address,

MUNN & CO., 361 Broadway, New York.

PATENTS.

In connection with the Scientific American, Messrs. MUNN & Co. are solicitors of American and Foreign Patents, have had 42 years' experience, and now have the largest establishment in the world. Patents are obtained on the best terms.

A special notice is made in the Scientific American of all inventions patented through this Agency, with the name and residence of the Patentee. By the immense circulation thus given, public attention is directed to the merits of the new patent, and sales or introduction often easily effected.

Any person who has made a new discovery or invention can ascertain, free of charge, whether a patent can probably be obtained, by writing to MUNN & Co.

We also send free our Hand Book about the Patent Laws, Patents, Caveats, Trade Marks, their costs, and how procured. Address

MUNN & CO.,

361 Broadway, New York.

Branch Office, 622 and 624 F St., Washington, D. C.