Bolton (H. C.)

—702—

AN ACCOUNT OF THE PROGRESS

IN

CHEMISTRY

IN

THE YEAR 1886.

BY

H. CARRINGTON BOLTON.

FROM THE SMITHSONIAN REPORT FOR 1886-'87.

WASHINGTON:
SMITHSONIAN INSTITUTION.
1889.

CHEMISTRY IN 1886.

By H. CARRINGTON BOLTON, Ph. D.,
Professor of Chemistry in Trinity College, Hartford.

GENERAL AND PHYSICAL.

Nature and Origin of the Elements.—Mr. William Crookes, F. R. S., president of the chemical section of the British Association for the Advancement of Science, gave an address at the Birmingham meeting in September, in which he undertook with great skill and learning to adapt the doctrine of evolution to the chemical elements. After glancing at the difficulty of defining an element he noticed the revolt of many physicists and chemists against the ordinary acceptation of the term. He next considered the improbability of their eternal self-existence or their origination by chance. He suggested as a remaining alternative their origin by a process of evolution, like that of the heavenly bodies according to Laplace. In this connection he remarks: "This building up or evolution is above all things not fortuitous; the variation and development which we recognize in the universe run along certain fixed lines, which have been preconceived and foreordained. To the careless and hasty eye design and evolution seem antagonistic; the more careful inquirer sees that evolution, steadily proceeding along an ascending scale of excellence, is the strongest argument in favor of a preconceived plan." Mr. Crookes then shows that in the general array of the elements, as known, a striking approximation is seen to that of the organic world, though he admits this apparent analogy must not be strained.

He then reviews indirect evidences of the decomposition of the so-called elements, taking into consideration the light thrown upon this subject by Prout's law and by the researches of Mr. Lockyer in solar spectroscopy. He also reviews the evidence drawn from the distribution and collocation of the elements in the crust of our earth. He gives due consideration to Dr. Carnelly's weighty argument in favor of the compound nature of the so-called elements from their analogy to the compound radicals.*

---

* See Smithsonian Report for 1885, Chemistry.

A study of a special method of illustrating the periodic law, proposed by Prof. Emerson Reynolds, leads Mr. Crookes to a theory of the genesis of the elements.

He supposes in the very beginnings of time, before geological ages, the existence of a primordial matter, which he names *protyle* (πρo and ύλη). He imagines a "primal stage, before even the sun himself had consolidated from the original protyle, when all was in an ultra-gaseous state, at a temperature inconceivably hotter than anything now existing in the visible universe; so high, indeed, that the chemical atoms could not have been formed, being still far above their dissociation points. In the course of time some process akin to cooling, probably internal, reduces the temperature of the cosmic protyle to a point at which the first step in granulation takes place—matter, as we know it, comes into existence, and atoms are formed. As soon as an atom is formed out of protyle it is a store of energy potential and kinetic. To obtain this energy the neighboring protyle must be refrigerated by it, and thereby the subsequent formation of other atoms will be accelerated. But with atomic matter the various forms of energy which require matter to render them evident begin to act; and amongst others that form of energy which has for one of its factors what we now call atomic weight. The easiest formed element, the one most nearly allied to the protyle in simplicity, is first born. Hydrogen (or perhaps *helium*), of all the known elements the one of simplest structure and lowest atomic weight, is the first to come into being. For some time hydrogen would be the only form of matter (as we now know it) in existence, and between hydrogen and the next formed element there would be a considerable gap in time, during the latter part of which the element next in order of simplicity would be slowly approaching its birth point. Pending this period we may suppose that the evolutionary process, which soon was to determine the birth of a new element, would also determine its atomic weight, its affinities, and its chemical position."

Space at our command forbids our following the author further in his sketch of the genesis of the elements. The application of radiant-matter spectra to the theory is a weighty contribution to the ingenious argument so interestingly portrayed, and one which the author alone is qualified to advance. (Nature, XXXIV, 423.)

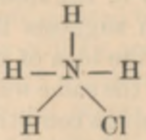
Valency and the Electrical Charge on the Atom, by A. P. Laurie.—The author points out the bearing of the facts of electrolysis on the true nature of valency. Helmholtz has shown that it follows from Faraday's experiments on electrolysis, that while a monovalent atom carries to the electrode one charge of electricity, a divalent atom carries two charges of electricity; in other words, electrolysis proves that differences of valency mean differences in the electrical charge on the atom. The author remarks that many elements vary in valency; copper, for instance, forms two very unlike series of compounds, one in which it is monovalent, and one in which it is divalent; since, however, we may pass from cuprous to cupric compounds we are able to alter the electrical charge on the atom, increasing it by some simple multiple. He remarks further that in the case of the two copper chlorides their heat of formation per chlorine atom is not very different. It is well known that the heat of formation of a salt approximates to the heat of formation as calculated from the electro-motive force developed when that salt is formed in a voltaic cell; hence from the heat of formation of the cuprous or cupric chloride, an approximate calculation can be made of the difference of electric potential between the copper atom and the chlorine atom in the two salts. But since the heat of formation per chlorine atom is nearly the same, the difference of potential is nearly the same in both salts; whence it follows that in doubling the electric charge on the copper atom the potential is not also doubled. This signifies, then, that the capacity of the atom for electricity is increased at the same time. Laurie then suggests that the idea of atomic weight may perhaps be replaced by the idea of charges of electricity; that the atoms of the elements are of the same weight and probably of the same "stuff," and that only two things condition the properties of the atom, namely, its electrical charge and its electrical potential. If this be accepted Mendelejeff's table becomes a statement of the periodic relationship between these. (Nature, XXXV, 131.)

Water of Crystallization, by W. W. J. Nicol.—When a hydrated salt is dissolved does it retain its water of crystallization or does this latter cease to be distinguishable from the solvent water? Both views have been held by chemists, but the author shows that the science of thermochemistry clearly demonstrates that water of crystallization can not be attached to the salt in solution. The argument will be found in the original note. (Chem. News, LIV, 53.)

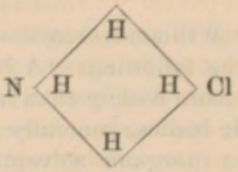
A Law of Solubility, by William Ackroyd.—The author announces as a new law of solubility the following: "A body will dissolve in a solvent to which it is allied more readily than in one to which it is highly dissimilar." Thus organic bodies, generally speaking, require organic solvents, inorganic bodies inorganic solvents. Exceptions to the law are admitted by the author. (Chem. News, LIV, 58.)

Chemical Affinity and Solution.—In a paper before the Royal Society of Edinburgh, presented in 1878, W. Durham stated his opinion, based on the results of many experiments, that chemical combination, solution, and suspension of solids, such as clay, in water, differ in degree only, and are manifestations of the same force; that there seems to be a regular gradation of chemical attraction from that exhibited in the suspension of clay in water up to that exhibited in the attraction of sulphuric acid for water, which we call chemical affinity.

More recently Mr. E. Durham endeavored to show that the theory of valency as usually held is incorrect in assuming chemical affinity to act in units or bonds, and insufficient to account for the various phenomena of varying atomicity, or valency, molecular compounds, crystallization, solution, alloys, etc., and that all these varied phenomena are simply due to the chemical affinity of the elementary atoms; the difficulties disappear if the idea of indivisible units of chemical affinity is abandoned. This view is illustrated by reference to the compounds HCl, NH_3, and NH_4Cl. In HCl we have two monovalent elements combined and their chemical affinities completely neutralized or satisfied. In NH_3 we have N considered as a trivalent element satisfied with three monovalent elements. Now these two completed or satisfied compounds combine with one another to form the third compound NH_4Cl. This is usually explained by regarding the N as acting with pentavalent force, and the compound is represented thus:



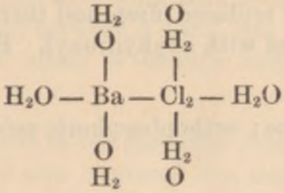
Durham thinks this explanation most unreasonable and incredible, because it supposes that N, which has usually such a weak affinity for Cl, can nevertheless decompose the HCl into its constituent atoms, and fix the atom of Cl to itself. While on the other hand the Cl leaves the H, for which usually its affinity is so great, and unites itself to the N, for which usually its affinity is so small. Durham explains this action simply thus: The affinity of the Cl acts on all the four atoms of H, and the affinity of the N does the same; and thus the whole molecule is held together, and may be represented thus:



Mr. Durham finds that chemists are apparently coming more and more to agree with his views, and quotes Pattison Muir's "Principles of Chemistry" to substantiate this. By reference to Thomsen's researches in thermo-chemistry, he obtains data which he regards as demonstrating the truth of his views on the subject of solution. He regards solution as due to the affinities of the constituent elements of the body dissolved for the constituent elements of the solvent; thus NaCl dissolves in water on account of the affinity of the Na for the O and of the Cl for the H. These affinities are not strong enough to cause double decomposition, and therefore an indefinite compound is formed, which we call a solution. On examining the heat of formation of chlorides and of oxides (as obtained by Thomsen) he finds that that oxide (or chloride) which has the greatest heat of formation is the least soluble. Thus the heat of formation of the chlorides of Mg, Ca, Sr, Ba increases in the order of the metals as given; and the solubility of the chlorides of these metals decreases in the order given; again the heat of formation of the oxides increases in the order Ba, Sr, Ca, Mg, whereas the solubility of these oxides decreases in the same order.

Mr. Durham contends that if his views be admitted, crystallization can be satisfactorily explained, and regular structure follows:

In such a compound as $BaCl_2 . 6H_2O$, the atoms of the molecule must be arranged somewhat in this way:

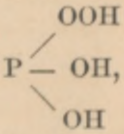
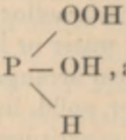
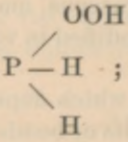
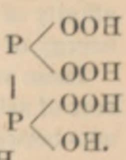


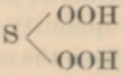
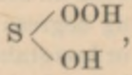
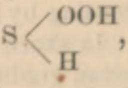
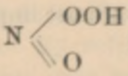
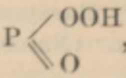
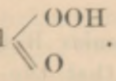
$$\begin{array}{ccccccc} & & H_2 & & O & & \\ & & O & & H_2 & & \\ & & | & & | & & \\ H_2O & - & Ba & - & Cl_2 & - & H_2O \\ & & | & & | & & \\ & & O & & H_2 & & \\ & & H_2 & & O & & \end{array}$$

His theory affords also a simple explanation of the freezing of water: In water attraction exists between the H_2 of one molecule and the O of another, and *vice versa;* now, if the heat of the liquid be diminished sufficiently, that attraction will cause cohesion of the molecules, and will produce solid water or ice, the regular structure of which is caused by the symmetrical arrangement of the atoms. Hence the various conditions of matter, solid, liquid, and gaseous, may be due to the chemical affinity of the constituent atoms, modified in various ways by the kinetic energy of the system.

These views are opposed to that which depicts chemical affinity as a sort of arbitrary force acting in units or bonds; on the contrary, affinity acts between all atoms of matter, whether of the same or different kinds, in varying degrees of intensity and quantity, producing combinations of more or less stability, graduating from the so-called mechanical mixture of clay and water up to the irresolvable molecules of the permanent gas, condensing by its action the gas into the liquid, and the liquid into the solid. In short, there are no hard and fast lines in nature, but every phenomenon graduates by almost imperceptible degrees into another. (Nature, XXXIII, 615.)

A General Method for the Determination of Molecular Weights, by F. M. Raoult.—The author has previously shown that the molecular weights of organic bodies soluble in water can be determined by the amount of reduction in the temperature of its freezing point. Further investigations now enable him to generalize this method and to maintain that the molecular weights of all bodies, inorganic or organic, can be determined in like manner, provided the bodies are soluble in some liquid capable of assuming a solid state at a temperature ascertainable with accuracy. The menstruums employed are acetic acid, benzene, and water. The methods of procedure and of calculation will be found in the original paper. (Ann. Chim. Phys. [6], VIII, 317.)

On the Constitution of Acids, by W. A. Dixon.—The author proposes a theory explaining the fact that some acids form with the alkali metals alkaline hydrogen salts, whilst the similar salts of other acids are acid. He suggests that, as is the case with organic compounds, the hydrogen in inorganic acids exists in combination in two states, first, with oxygen as hydroxyl, and, second, with two oxygen atoms as oxyhydroxyl. He thinks that where both these exist in one acid the hydrogen of the oxyhydroxyl is invariably replaced first, and therefore the principal acid function is in connection with oxyhydroxyl. Examples are taken from the acids of phosphorus; orthophosphoric acid is probably  $\mathrm{P}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{OH}\\ \mathrm{OH}\end{array}\right.$, because the acid itself has strong acid properties; but these are immediately neutralized by the replacement of the hydrogen of the oxyhydroxyl group by sodium, while the replacement of the hydrogen of one hydroxyl group gives a salt having an alkaline reaction. In like manner phosphorous acid may have the composition  $\mathrm{P}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{OH}\\ \mathrm{H}\end{array}\right.$, and is dibasic; hypophosphorous acid is  $\mathrm{P}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{H}\\ \mathrm{H}\end{array}\right.$; and pyrophosphoric acid,  $\begin{array}{l}\mathrm{P}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{OOH}\end{array}\right.\\ \mid\\ \mathrm{P}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{OH}\end{array}\right.\end{array}$.

Sulphuric acid may be  $\mathrm{S}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{OOH}\end{array}\right.$ and sulphurous  $\mathrm{S}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{OH}\end{array}\right.$, the first forming acid and the second alkaline hydrogen salts with the alkaline metals. Hyposulphurous acid may be  $\mathrm{S}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{H}\end{array}\right.$, and is monobasic. Nitric acid may be  $\mathrm{N}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{O}\end{array}\right.$; metaphosphoric,  $\mathrm{P}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{O}\end{array}\right.$, and chloric,  $\mathrm{Cl}\left\langle\begin{array}{l}\mathrm{OOH}\\ \mathrm{O}\end{array}\right.$. (Phil. Mag. [5], XXI, 127.)

The Re-actions between Metals and Acids, by Henry E. Armstrong.—In the course of a paper before the Chemical Society of London on the "action of metals on acids," in which experiments were described attempting to obtain evidence of definite compounds of metals in alloys by dissolving the alloys in a liquid capable of acting on both metals and determining the electromotive force between the alloy and a less positive metal, the author made the following remarks: "With reference to the action of metals on acids generally it is probably impossible for the chemist to pronounce definitely in favor either of the modern view that the metal directly displaces the hydrogen of the acid, or of the older view that the metal displaces the hydrogen from water, the resulting oxide and the acid then interacting to form a salt; the decision of this question must apparently depend upon the determination of the nature of the phenomena during electrolysis of an acid solution. If the acid alone be the electrolyte, then doubtless the modern view is the correct one; but if both water and acid are electrolyzed, and in proportions which vary according to the conditions, then both the old and new views of the nature of the action between a metal and the solution of an acid are correct, and the two kinds of change may go on side by side." (Chem. News, LIII, 212.)

Chemical Behavior of Iron in the Magnetic Field, by Edward L Nichols.—When finely-divided iron is placed in a magnetic field of considerable intensity and exposed to the action of an acid, the chemical reaction differs in several respects from that which occurs under ordinary circumstances. The cause of one such difference may be found in the fact that the solution of iron in the magnetic field is in a sense equivalent to its withdrawal by mechanical means to an infinite distance. Mechanical removal requires the expenditure of work, and the same thing is doubtless true of what might be called its chemical removal. In other words the number of units of heat produced by the chemical reaction should differ, within and without the field, by an amount equivalent to the work necessary to withdraw the iron to a position of zero potential.

Experiments with aqua-regia and iron show that the speed of reaction is greater in the magnetic field than without and that the heat of chemical union is much greater. Under the influence of the magnet, aqua-regia and iron produce nitrous fumes, whereas when the influence of the magnet is removed only hydrogen is generated.

When experimenting with iron and nitric acid, interesting effects of magnetism on the passivity of the iron were observed; five grams of powdered iron lay in a beaker close above the poles of the electro-magnet which was in circuit. Some cold nitric acid was poured upon the iron, but the latter remained passive. Wishing to note the character of the reaction the author warmed the beaker slightly, then placed it upon the poles of the magnet and put a thermometer into the solution to get its temperature. The bulb of the thermometer touched the iron in stirring the acid, when the hitherto passive mixture burst almost explosively into effervescence, and red nitrous fumes were liberated. Removal of the solution from the field of the magnet restored the passivity of the iron, and the action in a few seconds ceased entirely. When the beaker was brought back into the neighborhood of the magnet a touch of a glass rod excited again the violent chemical action. Further researches are in progress. (Am. J. Sci. XXXI, 272.)

Density of Liquid Oxygen and of Liquid Nitrogen, by S. Wroblewski.—The author finds that liquid oxygen has a density of 0.6 at −118° C. and of 1.24 at −200° under a pressure of 0.02^{m}. The following table gives the constants for liquid nitrogen:

Temperature.	Pressure in atmospheres.	Density referred to water at 4° C.	Coefficient of dilatation.
−146.6	38.45	0.4552	....
−153.7	30.65	0.5842	0.0311
−193.0	1.00	0.83	0.007536
−202.0	0.105	0.866	0.004619

Hence the atomic volume of oxygen is less than 14, and that of nitrogen is near 15.5.

The density of liquid air at −146.6° C. and 45 atmospheres is equal to 0.6. (Comptes Rendus, CII, 1010.)

INORGANIC.

Redeterminations of atomic weights.

Element.	Atomic weight.	Authority.	Reference.
Uranium	239.02	Zimmermann	Liebig's Annalen, CCXXXII, 299.
Cobalt	58.74	do	Liebig's Annalen, CCXXXII, 324.
Nickel	58.56	do	Do.
Platinum	194.57	Halberstadt	Z. anal. Ch., XXV (II).
Germanium	72.32	Lecoq de Boisbaudran	Comptes Rendus, CII, 1291.
Antimony	120.69	Popper	Ann. Chem., CCXXXIII.
Tungsten (0=15.96)	184.04	Waddell	Am. Chem. J., VIII, 280.

Austrium, a new Element.—Dr. E. Linnemann, professor of chemistry at Prague, died in April, 1886. Among his papers was found a letter addressed to the Vienna Academy of Sciences, announcing the discovery of a new element, which he called austrium, Aus. Dr. Linnemann obtained the new metal from orthite of Arendal; its spectrum shows two violet lines; the wave lengths were found to be, for Aus. α, $\lambda = 416.5$, and for Aus. β, $\lambda = 403.0$. Prof. F. Lippich, of Prague, who presented Dr. Linnemann's paper to the Vienna Academy, called attention to the fact that three not yet identified lines ($\lambda = 415.56$, $\lambda = 416.08$, and $\lambda = 416.47$) are shown in Ängström's atlas of the normal spectrum of the sun in the neighborhood of the Aus. α line; the last of them might be supposed to be coincident with the Aus. α line ($\lambda=416.5$). (Nature, XXXIV, 59, 1886.)

Germanium, a new Element, by Clemens Winkler.—In the summer of 1885 a rich silver ore of uncommon appearance was found in the Himmelfuerst mine near Freiberg. It was recognized as a new mineral species by Prof. A. Weisbach, and named by him "argyrodite." Th. Richter subjected the mineral to a preliminary examination with the blow-pipe, and found it to consist essentially of silver and sulphur. In addition to these, he also detected the presence of a small quantity of mercury, which is remarkable and interesting from the fact that this metal had never before been found in the Freiberg ores.

In the analyses made, Winkler found that the mercury did not amount to more than 0.21 per cent. According to the purity of the material the silver varied from 73 to 75 per cent., and the sulphur from 17 to 18 per cent. Small quantities of iron and traces of arsenic were also found. Though the analysis was often and carefully repeated there was always a loss of 6 to 7 per cent. without it being possible by the ordinary methods of qualitative analysis to discover the missing body.

After several weeks of tedious search Winkler found that argyrodite contains a new element, very similar to antimony, but still very distinct from the same, which he named Germanium. The detection of this element was very difficult, because the argyrodite was accompanied by minerals containing arsenic and antimony, which, on account of their similar behavior, and a total lack of a sharp method for separation, caused much difficulty.

Argyrodite, when heated with exclusion of air, preferably in a current of hydrogen, gives a black, crystalline, quite volatile, readily fusible sublimate, which melts to reddish-brown drops. In addition to mercury sulphite it consists essentially of germanium sulphide. Germanium sulphide is a sulpho-acid; it is readily soluble in ammonium sulphide, and when reprecipitated by hydrochloric acid, in a perfectly pure plate, it forms a snow-white precipitate, which is instantly soluble in ammonium hydrate. In the presence of antimony or arsenic the precipitate is always tinged more or less yellow.

On heating in a current of air or in nitric acid, germanium sulphide is converted into a white oxide, which is not volatile at a red heat. It is soluble in potassium hydrate, and the alkaline solution, when acidified with sulphuretted hydrogen, gives the characteristic white precipitate. Too great dilution prevents or retards the precipitation.

The oxide, like the sulphide, is reduced by hydrogen, the latter with greater difficulty on account of its volatility. The element has a gray color, and perfect metallic luster. It melts at a point somewhat below silver, say about 900°, and crystallizes in octahedra, which are very brittle. Its specific gravity is 5,469 at 20°.4. It is insoluble in hydrochloric acid, readily dissolved by aqua-regia, is converted into a white oxide by nitric acid and into a soluble sulphate by concentrated sulphuric acid. Its atomic weight is 72.32, and it proves to be Mendelejeff's *ekasilicium.* It forms two oxides, GeO and GeO_2, two corresponding sulphides, and two chlorides, both of which are thin colorless fuming liquids. (J. Prakt. Chem., 1886, *passim.*)

Atomic Weight of Antimony.—Alfred Popper, of the University of Graz, has made very careful determinations of the atomic weight of antimony, and obtains a mean of 120.69, which is an entire unit more than J. P. Cooke's result, 119.60. He can find no source of error either in Cooke's determinations or in his own, and suggests that the possible presence of germanium may solve the question. (Ann. Chem., CCXXXIII.)

On some Probable New Elements, by Alexander Pringle.—The author states that he obtained the material on which he worked from his own landed property, situated upon the river Tweed, county of Selkirk, Scotland. He examined some gravel and other material forming the débris of an ancient glacier, which he "imagines" to be the ancient soil of the very ancient mountains in that geologic formation. He describes more or less fully no less than six probable new elements; *polymnestum* is a metal of rather dark color, with an equivalent of about 74, and forming four oxides of various colors; *erebodium* is as black as charcoal and has an equivalent of 95.4; *gadenium* has an equivalent of 43.6 and forms two oxides; *hesperisium* is a non-metallic element having an equivalent of 45.2, and a red color and a metallic luster like a sunset sky. Two other nameless elements are briefly claimed by the author. (Chem. News, LIV, 167.)

Dysprosium, a new Element, by Lecoq de Boisbaudran.—In October, 1878, Delafontaine announced a new earth, which he called philippium, but early in 1880 he recognized that it was identical with holmium, previously studied by Soret and by Cleve. Later in the same year, however, Delafontaine abandoned this view, because he determined that philippium had no absorption spectra. Lecoq de Boisbaudran has succeeded by several hundred fractional treatments in separating holmium into two bodies, for the first of which he proposes to preserve the name holmium, and the second he names dysprosium (*δυσπρόσιτος* = hard to get at). The new holmium has for characteristic absorption bands 640.4 and 536.3, and the bands of dysprosium are 753 and 451.5. The author has encountered extraordinary difficulties in the separation of holmium, erbium, terbium, and dysprosium, and the scarcity of material greatly retards the laborious investigation. (Comptes Rendus, CII, 1003 and 1005.)

New Elements in Gadolinite and Samarskite detected Spectroscopically, by William Crookes.—Finding that Lecoq de Boisbaudran is pursuing the spectroscopic study of the rare earths in the same track as himself, and publishing notes of phenomena already known to Mr. Crookes, the latter gives in this paper a preliminary notice and summary of his studies, although in an unfinished state. Mr. Crookes holds with other chemists the opinion that didymium is not a simple body, but has been unable to split it up into the green praseodymium and rose-red neodymium announced in 1885 by Dr. Auer von Welsbach. Mr. Crookes thinks didymium will prove to be more complex than this indicates.

The author, referring to his note-book under date March 3, 1886, finds the statement that the "big blue line (λ 451.5) is still unclaimed," and this blue line proves to be characteristic of dysprosium discovered by Lecoq de Boisbaudran.

As a result of the spectroscopic examination of the fractionated earths from samarskite and from gadolinite the author concludes that the earth hitherto called yttria is a highly complex body, capable of being dissociated into several simpler substances, each of which gives a phosphorescent spectrum of great simplicity, consisting, for the most part, of only one line. The author admits that a hitherto unrecognized band in the spectrum, by absorption or phosphorescence, is not of itself definite proof of a new element, but if supported by chemical facts, such as he details, there is sufficient prima facie evidence that a new element is present. Until, however, the new earths are separated in sufficient purity to enable their atomic weights to be approximately determined, and their chemical and physical properties observed, Mr. Crookes thinks it prudent to regard them as elements on probation. He gives in tabular form a list of these probationary elements, designating them by the initial letters of the minerals (or bodies) didymium, samarskite, and gadolinite, from which they are respectively derived, and by the addition to the initials of Greek letters. The table also gives the mean wave lengths of absorption lines in the phosphorescent spectra, and other data.

Table of Probationary Elements.

Position of lines in the spectrum.	Scale of spectroscope.	Mean wave length of line or band.	$\frac{1}{\lambda^2}$	Provisional name.	Probability.
Absorption bands in violet and blue	8.270°	443	5096	Dα	New.
	8.828	475	4432	Sβ	Do.
Bright lines in—					
Violet	8.515	456	4809	Sγ	Ytterbium.
Deep blue	8.931	482	4304	Gα	New.
Greenish blue (mean of a close pair).	9.650	545	3367	Gβ	Gadolinium.
Green	9.812	564	3144	Gγ	New.
Citron	9.890	574	3035	Gδ	Do.
Yellow	10.050	597	2806	Gε	Do.
Orange	10.129	609	2693	Sδ	Do.
Red	10.185	619	2611	Gζ	Do.
Deep red	10.338	647	2389	Gη	Do.

Concerning the "radiant-matter test" for these phosphorescing bodies Mr. Crookes says it proves itself every day more and more valuable as one of the most far-searching and trustworthy tools ever placed in the hands of the experimental chemist. It is an exquisitely delicate test, capable of being applied to bodies which have been approximately separated, but not yet completely isolated, by chemical means; its delicacy is unsurpassed even in the region of spectrum analysis; its economy is great inasmuch as the test involves no destruction of the specimen; its convenience is such that any given test is always available for future reference, and the quantity of material is limited solely by the power of the human eye to see the body under examination. Beyond all these in importance is its trustworthiness, and during the five years this test has been in daily use in his laboratory Mr. Crookes has found it well-nigh infallible. Anomalies and apparent contradictions have arisen, but a little more experiment has shown that the anomalies were but finger-posts pointing to fresh paths of discovery, and the contradictions were due to erroneous interpretation of the facts. (Chem. News, LIV, 13.)

On the Atomic Weight of the Oxide of Gadolinium, by A. E. Nordenskjøld.—The author signifies by "oxide of gadolinium" the mixture of oxides of yttrium, erbium, and ytterbium first discovered in the gadolinite of Ytterby. He shows that this mixture of three isomorphous oxides, even when derived from totally different minerals found in localities far apart from one another, possesses a constant atomic weight, viz, about 262. The atomic weights of the three constituents vary greatly—

Oxide of yttrium	227.2
Oxide of erbium	380.
Oxide of ytterbium	392.

taking O=16 and calculating as R_2O_3.

The fact here demonstrated is one altogether new in chemistry and confirms in a remarkable way the views announced by William Crookes in his address to the B. A. A. S. on the genesis of the elements. It would appear that the work of these savants on the rare earths, so called, will result in revolutionizing views of chemists concerning the elements, so called. (Comptes Rendus, CIII, 795.)

Isolation of Fluorine by Electrolysis of Anhydrous Hydrofluoric Acid, by H. Moissan.—The preparation of fluorine in its elementary state is a problem which has long defied the efforts of chemists; the classical experiments of Davy, Gore, G. J. Knox, Pfaundler, Baudrimont, and others did not yield results satisfactory to all, and the alleged discovery of Prat was soon after experimentally refuted by Cillis. At the meeting of the French Academy of Sciences, held June 28, Monsieur H. Moissan described the results obtained by electrolyzing anhydrous hydrofluoric acid, and cautiously stated that fluorine was in all probability isolated; this memoir was followed by another on July 19, and soon after by a third, which finally removed all doubts as to the nature of the gas separated in the experiments.

Moissan prepared anhydrous hydrofluoric acid after the method of Frémy, taking great precautions to eliminate water. This acid was placed in a platinum U-tube, cooled to —50° C. and submitted to the action of an electric current from fifty Bunsen cells. Under these conditions hydrogen was set free at the negative pole, and at the positive pole a gas was obtained in a continuous current and having the following properties: In the presence of mercury it is completely absorbed, with formation of mercury fluoride of a light yellow color; the gas decomposes water, liberating ozone; phosphorus is ignited by it; sulphur is heated, melting rapidly; carbon seems to be without action; melted potassium chloride is attacked with an escape of chlorine; crystalline silicon, purified by treatment with nitric and hydrofluoric acids, takes fire in contact with this gas and burns brilliantly, forming silicon fluoride. The electrode of platin-iridium forming the positive pole is strongly corroded, while that of the negative pole is untouched.

Moissan pointed out that the simplest explanation of these reactions is that they are due to elementary fluorine, but he deferred decision until he could show that the phenomena were not due to hydrogen perfluoride or to a mixture of ozone and hydrofluoric acid.

In the second memoir Moissan details the precautions observed in preparing the anhydrous hydrofluoric acid and gives additional data concerning the behavior of the gas. The anhydrous acid is made by heating to redness in a platinum vessel very carefully dried double fluoride of potassium and hydrogen (HF KF), the liquid being condensed in a receiver cooled with a mixture of ice and salt. The anhydrous acid boils at 19°.5, is very hygroscopic, and fumes abundantly in moist air. For electrolysis the acid was cooled with chloride of methyl to —23°, and a current of twenty Bunsen cells sufficed. Absolutely anhydrous hydrofluoric acid will not conduct electricity, therefore a small quantity of fused double fluoride of potassium and hydrogen is added.

The gas liberated at the positive pole not only attacks silicon in the cold, but adamantine boron as well.

Sulphur takes fire in the gas, as do arsenic and antimony. The metals are attacked with less energy; organic bodies, however, are violently attacked; alcohol, ether, benzene, petroleum, etc., take fire on contact.

When the experiment has lasted several hours and the gases are no longer separated by liquid hydrofluoric acid in the bend of the tube, the gases H and F recombine in the cold with violent detonation.

In the third memoir the author shows that the same gas can be obtained by the electrolysis of carefully dried and fused double fluoride of hydrogen and potassium. The temperature maintained is 110°. He also describes experiments showing conclusively that the gas in question is free fluorine; under certain conditions the gas was absorbed by a weighed amount of iron, and a weight of iron fluoride was obtained sensibly corresponding to the weight of the hydrogen liberated.

The isolation of fluorine by M. Moissan was regarded by the French Academy of Sciences as of such prime importance that the subject was referred to a committee for examination. This committee reported through its chairman, M. Debray (on the 8th of November), that they found Moissan's experiments and statements satisfactory in all respects, and that the isolation of the element was undoubtedly an accomplished fact. (Comptes Rendus, CII, 1543, CIII, 202, 256, and 850.)

A New Gaseous Body, Phosphorus Oxyfluoride, by H. Moissan.—The new compound PF_3O_2 has an experimental density, which oscillates between 3.68 and 3.75. It is instantly absorbed by anhydrous alcohol, by solutions of chromic acid, or by the alkalies. The existence of this compound renders impossible the experiment indicated by Davy, who proposed to isolate fluorine by burning phosphorus fluoride in an atmosphere of oxygen inclosed in a vessel of fluor-spar. Fluorine has the curious property of tending always to form ternary or quaternary addition products. (Comptes Rendus, CII, May 31, 1886.)

The Combustion of Carbonic Oxide and Hydrogen, by Harold B. Dixon.—The author in 1880 published the fact that a mixture of carefully dried carbonic oxide and oxygen would not explode when electric sparks were passed through it, but that by the addition of a minute trace of water or volatile body containing hydrogen the mixture became inflammable. To account for this fact the author has more recently put forward the hypothesis that the steam acts as the part of a carrier of oxygen, and that it undergoes reduction and successive re-formation. Discussion has arisen* as to the mode in which steam exerts its influence, and the author herein gives his reasons for maintaining his hypothesis.

Experiments were made with small quantities of various gases added to the non-inflammable mixture of dry carbon monoxide and oxygen, and the electric spark passed. In all cases where a gas containing hydrogen was introduced the mixture exploded; otherwise, not. Steam, therefore, and bodies which form steam under the conditions of the experiment, are alone able to determine the explosion, and it is evident that steam does not act as a mere third body, but in virtue of its own peculiar chemical properties.

Moritz Traube rejected Mr. Dixon's explanation of the phenomena under consideration, claiming that carbon monoxide does not decompose steam at high temperatures, but the author shows that it has been amply proved by different experiments, notably by Naumann and Pistor (Berichte d. chem. Ges., 1885, 2894) that the re-action mentioned does take place. Mr. Dixon also gives experimental data for refuting Traube's view that hydrogen peroxide acts as the carrier of oxygen.

---

* See Report on Chemistry in Smithsonian Report for 1885, p. 651.

In a note following Mr. Dixon's paper, Professor Armstrong suggests that in a mixture of carbon monoxide and oxygen, the former is oxidized and the latter hydrogenized simultaneously by the steam present, a view which Mr. Dixon remarks is not opposed to any of the observed facts. The explanation offered by Professor Armstrong involves the simultaneous occurrence of two re-actions, which Mr. Dixon regards as taking place successively. (J. Chem. Soc. [London], 1886, 94.)

On the Combustion of Cyanogen, by Harold B. Dixon.—The author has examined the conditions under which a mixture of cyanogen and oxygen gases explodes, and comes to the conclusion that the explosion depends solely upon the nature of the spark itself. The spark from a Holtz machine failed entirely to explode dry mixtures of these gases. The induction spark failed to explode the mixture in the eudiometer, where the wires were 0.25 to 1^{mm} apart; but the explosion was violent in the tubes when the wires were 1 to 3^{mm} apart, and this was the case where the gases were moist. He then compared the explosion rate of this mixture with that of carbon monoxide and oxygen, using for the purpose a tube 10 feet long and recording the time on a pendulum chronograph. The velocities obtained were as follows in meters per second: Cyanogen and oxygen, dried with phosphoric anhydride, 813; dried with KHO, 808; saturated with moisture at 15° C., 752. Carbon monoxide and oxygen dried with phosphoric anhydride, 36; dried with H_2SO_4, 119; saturated with moisture at 10° C., 175; at 35° C., 244; and at 60°, 317. It is notable that in the latter case the rate of explosion increases rapidly by the addition of moisture, while with the cyanogen moisture produces an opposite effect. When a platinum wire is heated to dull redness in the mixture of cyanogen and oxygen, the coil cooled without result when the circuit was opened; but when raised to full redness it glowed brightly for half a minute after the current was broken, and orange fumes appeared in the tube. On opening the tube it was found that about three-fourths of the cyanogen had been converted into carbon dioxide, and one-fourth into carbon monoxide. (J. Chem. Soc., XLIX, 384.)

Preparation of Hydrogen Dioxide, by James Kennedy.—The author points out the difficulty of removing the barium chloride by means of silver sulphate when preparing hydrogen dioxide by Regnault's method, and the uncertainties of Fownes's method, and proposes the following, for which he claims simplicity and economy.

Place any convenient quantity of tribasic phosphoric acid in a shallow porcelain vessel immersed in a freezing mixture (ice and salt), and when the temperature has fallen to 40° F. or below, saturate with peroxide of barium previously made into moderately thick paste with distilled water; when completely saturated filter through pure filter paper.

Certain precautions are to be observed in this process in order to insure success. The use of a shallow vessel to allow a large contact surface with the freezing mixture; the BaO_2 must be added very slowly to prevent too great a rise in temperature, and stirred constantly. The BaO_2 should be added until the mixture shows a slight alkaline reaction to insure the complete precipitation of $BaHPO_4$, as this compound is soluble in acids. The solution is freed from dissolved barium by addition of diluted sulphuric acid, and the insoluble precipitate removed by filtration.

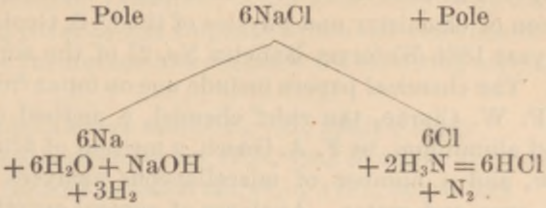
In order to prevent the decomposition of the H_2O_2, the temperature should not be allowed to rise above 40° or 45° F. The reaction in this process is explained in the following equation: $BaO_2 + H_3PO_4 = BaHPO_4 + H_2O_2$.

The solution obtained is sufficiently concentrated for most purposes to which it is applied, and is much stronger than much of that found in commerce. (Pharm. News, VI, 148.)

Hydrogen Peroxide and its Estimation, by Maurice de Thierry.—Since its discovery by Thénard in 1818, hydrogen peroxide has remained a mere chemical curiosity, but it has recently acquired industrial importance. It is now used not only for restoring blackened oil paintings, but a large quantity is consumed in bleaching ostrich feathers, silk, and hair. When pure, peroxide of hydrogen has a density of 1.454, but the commercial product is much weaker; its activity being dependent on its concentration the author has devised a method for determining the value of samples. The method is based on the decomposition by manganese dioxide and is conveniently carried out by means of the simple apparatus figured in the original memoir. (Comptes Rendus, CII, 611.)

Hydrates of Sulphuric Acid.—At the January meeting of the Russian Chemical Society Professor Mendelejeff communicated some results of his investigations into the thermic effects of dilution of sulphuric acid with water. The maximum evolution of heat, and the maximum contraction of 100 parts of the solution both correspond to the solution containing from 65 to 75 per cent. of H_2SO_4, which is very near the hydrate $H_6SO_6 = S(OH)_6$. Together with some other observations this leads the author to the conclusion that there exist at least five more or less constant hydrates of sulphuric acid, viz, H_2SO_4, H_4SO_5, H_6SO_6, and two more containing a large amount of water, as $H_2SO_4 + 100\ H_2O$. (Nature, XXXIII, 591.)

Decomposition of Ammonia by Electrolysis, by the Rev. A. Irving.—The author electrolyzes a concentrated solution of sodium chloride, with which is mixed about one-tenth its volume of the strongest solution of ammonia. The solution is placed in an ordinary three-tubed voltameter of Hofmann's form, into which carbon pencils are introduced (with the aid of corks), to obviate the action of nascent chlorine on platinum were this metal used for the electrodes. With four to six Bunsen or Grove cells a considerable volume of nitrogen and hydrogen is liberated in the separate tubes in a few minutes. The re-action may be thus represented:



$$\begin{array}{ccc} -\text{Pole} & 6NaCl & +\text{Pole} \\ 6Na + 6H_2O + NaOH + 3H_2 & & 6Cl + 2H_3N = 6HCl + N_2 \end{array}$$

The HCl is of course fixed by the free ammonia. The experiment is suitable for the lecture table. (Chem. News, LIV, 16.)

Electrolytic Aluminium.—L. Senet has devised a new process for obtaining aluminium, as well as copper, silver, etc., by electrolysis. He exposes a saturated solution of sulphate of alumina, separated from a solution of chloride of sodium by a porous vessel, to a current of 6 or 7 volts and 4 ampères. The double chloride of aluminium and sodium is decomposed, and the aluminium is deposited upon the negative electrode. (Cosmos, August 10, 1885.)

Researches on Titanium and its Compounds, by Otto Freiherr von der Pfordten—First Part.—The results of this lengthy investigation are thus summarized by the author:

(1) Pure sulphuretted hydrogen can be prepared by drying the gas over phosphorus pentoxide and passing it through chromous chloride, which removes the oxygen.

(2) The hydrogen evolved in the usual way by zinc and acid contains no oxygen.

(3) With titanium and some other elements having a great affinity for oxygen the sulphides can best be obtained by the action of sulphuretted hydrogen on the chloride. The action of sulphuretted hydrogen on the oxide does not give pure products.

(4) At a low temperature sulphuretted hydrogen reduces tetrachloride of titanium to the dichloride, and at a higher temperature another compound forms, probably a sulpho-chloride.

(5) On the other hand, at a red heat, a pure crystalline disulphide is obtained, derived from the product first formed.

(6) Disulphide of titanium is oxidized by carbonic acid gas free from oxygen. (The only known case of a metallic sulphide decomposing carbon dioxide.)

(7) Disulphide of titanium in nitrogen is changed to sesquisulphide. Hydrogen effects the same at a high heat in glass.

(8) The same is reduced by hydrogen in a highly-heated platinum tube to monosulphide.

(9) The properties of the three sulphides are fully described and compared. (Am. Chem., CCXXXIV, 257.)

Occurrence of Titanium in Eruptive Rocks and Clays.—The work done in the division of chemistry and physics of the U. S. Geological Survey during the year 1884–'85 forms Bulletin No. 27 of the series issued by the Survey. The chemical papers include one on topaz from Stoneham, Maine, by F. W. Clarke, the chief chemist, a method of separating titanium and aluminium, by F. A. Gooch, a method of filtration, by the same author, and a number of miscellaneous analyses of minerals, rocks, soils, ores, and water. Analyses of several eruptive rocks and of clays show a considerable percentage of titanium:

Rock.	Per cent. TiO_2.
Hornblende-andesite, from Hagne Volcano, Bogosloff Island, Alaska	1.24
Eruptive rock from New Mexico	0.92
Another specimen from New Mexico	2.67
Basalt, from New Mexico	2.76
Clay, Henry County, Illinois	0.79
Another sample from Illinois	0.64
Clay from Dodgeville, Wisconsin	0.45

A New Oxide of Zirconium and its Utility in the Determination of this Element, —— Bailey.—By the action of hydrogen peroxide on zirconium sulphate the author obtained a white bulky precipitate, which proved to have the formula Zr_2O_5. This is a perfectly stable and definite body, less readily soluble in dilute sulphuric acid than ZrO_2, and of positive utility in analytical determinations. Hydrogen peroxide does not precipitate iron, aluminium, titanium, niobium, tantalum, tin, nor silicon, and the zirconium can be separated from all or any of these. With a moderately concentrated solution of hydrogen peroxide the precipitation is complete. (J. Chem. Soc., XLIX, 149.)

Researches on Uranium, by Clemens Zimmermann; Third Paper, published after the author's death by George Alibegoff and Gerhard Krüss.—A careful examination of the reactions of the oxide of uranium, U_3O_8, has led the author to the conclusion that the oxide U_2O_5 of Péligot is a mixture, and that a body having this composition does not exist. Péligot's results were based on the behavior of U_3O_8 when ignited in the air. Zimmermann finds that U_3O_8 ignited in the air loses varying quantities of oxygen, but if ignited in an indifferent gas, like N or CO_2, the uranic oxide is gradually and completely converted into UO_2. U_3O_8 is only absolutely stable when ignited in a current of oxygen. The color of the U_3O_8 varies with the method of preparation, and therefore can not be used to control its purity.

Determinations of the atomic weight of the element, conducted in several ways, lead to the value 239.02. (Ann. Chem., CCXXXII, 273.)

New Compounds of Vanadium, by J. T. Brierley.—By mixing a blue solution of hypovanadium sulphate with a colorless one of an alkaline metavanadate the author has obtained the following series of new compounds:

A soluble sodium salt, $2V_2O_4$, V_2O_5, $2Na_2O + 13H_2O$.
A soluble potassium salt, $2V_2O_4$, V_2O_5, $2K_2O + 6H_2O$.
An insoluble potassium salt, $2V_2O_4$, $4V_2O_5$, $5K_2O + H_2O$.
A soluble ammonium salt, $2V_2O_4$, $2V_2O_5$, $(NH_4)_2O + 14H_2O$.
An insoluble ammonium salt, $2V_2O_4$, $4V_2O_5$, $3(NH_4)_2O + 6H_2O$.

The first named crystallizes well in hexagonal plates of considerable size, and black color. The last named is a precipitate insoluble in hot water. (Ann. Chem., CCXXXII, 359.)

Non-existence of Silver Subchloride, by Spencer B. Newbury.—The author has obtained the product called silver subchloride (Ag_2Cl?) by the three methods of Cavillier, Wetzlar, and Wöhler, and after careful examination and analysis, finds that there is no evidence whatever of the existence of such a compound, and believes the substances supposed to be silver subchloride are nothing but simple mixtures of silver and silver chloride. He also rejects the existence of the silver subcitrate obtained by Wöhler and von Bibra, claiming that the loss of weight on heating silver citrate in hydrogen, the formation of carbon dioxide, and residue of metallic silver indicate the decomposition of citric acid and separation of silver rather than the formation of silver subcitrate. (Am. Chem. J., VIII, 196.)

On Berthollet's Fulminating Silver, by F. Raschig.—Although this substance was discovered by Berthollet nearly one hundred years ago, it has not been since closely studied, and its constitution has been uncertain. Berthollet obtained it by the action of ammonia on silver oxide. Raschig prepares it as follows: A solution of silver nitrate is precipitated with sodium hydroxide, and the silver oxide is washed by decantation in the beaker and then transferred to a small flask. For each gram of silver nitrate used 2 c.c. of an ammonia solution, containing 25 per cent. of NH_3, is added to the oxide, which dissolves easily with very slight residue. The solution of fulminating silver thus obtained is divided into several portions, and each dish is covered with a watch glass and allowed to stand sixteen to twenty hours. The ammonia evaporates, leaving the fulminating silver as a black crystalline mass. After washing it was analyzed by digesting with very dilute sulphuric acid, which usually leaves a residue of metallic silver. The dissolved silver was precipitated with hydrochloric acid, and the ammonia determined in the filtrate as platinic chloride. The results of sixteen analyses gave ratios approximating three atoms of silver to one of nitrogen, which gives the formula NAg_3.

The substance was also prepared by warming the ammonia solution of the silver oxide on a water bath, and by precipitating it with alcohol, and these samples gave the same results on analysis. Berthollet's fulminating silver explodes with a very slight concussion when dry, and even when moist must be handled with precaution. The explosive character of each sample analyzed was determined. It dissolves in potassium cyanide solution almost immediately, probably giving the reaction:

$$NAg_3 + 3KCy + 3H_2O = NH_3 + 3KHO + 3AgCy$$

(Liebig's Annalen, CCXXXIII, 93.)

Compounds of the Nitrates of the Alkalies with Nitrate of Silver, by A. Ditte.—The author describes the preparation and characteristics of the following double salts: $AgNO_3, KNO_3$; $AgNO_3, RbNO_3$; $NH_4NO_3, AgNO_3$; and shows that with sodium and lithium analogous double salts are difficult to obtain in definite compounds. No less than twelve reasons are presented for dividing the alkaline group of metals into two sections, one embracing K, Rb, Cs, NH_4; and the other, Li and Na. (Ann. Chim. Phys. [6], VIII, 418.)

Decomposition of Potassium Chlorate, by Frank L. Teed.—In a previous paper the author arrived at the conclusion that the decomposition of potassium chlorate by heat was represented by the equation:

$$10KClO_3 = 6KClO_4 + 4KCl + 3O_2$$

but later experiments lead him to believe that the following is more nearly correct:

$$22KClO_3 = 14KClO_4 + 8KCl + 5O_2$$

A majority of the author's results fall within the limits calculated from these two equations. When the chlorate is heated with manganese dioxide it decomposes apparently without formation of perchlorate.

In the discussion which followed the reading of this paper at the Chemical Society of London, Dr. Percy Frankland said experiments made in the South Kensington laboratory had lead to the equation:

$$8KClO_3 = 5KClO_4 + 3KCl + 2O_2$$

(Chem. News, LIII, 56.)

For a further discussion of this subject see article by E. J. Maumené in Chem. News, LIII, 145.

The Solvay Process of Manufacturing "Soda."—In our reports for 1883 and 1884 we chronicled the decline of the Leblanc process and the rise of the so-called "ammonia process" of manufacturing soda; we now note the establishment of a manufactory of carbonate of soda by the latter process in the United States.

Solvay & Co. have established extensive works for conducting the process with which their name is connected in Belgium, France, Germany, Russia, and Austria; and a company of gentlemen, which has secured the right to work under all the Solvay patents, has erected works at Geddes, near Syracuse, New York State. These works produced in 1885 14,651,500 kilos. of 98 per cent. carbonate of soda, and the production for 1886, with increased facilities, is estimated to reach 30,000,000 kilos.

The purity of the product is shown by the following analysis of the brand known as "Pure Soda:"

Analysis of "Pure Soda."

	Per cent.
Iron and aluminum oxides	.025
Silica	.025
Carbonate of lime	.404
Carbonate of magnesia	.175
Chloride of sodium	.904
Carbonate of soda	98.730
	100.263

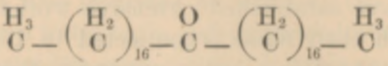
This product, being very pure, is especially adapted for glass making, soap making, paper making, scouring textile fabrics, and all the innumerable uses to which this adjunct of civilization is continually put.

The product of all the works making soda under the Solvay patents is over 220,000 tons per annum, and new establishments are rising in several localities.

Composition of a Crystalline Scale formed in the Ammonia-Soda Process, by George W. Leighton.—The crystalline scale, formed on the inner surface of an iron tank, in which vapors consisting of ammonia, carbon dioxide, and small quantities of hydrogen sulphide are passed through brine holding in solution the chlorides of sodium, magnesium, and calcium, with a small amount of calcium sulphate, has been examined. It has the appearance of a boiler scale, from one to two inches thick, with a vitreous luster and greenish-gray color, although sometimes black on the surface. The scale is usually covered with crystal planes, which prove to be the terminations of prisms (probably monoclinic). Analysis gave results corresponding closely to the formula: $MgCO_3$, Na_2CO_3, $NaCl$; and impurities consisting chiefly of $CaCO_3$. This is not a mixture, but an interesting triple salt analogous to some mineral species. (Proc. Am. Acad. Arts and Sci., XXII, 158.)

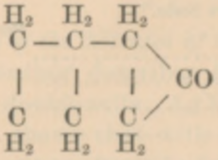
ORGANIC CHEMISTRY.

On the Formation of So called closed Chains, by Prof. Victor Meyer.—Carbon atoms possess the marked peculiarity of combining to form molecules in so-called chains, a property giving rise to the multiplicity of organic bodies. In stearone no less than thirty-five carbon atoms unite to form a chain, which may be indicated thus:



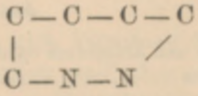
$$\overset{H_3}{C}-\left(\overset{H_2}{C}\right)_{16}-\overset{O}{C}-\left(\overset{H_2}{C}\right)_{16}-\overset{H_3}{C}$$

A limit to the extent of open-chain structure can not be predicted, but the case is very different when closed chains are considered. While closed chains of three, four, five, and six links or atoms are numerous, the problem of forming rings having a greater number of links has been scarcely attacked by chemists. If bodies like anthracene and acridine, having double rings of the benzene type, be excepted, only two substances are known having seven links in the molecular ring. These are:



Suberone.

and



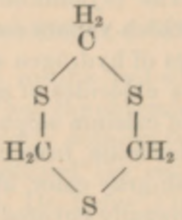
Carbazostyril.

The author has begun the study of the construction of rings having a number of links greater than six, and some of the results are as follows:

Sodium sulphide acts on iodide of methylene in accordance with the equation:

$$CH_2I_2+Na_2S=2NaI+CH_2S$$

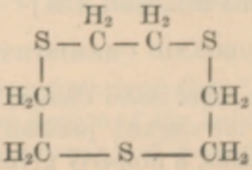
But A. W. Hofmann has shown that the molecular weight of CH_2S is three times as great as thus indicated, and Meyer formulates this as follows: $C_3H_6S_3$ or



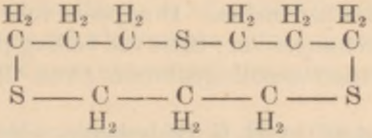
By a study of the body formed in the re-action

$$C_2H_4Br_2+Na_2S=2NaBr+C_2H_4S$$

the author arrives at the conclusion it should be formulated thus:



which is an example of a closed chain of nine links. Further researches led the author to the discovery of a body having the following constitution:



which is the first example of a closed chain of twelve links. These bodies are quite unstable, as indeed might be anticipated from their complex structure. (Naturwiss. Rundschau, I, 2, 1886.)

Products of the Manufacture of Gas from Petroleum, by Henry E. Armstrong and A. K. Miller.—This paper gives results of an investigation which the authors have conducted during several years, on the decomposition and genesis of hydrocarbons at high temperatures; their main object has been to throw light on the nature of the changes resulting from the decomposition of petroleum hydrocarbons at high temperatures. The authors have thus far recognized among the products of the manufacture of oil-gas the following hydrocarbons:

(*a*) Paraffines, only in traces.

(*b*) Pseudolefines, or saturated hydrocarbons of the series C_nH_{2n}, such as occur in Russian petroleum; present in relatively small amount..

(*c*) Olefines, viz, ethylene, propylene, normal amylene, hexylene, and heptylene; higher homologues being absent.

(*d*) Pseudacetylenes, viz, crotonylene (dimethylenethane) and isoallylethylene.

(*e*) Benzenoid hydrocarbons, viz, benzene, toluene, the three isomeric dimethylbenzenes, the two trimethylbenzenes (pseudocumene and mesitylene), and naphthalene. (J. Chem. Soc. [London], 1886, p. 74.)

Some Organic Substances of High Refractive Power, by H. G. Madan.—The author finds that naphthyl-phenyl-ketone has a refractive index of 1.666, which is even higher than that of carbon disulphide (1.63). Its dispersive power is almost exactly that of carbon disulphide.

Metacinnamene has a refractive index of 1.593; monobromonaphthalene has a refractive index of 1.662, and the author thinks it may prove a valuable substitute for carbon disulphide for filling prisms, as it is much less volatile and inflammable. Mr. Madan mentions as a great desideratum a substance having all the excellent qualities of Canada balsam—colorless, neutral, permanent in the air, becoming fluid when moderately heated, but hard and tough when cold, and with a refractive index of at least 1.66. Such a substance would be invaluable for mounting microscopic objects. (Phil. Mag. [5], XXI, 245.)

A Convenient Method of Preparing Organic Compounds of Fluorine, by O. Wallach.—The author finds that organic bodies containing fluorine can be readily obtained by the action of aqueous hydrofluoric acid on diazoamido compounds. He describes fluorbenzene (C_6H_5Fl) boiling at 84° to 85°, parafluortoluene boiling at 116° to 117°, fluornitrobenzene, fluoranilin, and other bodies. It appears that the replacement of hydrogen by fluorine changes very little the boiling points of the bodies, but greatly increases their specific gravities. (Ann. Chem., CCXXXV, 255.)

On Platoso-Oxalic Acid, by H. G. Söderbaum.—Doebereiner formerly obtained, by the action of oxalic acid upon the sodium salt of platinum dioxide, a salt of a copper-red color, which he regarded as platinous oxalate. Souchay and Lenssen assign it the formula $PtNa_2C_4O_8+4H_2O$. This salt has much analogy with the platinum sulphites, since the solution gives neither the reactions of platinum nor those of oxalic acid. We may therefore regard this compound as the sodium salt of platoso-oxalic acid, which has been isolated.

The salts of platoso-oxalic acid are very remarkable, because they occur in isomeric or rather polymeric forms.

For the preparation of the sodium salt sodium chloro-platinate is heated with an equal weight of sodium hydrate. The residue is treated with water, which dissolves out sodium chloride, leaving a yellow powder, $Na_2O, 3PtO_2, 6H_2O$. More of it is obtained by the addition of hydrochloric acid to the solution of sodium chloride, avoiding excess. It is washed with cold water and washed with one and a half parts of crystalline oxalic acid. Carbonic acid escapes, and there is obtained a solution of an intense blue color, from which cold slender brown needles of a metallic luster are deposited. This salt is collected upon a filter and repeatedly washed with boiling water. There filters first a yellow solution, then a greenish or blue one, and lastly a solution of a reddish-brown. From the last liquid the mass of the sodium salt is deposited on cooling, crystallized in capillary needles of a coppery luster. The first solution after some time deposits lemon-yellow prisms of an isomeric salt. The intermediate solutions deposit mixtures of the two salts. Both salts yield with silver nitrate a yellowish-white precipitate of microscopic crystals of the silver salt of platoso-oxalic acid. On decomposing this silver salt with the calculated proportion of hydrochloric acid we obtain an indigo-blue solution, containing platoso-oxalic acid. We may obtain the salts of the acid either by the double decomposition of the sodium salts or by neutralizing the free acid with bases or carbonates. With the brown sodium salt there are obtained salts of a brown, greenish, or blue color; but with the yellow salt we obtain isomeric yellow or orange salts. The free acid generally gives salts of the former class, *i. e.*, of a dark color, but by repeated crystallizations yellow salts may be obtained. Several metals belonging to the zinc group form dark-colored salts most readily; others, for instance silver, yield yellow salts, and others again form with equal ease either dark or yellow salts. The tri- and tetra-atomic metals give both dark and yellow salts, but of a different composition. The dark salts are in general less soluble; their density is lower and they often contain a smaller number of molecules of crystalline water. The difference between the two classes of salts does not depend on the water of crystallization, because both dark and yellow anhydrous salts have been obtained, and because there exist both yellow and dark salts containing the same number of molecules of crystalline water.

The salts of platoso-oxalic acid are in general sparingly soluble in cold dilute acids; they are insoluble in alcohol. In hot water some of them dissolve readily; others are sparingly soluble. Most of them contain crystalline water, which they lose in part or entirely at 100°. They bear the temperature of 110° to 115° (though the ammonium salt is decomposed at 100°); but a little above this temperature they begin to decompose. If suddenly heated they are decomposed with detonation.

Platoso-oxalic acid, $PtC_4O_8H_2 + 2H_2O$, the preparation of which has been described above, gives, when its solution has been evaporated in a vacuum, a red crystalline mass of a metallic luster. It dissolves readily in water with an indigo-blue color, but this color changes to yellow on heating or diluting with water. Yet the blue color returns on cooling or on concentration.

There are two potassium salts, a brown one forming copper-colored needles of specific gravity 3.01, and a yellow one in hexagonal prisms of specific gravity 3.03. Both contain the same number of molecules of crystalline water. With the ammonium salts the case is similar. The dark sodium salt forms slender needles containing 4 molecules of crystalline water, whilst the yellow salt forms prisms with 5 molecules of crystalline water. There are three isomeric calcium salts: the brown one, with $6\frac{1}{2}H_2O$; the β-yellow salt, with $4H_2O$, losing one molecule water at 100°; and the γ-yellow salt, with $8H_2O$, losing at 100° $5H_2O$. There are also three strontium salts: α, dark, contains $3\frac{1}{2}H_2O$ and loses $\frac{1}{2}H_2O$ at 100°; β, also dark, contains $6\frac{1}{2}H_2O$, and loses $3H_2O$ at 100°; and γ, yellow, contains only 3 molecules of crystalline water and undergoes no change at 100°.

These researches were made in the laboratory of Prof. P. T. Clève. (Bull. Soc. Chim., 1886, 188.)

Iodo-aldehyde is obtained by P. Chautard by acting on an aqueous solution of aldehyde with a mixture of iodic acid and iodine.

$$5(C_2H_4O) + 4I + IO_3H = 5(C_2H_3IO) + 3H_2O$$

Iodo-aldehyde forms an oily, volatile, non-inflammable, colorless, limpid liquid, blackening rapidly on exposure to light. It decomposes at 80° C., but in solution may be heated to high temperatures without change. It acts as a strong caustic, attacking eyes and respiratory organs. Its density is 2.14 at 20°. It is soluble in all proportions in alcohol, ether, benzene, chloroform, etc. It combines readily with aniline and other ammonia derivatives. (Comptes Rendus, CII, 118.)

Synthesis of Conine, by A. Ladenburg.—Conine, the volatile alkaloid which forms the poisonous principle of hemlock (*conium maculatum*), was discovered in 1827 by Giesecke, but was first obtained in a pure state in 1831 by Geiger. It has been often studied by chemists, notably by Ortigosa, Blyth, Wertheim, and Kekulé and von Planta; the two latter gave it the formula $C_8H_{15}N$, but it is now known to be $C_8H_{17}N$. It forms a colorless, oily liquid of pungent odor, specific gravity = 0.89; boiling point 166° to 168°. It is easily soluble in alcohol and ether, sparingly in water, and forms crystalline deliquescent salts. It is an active poison. This natural alkaloid has been formed synthetically by Ladenburg in the manner to be described. Hugo Schiff, in 1871, thought he had effected this synthesis by the action of alcoholic ammonia on normal butyric aldehyde and subjecting the product to dry distillation, but the base thus obtained proved to be paraconine, an isomeric form.

Ladenburg's researches on the pyridine bases had already yielded him interesting results. The synthesis of piperidine was noted in our report for the year 1884. On the 25th of February he read a paper before the German Chemical Society entitled "Experiments on the Synthesis of Conine," in which he announced the preparation of a base very closely resembling this alkaloid, and in October he presented details of this remarkably interesting synthesis, and proofs of the identity of the artificial and natural substances. The process is as follows: Paraldehyde and α-picoline are heated for ten hours in closed tubes to a temperature of 250° to 260°. The allylpyridine thus obtained was separated from the unchanged picoline, purified and fractioned until it distilled at 187°.5 to 192°.5. The exact nature of this body was carefully established by many tests. The α-allylpyridine was then submitted in alcoholic solution to the reducing action of sodium, whereby α-propylpiperidine was obtained. The hydrochloride of this base, when purified, melted at 203° to 205°, and crystallized in silky-white needles.

The base separated from this salt boiled at 166° to 167° and proved to have the greatest resemblance to conine. After a very careful study of its toxic and optical properties the author satisfied himself of the absolute identity of this dextro—α-propylpiperidine and conine, $C_3H_7 . C_5H_{10} . HN$. (*Ber.* d. chem. Ges., XIX, 439 and 2578.)

New Synthesis of an Inactive Borneol, by J. Bouchardat and J. Lafont.—Berthelot accomplished the synthesis of the camphor of Borneo by treating camphor with potassium alcoholate, and Baubigny by the direct addition of hydrogen. The authors effect the transformation of terebene, or inactive camphene, $C_{10}H_{16}$, through the medium of an organic acid into an ether of borneol, which by saponification yields a borneol having no influence on polarized light. With the exception of its inactive optical properties, the new body is identical with borneol. (Comptes Rendus, CII, 171.)

Synthesis of Ammonium Cyanide by Electricity, by A. Figuier.—By passing a current of silent electricity through a mixture of one volume of methane and two volumes of nitrogen, cyanide of ammonium is formed and noticeable by its odor.

$$CH_4 + N_2 = CN. NH_4.$$

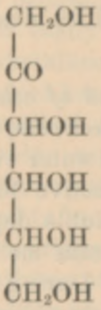
The product was collected and its identity established. (Comptes Rendus, CII, 694.)

Synthesis of Mellitic Acid and of other Benzo-carbonic Acids by Electrolyzing Water with Carbon Electrodes, by A. Bartoli and G. Papasogli.—By the electrolysis of distilled water with electrodes of pure carbon and a battery having an electromotive force equal to 1,200 Daniells, the authors obtained a black insoluble deposit (mellogen) and a very acid liquid which was found to contain mellitic, pyromellitic, hydromellitic, and hydropyromellitic acids. During the electrolysis carbon monoxide and dioxide with very little oxygen were evolved. Mellogen purified by precipitation from the aqueous solution by hydrochloric acid forms an amorphous, neutral, black, and friable body, insoluble in alcohols and soluble in water, to which it imparts an intensely black color. Mellogen dried at 140° has the composition $C_{11}H_2O_4$, and has some analogy with Brodie's graphitic acid $C_{11}H_4O_5$, but the two bodies are not identical. Oxidizing agents convert it into benzo-carbonic acids. (Annales Chim. Phys. [6], VII, 349 and 364.)

Products of the Electrolysis of a Solution of Ammonia with Coke Electrodes, by A. Millot.—A solution of ammonia containing 50 per cent. was electrolyzed with electrodes of coke purified by chlorine, and the chief products are an azulmic matter (which the author is still studying), urea, ammelide, biuret, and guanidine. The urea and guanidine probably arise from action of nascent carbon dioxide on ammonia with elimination of water. Biuret is probably formed by the action of carbon dioxide on guanidine, and ammelide from the action of this gas upon biuret with the co-operation of urea. Cyanuric acid was sought but not found. These results differ from those of Bartoli and Papasogli, who added salt to the ammoniacal solution to render it a better conductor, and the nascent chlorine resulting destroyed the above-mentioned products. (Comptes Rendus, CIII, 153.)

Identity of Cadaverine with Pentamethylendiamine, by A. Ladenburg.—Brieger in the course of his remarkable researches on ptomaines isolated from a cadaver a base having the formula $C_5H_{14}N_2$, and which he named cadaverine. This base was also discovered in decomposing fish. Brieger, noting the resemblance in properties between cadaverine and pentamethylendiamine, sent a small specimen of the former to Ladenburg for investigation. The latter chemist found the reactions of the two bodies similar in all respects except in their behavior with mercuric chloride; but he succeeded in transforming cadaverine into piperidine by a known process and thus fully established the identity of the two bodies. (Ber. d. chem. Ges., XIX, 2585.)

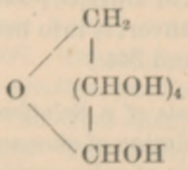
On the Constitution of Levulose and Dextrose, by Heinrich Kiliani.—According to the author, levulose is a ketone alcohol, and has the constitution



$$\begin{array}{c} CH_2OH \\ | \\ CO \\ | \\ CHOH \\ | \\ CHOH \\ | \\ CHOH \\ | \\ CH_2OH \end{array}$$

This result was arrived at by studying the behavior of levulose with hydrocyanic acid.

The question whether dextrose is an aldehyde or an anhydride is not entirely settled, but the probable constitution is



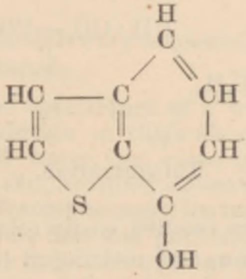
(Ber. d. chem. Ges., XIX, 767 and 1128.)

Chlorophyll and the Reduction of Carbonic Acid by Plants, by C. Timiriazeff.—On subjecting an alcoholic solution of chlorophyll to nascent hydrogen (by means of zinc and acetic acid) the chlorophyll is reduced, and forms in dilute solutions a straw-yellow substance and in concentrated solutions a substance of brown-red color. This substance has a well defined spectrum, in which the band in the red portion characteristic of chlorophyll is wanting. The most important property of this reduced chlorophyll is its rapid oxidation on exposure to air, with reproduction of green chlorophyll. The author terms this new substance protochlorophylline, or, more briefly, protophylline.

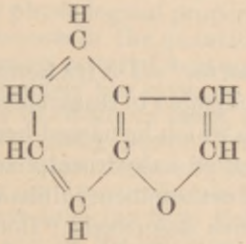
Solutions of protophylline can be preserved only in glass tubes hermetically sealed. If a solution of protophylline be sealed up in a tube together with carbonic acid and preserved in total darkness it retains indefinitely its color and characteristic spectrum, but on exposure to sunlight the solution turns green. The author remarks that in the absence of quantitative details he can not claim that this proves the reduction of carbonic acid by protochlorophylline in the presence of sunlight, but he can not find any other explanation of the facts. He thinks that there is evidence of the existence of protophylline in living plants. He also finds that by pushing the reducing action of nascent hydrogen further another and colorless substance is obtained, which is now under examination. (Comptes Rendus, CII, 687.)

Acetophenone, a new Hypnotic.—Acetophenone, also called acetylbenzene, $C_6H_5 . CO . CH_3$, has been found to possess valuable hypnotic properties. It is as yet only a laboratory product, but there should be no great difficulties in manufacturing it on a commercial scale. It is commonly obtained by distilling a mixture of calcium benzoate and calcium acetate, though many other methods are named in hand-books. It forms at ordinary temperatures a clear, colorless liquid, having a persistent characteristic odor; at a lower temperature it forms large flaky crystals, melting at 20°.5 C. Dr. Dujardin-Beaumetz, who has discovered its hypnotic properties, recommends it for simple insomnia, and says its use is not followed by disagreeable after-symptoms, such as nausea, headache, etc. He proposes for this substance the trade-name "hypnone." (Bull. Générale de Thérapeutique, 1886.)

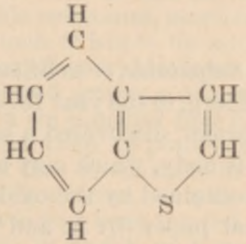
On Thionaphthenes, by Victor Meyer.—The author states that the first thiophene of the naphthalene series, which he names thionaphthene, has been obtained in his laboratory by A. Biedermann. It has the constitution



The author has obtained thionaphthene itself by the action of phosphide of sulphur on cumarone, the analogies of which are shown by the following schemes:



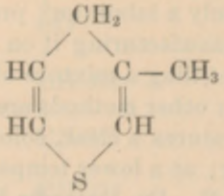
Cumarone.



Thionaphthene.

(Ber. d. chem. Ges., XIX, 1432 and 1615.)

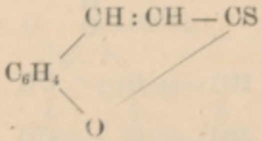
On Penthiophene and its Derivatives, by Karl Krekeler.—The existence of a body analogous to thiophene, but having five carbon atoms and one of sulphur in a closed chain, has been foreseen by Victor Meyer and others. The author obtained a methyl derivative by acting on *α* methylglutaric acid with sulphide of phosphorus, this acid being derived from lævulinic acid, a substance on which the author has lately experimented much. The body has the formula



β-methylpenthiophene.

This substance forms a colorless oily liquid, boiling at 134° C.; its specific gravity = 0.9938 at 19° C. It gives the Laubenheimer color-test and other colored reactions. (Ber. d. chem. Ges., XIX, 3266.)

Thiocumarine and its Derivatives, by Fred. Tiemann.—By the action of phosphorus pentasulphide on cumarine the author obtained a sulpho-compound having the constitution

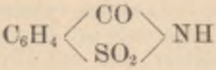


Thiocumarine.

This crystallizes in golden needles, easily soluble in alcohol, ether, and benzene, insoluble in water, and melting at 101°. By reacting on this body with hydroxylamine he obtained cumaroxime in long white needles, melting at 131°. In appropriate ways the following compounds were obtained: Cumaroximethyl ether, dihydrocumaroxime, and a phenyl-hydrazine derivative of cumarine. (Ber. d. chem. Ges., XIX, 1661.)

Benzoic Sulphinide, or so-called "Saccharine."—Dr. Ira Remsen, assisted by C. Fahlberg, in the year 1879, when engaged in researches originating with the former, discovered a substance which he named benzoic sulphinide. This body, which may also be called anhydrosulphaminebenzoic acid, was obtained by the oxidation of orthotoluenesulphamide, and in the original paper (by R. and F.) is thus described: "Benzoic sulphinide is difficultly soluble in cold water. It is much more soluble in hot water, and can be obtained in crystalline form from its aqueous solution. It crystallizes in short, thick prismatic forms, which are not well developed. Alcohol and ether dissolve it very easily. It fuses at 220° (uncorr.), but undergoes at the same time partial decomposition. It possesses *a very marked sweet taste, being much sweeter than cane sugar.* The taste is perfectly pure. The minutest quantity of the substance, if placed upon the tip of the tongue, causes a sensation of pleasant sweetness throughout the entire cavity of the mouth. As stated above, the substance is soluble only to a slight extent in cold water, but if a few drops of the cold aqueous solution be placed in an ordinary goblet full of water, the latter then tastes like the sweetest sirup. Its presence can hence easily be detected in the dilutest solutions by the taste. Orthonitrobenzoic acid has this same property, but the sweetness is by no means so intense as in the case of benzoic sulphinide." (Am. Chem. J., I, 430.)

On the 2d of February, 1886, Dr. Ivan Lewinstein read a paper before the Society of Chemical Industry on "Saccharine," in which he gives sole credit of the discovery of this sweet substance to Dr. Remsen's assistant. The process of preparing it is the same, though he prefers for it the name benzoyl-sulphonic-imide, or the trade-name "saccharine." The constitution of this body is thus shown:



$$C_6H_4 \left\langle \begin{matrix} CO \\ SO_2 \end{matrix} \right\rangle NH$$

Dr. Lewinstein gives the following account of the properties and prospective uses of this substance:

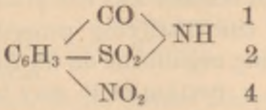
> Saccharine presents the appearance of a white powder, and crystallizes from its aqueous solution in thick short prisms, which are with difficulty soluble in cold water, but more easily in warm. Alcohol, ether, glucose, glycerole, etc., are good solvents of saccharine. It melts at 200° C., with partial decomposition; its taste in diluted solutions is intensely sweet, so much so that one part will give a very sweet taste to 10,000 parts of water. Saccharine forms salts, all of which possess a powerful saccharine taste; it is endowed with moderately strong antiseptic properties, and is not decomposed in the human system, but eliminated from the body without undergoing any change. It is about two hundred and thirty times sweeter than the best cane or beet-root sugar. According to Dr. Stutzser, of Bonn, who has carefully investigated the physiological properties of this substance, saccharine, taken into the stomach in the quantities in which it has to be added to food as a sweetening material, has no injurious effect whatever on the human system. Stutzser has given to dogs about 5 grams a day, without observing any ill effects in them, and when we consider that 5 grams are equal in sweetening power to rather more than 2¼ pounds of sugar, a quantity far larger than any one would like to consume in a day, his view seems amply corroborated by this fact alone; but, in addition to this, patients suffering from diabetes have now been treated for several months in one of the principal hospitals in Berlin, as I am informed, without their feeling the least inconvenience by its use. Physicians must be glad to find in saccharine a substance, by means of which di-

abetic persons may enjoy food which has hitherto not been admissible in their case. Saccharine does not belong to the class of carbohydrates, and does not possess nutritious properties. The use of saccharine will therefore, as indicated by its properties, be not merely as a probable substitute for sugar, but it may even be applied to medicinal purpose where sugar is not permissible. The inventor was fully aware that in order to supply a perfect substitute for cane or beet-root sugar, something else, viz, a similar substance, was needed for confectionery and similar purposes, besides sweetening properties, and he has also endeavored to solve this problem. Dr. Fahlberg combines glucose with starch sugar, a substance very similar to cane or beet-root sugar, but inferior to these in sweetening properties, with saccharine, and thus obtains a compound which he calls "dextro-saccharine," which, as far as the taste is concerned, is scarcely distinguishable from the best sugar. The quantity of saccharine used is in the proportion of one part to from 1,000 to 2,000 parts of glucose. Now, since the price of saccharine is at present about 50*s* a pound, we shall find that even at this price such a mixture would be very considerably cheaper than real sugar, but we must bear in mind the fact that there is great likelihood of the process of manufacture of saccharine being considerably cheapened.

It will then be evident not only that saccharine is a most interesting compound, but that it may also be destined to become an article of primary commercial importance. The future must decide as to the revolutions it may bring about in the coal-tar industry, in the cultivation of the soil now devoted to growing canes or beets, and in the sugar industry generally and other industries connected with it; but as great and important commercial interests are in question, it is highly advisable to look well into this matter, and not allow our foreign competitors in this and other markets to secure for themselves exclusively the benefit which this discovery may confer. There are in commerce small balls made from starch, to which has been added .05 per cent. of saccharine, of which one is sufficient to impart a very sweet taste, very similar to that of the best sugar, to a large cup of black coffee.

Investigations on the Sulphinides, by Dr. Ira Remsen.—The benzoic sulphinide described in the preceding note has been further studied by the author. By the substitution of the ethoxyl group for hydrogen paraethoxybenzoic sulphinide was obtained, crystallizing in fine white needles, melting at 257° to 258°. This derivative has not the sweet taste characteristic of the benzoic sulphinide. Another derivative, parabrombenzoic sulphinide, crystallizing in long needles and subliming in feathery flakes at about 200°, has a remarkable taste. When first placed upon the tongue its taste is extremely sweet, fully as much so as that of benzoic sulphinide, a single small crystal being able to sweeten half a liter of water. After the sweet taste has passed an equally bitter taste takes its place, reminding one in its extreme bitterness of strychnine. This peculiarity can not be due to the presence of two substances of different degrees of solubility, since the purest specimens have this property. (Am. Chem. J., VIII, 223.)

Paranitrobenzoic Sulphinide, etc., by W. A. Noyes.—This body crystallizes in small leaflets and in fine needles, fusing at 209°. It is difficultly soluble in cold water and (together with its salts) has an intensely bitter taste. Its structure is as follows:



Para-amidobenzoic sulphinide, on the other hand, has an intensely sweet taste. Its solution, even when very dilute, shows a dark-blue fluorescence. The author describes its salts with potassium, barium, and silver. (Am. Chem. J., VIII, 167.)

On Wrightine, by H. Warnecke.—This alkaloid, first isolated by Stenhouse in 1864, from the seeds of *Wrightia antidysenterica*, an apocynaceous tree from India. It is the first known solid base occurring in nature which is free from oxygen. If a trace of this base, dissolved in chloroform, is evaporated to dryness in a porcelain capsule, the residue covered with 2 to 3 c. c. of water and strong sulphuric acid is added in a slender stream, a golden-yellow color spreads from the bottom of the capsule through the whole liquid, and turns to a green on standing for twelve hours. If 1 milligram of the alkaloid is rubbed up in a watch-glass with five drops of strong sulphuric acid and let stand exposed to the air for two hours, the liquid which was at first colorless, turns yellowish green and finally a pale violet. If the above mixture is at once exposed in the neck of a flask to the steam of boiling water the mass turns dark green, and passes into deep blue on contact with a little water. (Ber. d. chem. Ges., XIX.)

Chemical Aspects of Future Food Supply.—The chemical section of the American Association for the Advancement of Science, at the meeting in Buffalo, August, 1886, was numerously attended. The president of the section, Dr. Harvey W. Wiley, addressed the members on "The Economical Aspects of Agricultural Chemistry." His concluding sentences on the *Future Food Supply* are as follows: "Since, with a proper economy, the natural supplies of potash and phosphoric acid, as we have seen, may be made to do duty over and over again, and last indefinitely, the economist who looks to the welfare of the future need have no fear of the failure of these resources of the growing plant. Indeed, it may be said that the available quantities of them may be increased by a wise practice of agriculture, based on the teachings of agricultural chemistry. But with the increase of population comes an increased demand for food, and therefore the stores of available nitrogen must be enlarged to supply the demands of the increased agricultural product. It is certain, that with the new analytical methods, and the new questions raised by the investigations of which I have spoken, many series of experiments will be undertaken, the outcome of which will definitely settle the question of the entrance of free nitrogen into vegetable tissues. If this question be answered affirmatively, agricultural science will not place bounds to the possible production of foods. If the nitrifying process does go on within the cells of plants, and if living organisms do fix free nitrogen in the soil in a form in which at least a portion of it may be nitrified, we may expect to see the quantities of combined nitrogen increase *pari passu* with the needs of plant life. Thus, intensive culture may leave the gardens and spread over the fields, and the quantities of food suitable for the sustenance of the human race be enormously increased. In contemplating the agricultural economies of the future, however, it must not be forgotten that a certain degree of warmth is as necessary to plant development as potash, phosphoric acid, and nitrogen. If it be true, therefore, that the earth is gradually cooling, there may come a time when a cosmic athermancy may cause the famine which scientific agriculture will have prevented. Fortunately however for the human race the cereals, the best single article of food, are peculiarly suitable to a cold climate. Barley is cultivated in Iceland, and oatmeal feeds the best brain and muscle of the world in the high latitudes of Europe. It is probably true that all life, vegetable and animal, had its origin in the boreal circumpolar regions. Life has already been pushed half-way to the equator, and slowly but surely the armies of ice advance their lines. The march of the human race equatorwards is a forced march, even if it be no more than a millimeter in a millennium. Some time in the remote future the last man will reach the equator. There, with the mocking disk of the sun in the zenith, denying him warmth, flat-headed and pinched as to every feature, he will gulp his last mite of albuminoids in his oatmeal, and close his struggle against an indurate hospitality." (Economical Aspects of Agricultural Chemistry, an Address by H. W. Wiley. Cambridge, 1886.)

Recent Progress in the Coal-Tar Industry.—Under the above title Sir Henry E. Roscoe delivered a most valuable and interesting discourse at the Royal Institution on April 16, 1886. He refers the numerous products, whether dye-stuffs, perfumes, antipyretic medicines, or sweet principles to two great classes of hydrocarbons, the paraffinoid and the benzenoid hydrocarbons. The first is the foundation of the fats, and the second of the essences or aromatic bodies. Petroleum is the source of the first class and coal-tar of the second. The following tables give an interesting view of the marvellous products of coal and their relative amounts.

I. Products of distillation of 1 ton of Lancashire coal:
    10,000 cubic feet gas.
    20 to 25 gallons ammoniacal liquor (5° Tw.).
    12 gallons of coal-tar (=139.2 pounds, specific gravity, 1.16).
    13 hundredweight of coke.

II. Products of 12 gallons of gas-tar:

1.10 pounds benzene (= 1.10 pounds aniline) } = 0.62 pound magenta.
0.90 pound toluene (= 0.77 pound toluidine) }
1.5 pounds phenol proper (= 1.2 pounds Aurin).
2.44 pounds solvent naphtha (three xylenes).
2.40 pounds heavy naphtha.
6.30 pounds naphthalene (= 5.25 pounds α-naphthylamine, 7.11 vermilline scarlet RRR, or 9.50 pounds naphthol yellow).
17.0 pounds creosote.
14.0 pounds heavy oil.
0.46 pound anthracene (= 2.25 alizarine 20 per cent.).
69.6 pounds pitch.

III. Dyeing power of colors from 1 ton of Lancashire coal:

Pounds.	Dye-stuff.	Dye yards of flannel 27 inches wide.
0.623	Magenta	500
[*or*, 1.23	Methylviolet	1,000]
9.50	Naphthol yellow..	3,800
[*or*, 7.11	Vermilline	2,560]
1.2.	Aurin	120
2.25	Alizarin	*255

* Printers' cloth.

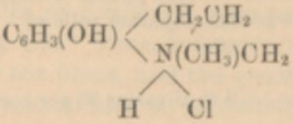
The distinguished lecturer illustrated the tinctorial power of the coal-tar products by exhibiting a party-colored flag showing the exact amount of color obtainable from 1 pound of Lancashire coal; this flag was made up as follows:

	Inches.
Magenta flannel	8 x 27
Violet flannel	24 x 27
Yellow flannel	61 x 27
Orange flannel	1.9 x 27
Turkey-red flannel	4 x 27

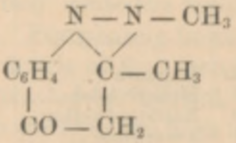
The colors chosen are only a few among the numerous list of derivatives. This list comprises at present the following:

16 distinct yellows.	Derived from benzene, toluene phenols, xylene, naphthalene, anthracene.
12 oranges.	
30 reds.	
15 blues.	
7 greens.	
9 violets.	
Several browns.	
Several blacks.	

The coal-tar antipyretic medicines next engaged the lecturer's attention. Professor Dewar discovered in 1881 that quinoline belongs to the aromatic series, and first observed that certain pyridine salts act as febrifuges; so he may be called the father of antipyretic medicines. Of these, kairine was discovered by Prof. O. Fischer in 1881, and its febrifuge properties were first noticed by Professor Filehne, of Erlangen. It is actually ethyl-tetraoxy-quinoline, and has the constitution



Antipyrine, the second of these febrifuges, was discovered by Dr. L. Knorr, of Erlangen, and its physiological properties were studied by Professor Filehne. It has the following constitution:



or $C_{11}H_{12}N_2O$. For the preparation of these bodies and their physiological effects, as well as for brief notices of cumarine and vanilline, we refer to the original address. (Nature, XXXIV, pp. 111 and 133.)

Statistics of the Coal-Tar Color Industry.—In a paper on the scientific development of the coal-tar color industry, by Prof. R. Meldola, before the Society of Arts, he gives some statistics showing the magnitude of the industry under discussion. In Germany a factory of about the third magnitude consumes at present 500 to 600 tons of aniline per annum. The Badische Company employ twenty-five hundred laborers and officials, and the Hoechst Color Works (formerly Meister, Lucius & Brüning) employ sixteen hundred men and fifty-four chemists. In these large establishments they manufacture not only aniline, but alizarine, acids, alkalies, and all the necessary chemicals.

The probable consumption of alizarine by British dye-works in 1886 amounted to 6,900 tons (of 10 per cent. paste), of which perhaps 65 per cent. was manufactured in Germany. The author points out that although historically the industry is indebted to English discoveries, commercially the control is leaving England for Germany. (Nature, XXXIV, 324.)

NOTES.

Gadolinium is the name definitely given by Marignac to the metal Yα, which he discovered in 1880. The provisional name was abandoned at the suggestion of Lecoq de Boisbaudran. This is not to be confounded with the same word as used by Nordenskjøld.

Ammonio-permanganate of silver, as well as the analogous compounds of copper, cadmium, nickel, zinc, and magnesium are new compounds obtained by J. Klobb. They are all explosive when heated or struck by a hammer. (Comptes Rendus, CIII, 384.)

The decomposition of chlorine water in sunlight is shown by A. Popper to yield, besides the usually admitted oxygen and hypochloric acid, chloric acid itself, and he shows that this was not formed by the treatment to which the liquid was subjected for analytical purposes. (Ann. Chem., CCXXXI.)

Phosphorus tetroxide, P_2O_4, has been obtained by Thorpe and Tutton. It forms when phosphorus is burned in a limited supply of dry air. It occurs as transparent, highly lustrous, very deliquescent crystals, which do not fuse at 100°, and do volatilize at 180°. On solution in water they form phosphoroso-phosphoric acid, previously discovered by Salzer. For reactions of this oxide and other details see original paper. (J. Chem. Soc., Trans. 1886, 833.)

The thickness of the air layer adhering to glass has been carefully measured by Otto Schumann and found to be somewhat less than 0.000007^{cm}. O. E. Meyer estimates the diameter of molecules at $0.000000005^{\mathrm{cm}}$; the air layer is therefore more than one thousand times as large as the diameter of molecules. (Wiedemann's Annalen, XXVII, 91, '86.)

Attention is called by Arthur G. Bloxam to the solubility of sulphur in alcohol, a fact not generally noted in text-books. By slowly cooling a solution of sulphur in hot alcohol he obtained brilliantly transparent crystals up to half an inch in length, and so white as easily to be mistaken for niter. Chemists using rubber corks in distilling alcohol should bear in mind this solubility of sulphur as a possible source of impurity. (Chem. News, LIII, 181.)

Tyrotoxicon is the name given to a highly poisonous ptomaine discovered by Dr. Victor C. Vaughan in cheese. Its occurrence in poisonous ice-cream has also been demonstrated by Dr. Vaughan, who presented a paper on the subject to the Michigan State Board of Health, July 13, 1886.

Lecoq de Boisbaudran remarks the fluorescence of manganese sulphate when mixed with a large amount of calcium sulphate and subjected to electrical action in a vacuum. Sulphate of manganese alone does not fluoresce under these conditions. (Comptes Rendus, CIII, 468.)

Cæsium and rubidium nitrites, according to Th. Rosenblatt, form with cobalt nitrite crystalline double salts, which are the least soluble compounds of these alkaline metals yet discovered. Cæsio-cobaltic-nitrite requires 20,100 parts of water at 17° C., and the rubidium salt 19,800 parts for solution. Thallium forms similar compound. (Ber. d. chem. Ges., XIX, 2531.)

The oxides of gold have been critically studied by Gerhard Krüss, who finds there are three only: Au_2O_1, Au_2O_2, and Au_2O_3. All attempts to obtain lower or higher oxides were futile. (Ber. d. chem. Ges., XIX, 2541.)

Iodine is reported by J. A. Wanklyn to exist in a free state in the mineral water of the Woodhall Spa, near Lincoln. Sufficient is present to impart a brown color to the water and to give the usual reaction with carbon disulphide. The spa has long been known as useful in skin diseases (Chem. News, LIV, 300.)

The complete synthesis of pyrrol has been accomplished by Ciamician and Silber; the steps in the transformation from succinimide to pyrrol are as follows: Succinimide, bichlormaleïnimide, perchloride of tetrachlorpyrrol, tetrachlorpyrrol, tetrajodpyrrol, pyrrol. (Ber. d. chem. Ges., XIX, 3027.)

Combinations of acetamide with metallic chlorides have been described by G. André, notably with cupric chloride, cadmium chloride, the chlorides of nickel and cobalt, and mercuric chloride. These bodies are crystalline, and decompose at a moderately low temperature. (Comptes Rendus, CII, 115.)

Prof. A. Michaelis, of Aachen, continues his extended researches on compounds of the elements of the nitrogen group with radicals of the aromatic series. In Liebig's Annalen, Vol. CCXXXIII, in union with A. Reese, he describes several compounds of antimony with phenyl and its derivatives, and in union with Paetow he describes compounds of arsenic with benzyl.

Calcined magnesia, showing peculiar behavior with reagents, is supposed by George Stillingfleet Johnson to contain rare earths. (Chem. News, LIV, 88.)

The mosandra of Dr. J. Lawrence Smith has been examined by Lecoq de Boisbaudran, samples being furnished by Dr. Marion, of Louisville, and found to consist chiefly of terbia and Y*α*. (Chem. News, LIII, 168.)

Sozolic acid, or orthoxyphenylsulphurous acid, discovered by M. Serrant, is a more powerful antiseptic than salicylic or phenic acids. The corresponding *para* compound has no antiseptic properties. The author claims for sozolic acid great benefits to medicine and surgery. (Comptes Rendus, CII, 1079.)

A summary of all that is known concerning samarium and its compounds has been published by P. T. Clève, of Upsala. The subject is treated under the heads history, separation, mode of occurrence, atomic weight, spectrum, oxides, and the numerous salts. (Chem. News, LIII, 30 *et seq.*)

Cerium, yttrium, and glucinum, according to Dr. J. H. Strohecker, occur in extraordinary quantities in the clays of Hainstadt. One of the clays analyzed contained as high as 13.4 per cent. cerium hydroxide. The author's analytical methods and his statements have met severe criticisms on the part of several chemists, but he insists on their accuracy. (J. f. prakt. Chemie, 1886.)

Glycyphyllin is a crystalline substance, which Dr. Edward H. Rennie extracted from the leaves of *Smilax glycyphylla*, a plant common in New South Wales. Crystallized from water it has the formula

$C_{21}H_{24}O_9+4\frac{1}{2}H_2O$. On boiling with dilute sulphuric acid it decomposes into phloretin and isodulcite, and is therefore closely allied to phlorizin. (J. Chem. Soc., Trans. 1886, 857.)

According to Dr. F. W. Dafert, starch obtained from *Panicum candidum* yields with iodine a reddish brown color instead of the usual blue coloration. (Biedermann's Centralblatt, 1886.)

The formation of ferrates can be conveniently exhibited in a lecture by a method described by C. L. Bloxam. Place a fragment of potassium hydroxide in a solution of ferric chloride, add a few drops of bromine, and heat gently. The resulting dark brown mass dissolves in water, yielding a fine red solution, which may be kept many hours without decomposition. By boiling ferric chloride with bleaching powder a similar red solution of calcium ferrate can be obtained. (Chem. News, LIV, 43.)

A new alloy of aluminium and tin (100Al : 10Sn), having a specific gravity of 2.85, is recommended by M. Bourbowze for all instruments requiring lightness. It can be soldered as easily as brass, and resists reagents almost as well as aluminium itself. (Comptes Rendus, CII, June 7, 1886.)

The third annual convention of the Association of Official Agricultural Chemists was held August 26 and 27, in Washington, D. C., under the presidency of Dr. Harvey W. Wiley. The members adopted official methods for determining phosphoric acid and moisture and for potash, but agreed not to select any single method for the determination of nitrogen as official. Details of the methods adopted and other papers of value will be found in the proceedings, published as Bulletin 12 of the Division of Chemistry, Department of Agriculture.

The Berichte of the German Chemical Society in Berlin grows apace; the volumes for 1885 contain 3,516 pages of contributions and 1,033 pages of abstracts, making a total of 4,549 pages. The society has ordered for 1886 an edition of 3,600 copies.

The Tōkyō Chemical Society (of Japan), organized in 1878 by the graduates of the Tōkyō University, has eighty-six members. The officers for 1886 are as follows: President, J. Sakurai; vice-presidents, T. Isono, M. Kuhara, N. Matsui, J. Takayama, G. Nakasawa; secretary, T. Uyeda; treasurers, T. Isido and T. Takamatsu. The members are exclusively Japanese (no foreigners). They meet twice a month and publish a journal in Japanese entitled Tōkyō Kagakkai Kaishi, edited by J. Sakurai. The eighth annual meeting was held April 10, 1886, at the botanical garden of the Imperial University, Tōkyō, and several interesting addresses and papers were read.

The Chemical Society of London now numbers fourteen hundred and fifty-nine fellows, thirty-one of these being honorary foreign members. During the year 1885–'86 one hundred and four papers were read to the society, a larger number than for several years past. The income for the year named amounted to £3,743. A subject catalogue of the library was recently published. The president for the current year is Dr. Hugo Müller, F. R. S., and the first vice-president is William Crookes, F. R. S

The twelve principal chemical societies of the world have nearly nine thousand members, distributed as shown in the following table (from H. C. Bolton's Address to N. Y. Academy of Sciences, March 15, 1886):

Deutsche chemische Gesellschaft zu Berlin	2,950
Society of Chemical Industry (England)	2,400
Chemical Society of London	1,500
Société chimique de Paris	560
Institute of Chemistry of Great Britain and Ireland	430
American Chemical Society	250
Society of Public Analysts (England)	180
Chemical Society of St. Petersburg	160
Associazione chimico-farmaceutica fiorentina	*200
Chemical Society of Tokio, Japan	83
Chemical Society of Washington, D. C	48
Association of Official Agricultural Chemists (United States of America)	17
Total	8,781

The centenary of the death of Scheele was commemorated on May 21, 1886, at the little town of Köping, Sweden, where he passed the last ten years of his life.

The prodigious activity in all departments of science obtaining in Germany is well illustrated by statistics of the meeting of "deutscher Naturforscher und Aerzte" held at Berlin in September, 1886. At this meeting no less than 5,651 persons took part, including 2,224 members, 1,931 associates, 1,496 women. Nearly every quarter of the globe was represented. North America by 42 persons, Japan by 16, India by 2, Egypt by 4, Australia by 4, and the Cape of Good Hope by 2. In the 30 sections into which the association is divided 522 lectures and 155 experimental demonstrations were held in 131 sessions. And those in attendance were invited to join 48 excursions.

The first meeting of this association was held in 1821, in Leipzig, and was attended by 13 persons; surely small beginnings are not to be despised.

NECROLOGY OF CHEMISTS, 1886.

Robert Alexander, a young English chemist of much promise, was killed instantly during the disastrous earthquake in Charleston, South Carolina, August 31, 1886. He was born March 18, 1863, near Birkenhead, England. His chemical education was chiefly in the analytical laboratory of Mr. G. W. Wigner, London. In January, 1886, he came to America, and in March went to Charleston, where he was engaged in developing a sanitary system when he met his death.

James Apjohn died June 2, 1886, at the advanced age of ninety-one. He held the chair of chemistry in the Royal College of Surgeons, Dub-

---

* Estimated. Many chemists are members of several societies; against this duplication may be set those chemists not connected with societies.

lin, from 1828 to 1850, and in the University from the latter date until 1874. He published many original memoirs on general physics and chemistry, and long held a foremost place as a theoretic and practical chemist.

H. A. BAYNE, professor of chemistry at the Royal Military College, Kingston, Ontario, died in September. He was a native of Nova Scotia. After graduating at Dalhousie College, Halifax, he studied chemistry with Bunsen and with Dumas. He had occupied the chair of chemistry at Kingston only since 1879.

APPOLINAIRE BOUCHARDAT, born in 1806, died April 7, 1886. He held since 1852 the chair of physics and organic chemistry in the College of Pharmacy of Paris. His investigations were chiefly in the field of pharmaceutical chemistry. He edited the "Annuaire de thérapeu, tique" from 1841 to 1885, the "Répertoire de pharmacie" from 1847 to 1872, and other important works. He was a member of many learned societies.

CARL BULK died in July, in the forty-first year of his age. He was a teacher in the Gewerbeschule in Barmen, and chemist to the Barmen Color Manufactory (Farben-Industrie), which makes a specialty of aniline dyes. Dr. Bulk was an original member of the German Chemical Society.

ALEXANDER MICHAILOWITSCH VON BUTLEROW died August 17, 1886. He was born September 6, 1828, in the province of Kasan, was at first a pharmaceutist, and then studied in the universities of Kasan and of Moscow. In 1854 he became professor of chemistry at Kasan-and in 1869 at the University of St. Petersburg, which chair he held at his death. His original researches were chiefly in organic chemistry, and gained for him a world-wide reputation.

HENRY SUGDEN EVANS, born at Islington, England, in 1830, died in Montreal in 1886. He was president of the Pharmaceutical Society and chief analyst to the Dominion of Canada. His publications were chiefly in pharmaceutical chemistry.

GOTTLIEB C. FAAS, a student of chemistry residing in Birmingham, Alabama, was killed by a locomotive October 3, in Pennsylvania.

FRANCESCO FILIPPUZZI, of Padua, died July 22, 1886. He was born in 1824, and after receiving his education in Austria was appointed professor of chemistry at the University of Padua, where he organized practical courses modeled on those of German universities. Though not eminent as an investigator he will long be remembered as a teacher by numerous grateful pupils. A fuller notice will be found in Ber. d. chem. Ges., XIX, 2941.

CHARLES FROEBEL died June 19, 1886. He was professor of analytical chemistry in the New York College of Pharmacy from 1872 to 1882.

FREDERICK GUTHRIE, born October 15, 1833, died October 21, 1886. From 1861 to 1867 he held the chair of chemistry and physics in the

Royal College, Mauritius, and since 1869 the chair of physics in the Royal School of Mines, London. His original contributions to both sciences were numerous and important. He founded in 1873 the Physical Society of London. Guthrie was also the author of several works on heat, electricity, and molecular physics.

FÉLIX LEBLANC died in Paris in May (?), 1886. He was for many years a co-laborer with Dumas, and at his death was connected with the École Centrale des Arts et Manufactures, in Paris. His studies on carbon monoxide are noteworthy. He was vice-president of the Society for Encouragement of National Industries, and member of many learned societies.

E. LINNEMANN, professor of chemistry at the University of Prague, died April 27, 1886. He was born in 1841. For an account of his scientific labors see Ber. d. chem. Ges., XIX, 1149.

FREDERIC MELSENS died in Brussels April 20, 1886, aged seventy-two years. He was an active investigator in both inorganic and organic chemistry throughout his life.

MOSER VON MOOSBRUCH, of Vienna, an agricultural chemist, died early in the year 1886.

WILLIAM RIPLEY NICHOLS died July 14, aged thirty-nine. He held the chair of general chemistry in the Massachusetts Institute of Technology, of which he was a graduate. He was the author of several text-books, and had a high reputation as an expert chemist in matters pertaining to hygiene.

MAX REIMANN died October 22, 1886. His investigations and writings for twenty years were chiefly in the line of industrial chemistry. For a biographical sketch see Ber. d. chem. Ges., XIX (1886).

G. F. HEINRICH SCHRÖDER, born in Munich, September 28, 1810, died May 12, 1885. A full biography will be found in Berichte der deutschen chemischen Gesellschaft, XVIII, R., 843.

CHARLES UPHAM SHEPARD, the well-known American mineralogist, died May 1, 1886, in his eighty-second year. His chemical work was chiefly in connection with minerals. A full notice will be found in the American Journal of Science, Vol. XXXI, 482 (June, 1886).

EDWARD SOLLY died April 2, 1886, in the sixty-seventh year of his age. He was a member of the Royal Society.

JULIUS ADOLPH STÖCKHARDT, the well-known agricultural chemist, died at Tharandt, Saxony, June 1, in his seventy-seventh year. He was the originator of the agricultural experiment stations now so common in Europe and elsewhere. His text-book, "Principles of Chemistry," did much to popularize the science. He was editor of many journals devoted to scientific agriculture. For a fuller sketch of his life see Popular Science Monthly for June, 1881.

MAGNUS TROILIUS died April 19, in Philadelphia, Pennsylvania. He was a graduate of the Royal School of Mines of Stockholm, and held for several years the position of chemist to the Midvale Steel

Works. His "Notes on the Chemistry of Iron" was published during the year.

Martin Websky, born July 17, 1824, died November 26, 1886. Since 1874 he has been professor of mineralogy at the University of Berlin, being the successor of Gustav Rose. His chemical work has been chiefly in connection with mining and mineralogy.

Clemens Zimmermann, instructor in chemistry at the University of Munich, died March 27, 1885. He was born March 4, 1856, in Munich, and was consequently only twenty-nine years of age. Dr. Zimmermann was one of the most active and promising young chemists of Germany. His researches on the atomic weight of uranium and in analytical chemistry are classical. A full biography (with portrait) will be found in Berichte der deutschen chemischen Gesellschaft, XVIII, R., 826.

Otto Ziurek died May 11, 1886. He was born in Upper Silesia June 19, 1821. His literary and practical works were chiefly in the field of pharmaceutical chemistry. (Ber. d. chem. Ges., XIX, 1316.)

BIBLIOGRAPHY OF CHEMISTRY, 1886.

Adriance, John S. Laboratory Calculations and Specific Gravity Tables. New York, 1886. 12mo.

Agrestini, A. Dosamento del biossido di zirconio in presenza di acido titanico. Nota preliminare. Urbino, 1886. 8vo.

Alessandri, P. E. Metodo sistematico per l' analisi chimica qualitativa delle sostanze inorganiche ed organiche e per le ricerche tossicologiche. Milano, 1885. 8vo.

Anderson, J. H. The Public School Chemistry: being at once a syllabus for the master and an abstract for the boy. Second edition, revised, corrected, and enlarged. London, 1886. 8vo.

Antrick, O. Ueber einige Verbindungen von Diacetonamin mit Aldehyden. Erlangen, 1886. 8vo.

Arendt, R. Leitfaden für den Unterricht in der Chemie. 2. durchgesehene und berichtigte Auflage. Hamburg, 1886.

Arth, G. Étude de quelques dérivés du menthol. Paris, 1885. 8vo.

Athanasesco, N. Recherches sur quelques sulfates basiques cristallisés. Paris, 1886. 4to.

Attfield, J. Chemistry, General, Medical, and Pharmaceutical, including the Chemistry of the British Pharmacopœia. 11th edition. London, 1885. 8vo.

Aveling, E. B. Chemistry of the non-metals. (Hughes's Matriculation Manuals.) London, 1886. 8vo.

Baessler, Arthur. Das Hydrochinon und seine Derivate. Inaug.-Diss. Berlin, 1886.

Baum, J. Oxydationsderivate des Coniins. Freiburg i. B., 1886. 8vo.

Bayley, T. Pocket-Book for Chemists, Chemical Manufacturers, etc. 4th edition. London, 1886.

Beck, P. Beitrag zur Kenntniss des Umbelliferons. Erlangen, 1886. 8vo.

Behrend, R. Versuche zur Synthese von Körpern der Harnsäurereihe. Leipzig, 1885. 8vo.

Beilstein, F. Handbuch der organischen Chemie. 2. völlig umgearbeitete Auflage. (In drei Bänden.) Lief. 9, 10, 11, 12, 13. Hamburg, 1885–'86. 8vo.

Bellenot, G. Ueber die Paranitrobenzoylessigsäure. München, 1885. 8vo.

Benedikt, R. Analyse der Fette und Wachsarten. Berlin, 1886. 8vo.

—— The Chemistry of Coal-Tar Colors. With special reference to their application to dyeing, etc. Translated and edited with additions by E. Knecht. London, 1886. Small post 8vo.

Berglund, E. Lärobok i qualitativ oorganisk analys. Lund, 1885.

Bergmann, H. Chemisch-technisches Receptbuch für die gesammte Metallindustrie. Wien, 1886. 8vo.

Bericht über die vierte Versammlung der freien Vereinigung bayrischer Vertreter der angewandten Chemie zu Nürnberg am 7. u. 8. August 1885. Herausgegeben von A. Hilger und R. Kayser. Berlin, 1886. 8vo.

Bernays, A. J. Notes on Analytical Chemistry. 2d edition. London, 1886. 8vo.

Bernstein, M. Ueber die Phenyl- und Kresylester der Bernsteinsäure und anderer Dicarbonsäuren, ihre Derivate und Umsetzungen. Freiburg i. B., 1886. 8vo.

Bernthsen, A. Zur Frage nach der Constitution der Safranine und verwandter Farbstoffe. Heidelberg, 1886.

Bersch, J. Die Essig-Fabrikation. Eine Darstellung der Essig-Fabrikation nach den älteren und neueren Verfahrungsweisen, der Schnell-Essig-Fabrikation, etc. 3. erweiterte und verbesserte Auflage. Wien, 1886.

Berthelot, M. Les origines de l'alchimie. Paris, 1885. 8vo.

Berthelot et E. Jungfleisch. Traité élémentaire de chimie organique. 3^{e} édition. Paris, 1886. 2 vols. 8vo.

Bertoni, G. Contributo allo studio dell' eterificazione per doppia decomposizione. Formazione dell' etere nitroso dell' alcool allilico. Roma, 1885. 8vo.

Bertoni, G. Ricerche nuove sull' eterificazione per doppia decomposizione. Roma, 1886. 8vo.

Betänkande och förslag till stadga angäende eftersökande och bearbetande af stenkolsfyndigheter, afgifna d. 13 Juni 1885 af dertill i nåder förordnade komiterade. Stockholm, 1885. 8vo.

Biedermann, A. Ueber den Thiophenaldehyd und seine Derivate. Ueber Thienylmercaptan. Versuche zur Synthese in der Thiophenreihe. Göttingen, 1886. 8vo.

Birnbaum, K. Kurzes Lehrbuch der landwirthschaftlichen Gewerbe. Chemische Technologie landwirthschaftlicher Producte. Band I. Die Fabrikation der Stärke, des Dextrins, des Stärkezucker, der Zuckercouleur, das Brotbacken und die Rübenzuckerindustrie. Braunschweig, 1886. 8vo.

—— Leitfaden der chemischen Analyse. 5. verbesserte Auflage. Leipzig, 1886. 8vo.

Bizio, G. L' applicazione del nitrato d' argento all' esame chimico degli olii. Venezia, 1885.

Black, James G. Chemistry for the Gold Fields, including Lectures on the Non-metallic Elements, Metallurgy, and the Testing and Assaying of Metals, Metallic Ores, and other minerals by the Test-tube, the Blow-pipe, and the Crucible. Dunedin [New Zealand], 1886.

Blas, C. Traité élémentaire de chimie analytique. Tome I. Analyse qualitative par la voie sèche ou analyse au chalumeau. 2^{e} édition, augmentée. Louvain, 1886. 8vo.

Blomstrand, C. W. Kort Lärebok i o-organisk kemi. 3. uppl. Lund, 1886. 8vo.

—— Minnesteckning öfver C. W. Scheele pa 100. arsdagen af hans död. Stockholm, 1886. 8vo.

Bloxam, C. L. Laboratory Teaching, or Progressive Exercises in Practical Chemistry. 5th edition. London, 1885. 8vo.

Bolton, H. Carrington. Recent Progress in Chemistry. An address prepared at the request of the New York Academy of Sciences and read March 15, 1886. New York. 8vo.

Bonna, A. Recherches sur la phénylparatoluidine. Genève, 1886. 8vo.

Bork, H. Die Chemie. Leitfaden für den chemischen Kursus in der Sekunda des Gymnasiums. Methodisch bearbeitet. Paderborn, 1886. 8vo.

Bourgoin, E. Alcalis organiques artificiels. Partie 1^e. Série grasse. Paris, 1886. 8vo.

Boussingault. Agronomie, chimie agricole, et physiologie. 3^e édition, revue et considérablement augmentée. Paris, 1886. 2 vols. 8vo.

Brant, William T., and William H. Wahl. The Techno-chemical Receipt Book. Philadelphia and London, 1886.

Braun, F. Untersuchungen über die Löslichkeit fester Körper und die den Vorgang der Lösung begleitenden Volum- und Energieänderungen. München, 1886. 8vo.

Breslauer, M. Die chemische Beschaffenheit der Luft in Brandenburg a. H. Ein Beitrag zur Kenntniss der quantitativen Zusammensetzung der atmosphärischen Luft. Berlin, 1886. 8vo.

Bresson, —. Les aciers. Paris, 1886.

Brieger, L. Untersuchungen über Ptomaine. Drei Theile. Berlin, 1886. 8vo.

Brunner, H., et E. Chuard. Sur la présence de l'acide glyoxylique dans les végétaux. Lausanne, 1886. 8vo.

Buckeridge, H. L. Chemical Student's Manual for the Lecture-Room and Laboratory, embracing non-metals, the analysis of simple salts, historical and much other useful memoranda. London, 1886.

Bulletin du laboratoire provincial de chimie agricole à Roulers. Bruges, 1886. 8vo.

Bunsen, R. Flammenreactionen. 2. Aufl. Heidelberg, 1886. 8vo.

Burstert, H. Ueber in Kern gechlorte Derivate des Meta-Xylols. Freiburg i. B., 1886. 8vo.

Бутлеровъ, А. М. Основныя Понятія Химіи. С.-Петербургъ, 1886.

Bulletin of the Chemical Society of Washington. No. 1. (January, 1884, January, 1886.) Washington [D. C.], 1886.

Calman, Albert. Ueber einige Derivate des Benzoylessigäthers. Inaug.- Diss. (Erlangen). Mainz, 1885.

Capaun-Karlowa, C. F. Chemisch-technische Specialitäten und Geheimnisse mit Angabe ihrer Zusammensetzung nach den bewährtesten Chemikern. Alphabetisch zusammengestellt. 2. vollständig umgearbeitete vermehrte und verbesserte Auflage. Wien, 1886. 8vo.

Carruthers, T. G. The cause of electricity, with remarks on chemical equivalents. Benares, 1886.

Casali, A. Il passato, il presente e l' avvenire della chimica: discorso inaugurale alla solenne apertura degli studi nella libera università di Ferrara. Ferrara, 1886. 8vo.

—— Ragguagli sui lavori eseguiti nel laboratorio chimico agrario di Bologna. Bologna, 1885. 16mo.

Catalogue (A) of the Library of the Chemical Society, arranged according to subjects, with indexes containing authors' names and subjects. London, 1886. 8vo.

Cavazzi, A. Azione dell' idrogene fosforato gassoso sul tricloruro di oro sciolto nell' etere, nell' alcool o nell' acqua. Bologna, 1885. 8vo.

—— Azioni del gas idrogene fosforato sopra l' acido solforico. Bologna, 1886. 4to.

—— Azione del solfuro di carbonio sopra alcuni metalli. Bologna, 1886. 4to.

—— Metodo per preparare il protocloruro di rame; sopra un miscuglio esplosivo. Bologna, 1886. 4to.

Cazeneuve, P. La coloration des vins par les couleurs de la houille. Méthodes analytiques et marche systématique pour reconnaître la nature de la coloration. Paris, 1886. 12mo.

Centenaire de Chevreul, 31 août 1886. Principaux travaux de Chevreul. Paris, 1886. 8vo.

—— 31 août 1886. Discours prononcés au Muséum d'histoire naturelle. Paris, 1886. 4to.

Centner, B. Die Praxis der Bleicherei und Appretur, Baumwolle, Leinen, Jute im Rohzustande, sowie als Garn und Gewebe. Leipzig, 1886. 8vo.

Cesaro, G. Mémoire sur la reproduction de quelques phosphates de fer naturels par l'action de l'oxygène de l'air sur une solution ferreuse acide. Liège, 1886. 8vo.

Chemistry. A Manual for Beginners. "Forti et fideli nihil difficile." London, 1885. Roy 24mo.

Chevy, E. De l'acide fluorhydrique et de son emploi en thérapeutique. Paris, 1885. 8vo.

Christensen, Odin T. Bidrag til manganets og fluorets chemi. Kjøbenhavn, 1886. 8vo.

Ciamician, C., e P. Silber. Studi sui composti della serie del pirrolo. Parte 9: Sull' azione dell' acido nitrico sul pirilmetilchetone. Roma, 1885.

Classen, Alexander. Friedrich Mohr's Lehrbuch der chemisch-analytischen Titrirmethode. Sechste umgearbeitete und vermehrte Auflage. Berlin, 1886. 8vo.

—— Analyse électrolytique quantitative. D'après la 2e édition allemande par C. Blas. Louvain, 1886. 8vo.

Claësson, P. Öfver radikalen cyanur, normala cyanurföreningar och substituerada cyaniders konstitution. Om rhodaninsyra, melamin och melaminföreningar. 5 Abh. Stockholm, 1885. 8vo.

Coit, J. M. Chemical Arithmetic. Boston, 1886.

Collischonn, Friedrich. Ueber die Halogenadditionsproducte der Propylchinolinhalogenüre und ein daraus gewonnenes Monobromchinolin. Inaug.-Diss. Freiburg i. B., 1886.

Coloriano, A. Recherches sur quelques arséniates cristallisés. Paris, 1886. 4to.

Conférences faites à la Société chimique de Paris en 1883, 1884, 1885, 1886 par Wurtz, Pasteur, Friedel, Scheurer-Kestner, Grimaux, Duclaux, Moissan, Raoult, Schutzenberger. Paris, 1886. 8vo.

Cooke, J. Parsons. Descriptive List of Experiments on the Fundamental Principles of Chemistry. Cambridge, 1886.

—— Elements of Chemical Physics. 4th edit. London, 1886. Roy. 8vo.

Cooley, Le Roy C. A Guide to Elementary Chemistry for Beginners. New York, 1886.

Cleef, G. Doyer van. Leerboek der scheikunde. Haarlem, 1886. Roy. 8vo.

Clerc, A. Chimica popolare illustrata. Milano, 1886. 8vo.

Cleve, P. T. C. W. Scheele. Minnesblad på 100 arsdagen af hans död. Köping, 1886. [With Scheele's portrait.]

—— Lärebok i kemiens grunder. 3e. heft. Lärebok i o-organisk och organisk kemi för begynnare. Stockholm, 1886. 8vo.

Cloez, Ch. Recherches sur les dérivés chlorés de l'acétone. Thèse presenté à la Faculté des sciences de Paris. Paris, 1886.

Cochenhausen, E. von. Die Reinigung des Wassers, mit Berücksichtigung seiner Verwendung in der Textilindustrie, nebst Beiträgen zur technischen Wasseranalyse. Inaug.-Diss. Chemnitz, 1886. 4to.

Cornelius, H. Ueber die Synthese des Dioxyphenylessigsäure und des Orcins. München, 1886. 8vo.

Courant, E. Ueber Versuche zur Darstellung der Dithioschwefelsäure und Beiträge zur Kenntniss der Phenylazoacetessigäthers. (Inaug.-Diss.) Breslau, 1886. 8vo.

Crookes, W. On Radiant-Matter Spectroscopy. Part II. Samarium. London, 1886. 8vo.

—— Select Methods in Chemical Analysis (chiefly Inorganic). Second edition, rewritten and greatly enlarged. London, 1886. 8vo.

Cross, C. F., and E. J. Bevan. Cellulose, being a Short Account of the Chemical Properties of Typical Members of the Cellulose Group with reference to their natural history. Edited by W. R. Hodgkinson. London, 1886.

Curry, G. Ueber die Zersetzung des Natrium-Aluminats durch Wasser. (Inaug.-Diss.) Breslau, 1886. 8vo.

Curtins, Th. Diazoverbindungen der Fettreihe. München, 1886. 8vo.

Curtman, C. O. Dr. F. Beilstein's Lessons in Qualitative Chemical Analysis. Second edition. St. Louis, Missouri, 1886.

Daccomo, G. Sul triclorometanitro- e sul triclorometamido fenolo. Torino, 1885.

Δαμβέργης, A. K. *Νοθεύσεις ἐδωδιμῶν καὶ ποτῶν καὶ ἐξέλεγξις αὐτῶν. Ἐν Ἀθήναις.* 1887.

Dammer, O. Chemisches Handwörterbuch zum Gebrauche für Chemiker, Techniker, Aertze, Pharmaceuten, Landwirte, Lehrer und für Freunde der Naturwissenschaft. 2. verbesserte Auflage. (In 12 Lieferungen.) I. Lieferung. 8vo. Stuttgart, 1886.

Davy, E. W. On the Nitroprussides of the more important Bases of Opium. Dublin, 1886. 4to.

Denigés, G. Formules générales pour servir au calcul rapide des analyses élémentaires. Bordeaux, 1885. 8vo.

Deutsche Chemiker-Zeitung. Centralblatt für die chemische Praxis und öffentliche Gesundheitspflege. Unter Mitwirkung bewährter Fachgelehrten herausgegeben und redigirt von Breslauer. Berlin, 1886. 4to. [Weekly.]

Dessaignes, V. Travaux de chimie organique. Precédés d'une notice biographique d'A.-R. Dessaignes. Vendôme, 1886. 8vo.

Dircks, V. Veiledning i kvalitativ analyse til brug ved landbrugsskoler. 2den omarbeidede udgave. Christiania, 1886. 8vo.

Ditte, A. Kurzes Lehrbuch der anorganischen Chemie gegründet auf die Thermochemie. Deutsch von H. Böttger. Berlin, 1886. 8vo.

Dittmar, W. Analytical Chemistry. New edition. London, 1886. 12mo.

Dobreff, N. Recherches sur les acides dibenzyldicarbonique et diphtalique. Genève, 1886. 8vo.

Doijer van Cleef, G. Leerboek der scheikunde. Haarlem, 1886. 8vo.

Dragendorff. Manuel de toxicologie. Deuxième édition française, publiée avec le concours de l'auteur par L. Gautier. Paris, 1886.

Dudley, William L. Iridium. (From Mineral Resources of the United States.) Washington, 1885. 8vo.

Dufour, J. Recherches sur l'amidon soluble. Lausanne, 1886. 8vo.

Dühring, E., and M. Neue Grundgesetze zur rationellen Physik und Chemie. II. Folge, enthaltend fünf neue Gesetze, nebst Beleuchtung der nach der ersten Folge erschienenen Contrefaçons und Nachentdeckungen. Leipzig, 1886. 8vo.

Dupré, Auguste, and H. Wilson Hake. A Short Manual of Chemistry. 2 parts London, 1886.

Durand-Claye, C.-L. Chimie appliquée à l'art de l'ingenieur. Paris, 1885. 8vo.

Dürkopf, E. Zur Kenntniss des Aldehyd-collidins. Kiel, 1886. 8vo.

Dyckerhoff, O. Beiträge zur Kenntniss des Orthocymols. (Orthomethylnormalpropylbenzol.) Freiburg i. B., 1886. 8vo.

Ehestädt, P. Abbau der Laurinsäure bis zur Caprinsäure. Freiburg i. B., 1886. 8vo.

Ehrhardt, O. Ueber die Bestimmung der specifischen Wärme und der Schmelzwärme bei hohen Temperaturen. Giessen, 1885. 8vo.

Ellis, G. E. R. An Introduction to Practical Organic Analysis. Adapted to the requirements of the first M. B. examination. London, 1885. 8vo.

—— Papers in Inorganic Chemistry. Part I. Non-metals. Part II. Non-metals and Metals. London, 1886.

Encyclopédie chimique, publié sous la direction de Frémy. Paris, 1886. 8vo.

Tome II: Métalloïdes. Complément. Partie 2. Diamants, par E. Boutan.

Tome III: Métaux. Cahier 8. Molybdène, vanadium et titane, par Parmentier.

Tome V: Applications de chimie inorganique. Sect. 2. Industries chimiques. Partie II. Métallurgie. Aciers, par Bresson.

Tome VII: Chimie organique. Fasc. 4. Éthers, par Leidié.

Tome VIII. Chimie organique. Fasc. 6. Section 1. Alcalis organiques artificiels, par E. Bourgoin. Partie 1. Série grasse.

Tome X: Applications de chimie organique. Analyse chimique des végétaux, par G. Dragendorff. Traduit par F. Schlagdenhauffen.

ENEBUSKE, C. Om platinas metylsulfinbaser. Akademisk afhandling. Lund, 1886 4to.

ENGLER, C. Das Erdöl von Baku. Geschichte, Gewinnung, Verarbeitung. Stuttgart, 1886.

ERCK, E. Beiträge zur Kenntniss des Brasilins. Einwirkung von Cyansilber auf Monochloressigsäurechlorid. Göttingen, 1886. 8vo.

ERLENMEYER, E. Lehrbuch der organischen Chemie. Theil II. Die aromatischen Verbindungen, von R. Meyer und H. Goldschmidt. Leipzig, 1886. 8vo.

ERRERA, L. Pourquoi les éléments de la matière vivante ont-ils des poids atomiques peu élevés? Messina, 1886. 8vo.

—— Sur l'existence du glycogène dans la levure de bière. (Paris?), 1885.

FABRE, J.-H. Chimie élémentaire. 9e édit. Paris, 1886. 18mo.

FEER, A. Ueber einige Derivate des Carbostyrils und des 1-oxypyridins. Ueber Methylhydrochinolin. München, 1886. 8vo.

FENNEL, CHARLES T. P. Principles of General Chemistry, pursuant to a course by Adolphus Fennel. Cincinnati, 1886.

FERNANDEZ Y CHÁVARRI, PEDRO. Ueber Arsen-Vanadinsäure. Inaug.-Diss. Halle a. S., 1886.

FILETI, M. Ricerche sull' ortoisopropilfenol. Torino, 1886. 8vo.

FRÄNKEL, N. Przyczynek do Znajomości tiodwufenilaminu opracowal. Kraków, 1886.

FRANKLAND, E., and F. R. JAPP. Inorganic Chemistry. Philadelphia, 1885. 8vo.

FRÉMY, E. Chimie végétale. La Ramie. Paris, 1886.

FRESENIUS, H. Chemische Untersuchung der Schützenhofquelle zu Wiesbaden. Wiesbaden, 1886. 8vo.

FRESENIUS, R. Chemische Analyse der Marienquelle zu Oelheim. Wiesbaden, 1886.

—— Neue chemische Untersuchung des Kochbrunnens zu Wiesbaden und Vergleichung der Resultate mit den 1849 erhaltenen. Wiesbaden, 1886.

—— Tratado de análisis química cuantitativa. Valencia, 1886.

FRIEDEL, CH. Cours de chimie organique. Partie I. Série grasse. Paris, 1886.

GABBA, L. Sull' indirizzo dell' insegnamento nelle scuole di chimica applicata all' industria: relazione alla Società d' incoraggiamento d' arti e mestieri in Milano. Milano, 1886. 8vo.

GANGE, C. Lehrbuch der angewandten Optik in der Chemie. Spectralanalyse, Mikroskopie, Polarisation. Praktische Anleitung zu wissenschaftlichen und technischen Untersuchungen mit Hülfe optischer Instrumente, nebst theoretischer Erklärung der beobachteten Erscheinungen. Mit Tabellen der Emissions- und Absorptions-Spectra in Wellenlängen, zahlreichen Abbildungen im Text und 24 Spectraltafeln. Braunschweig, 1886. 8vo.

GALLINEK, A. Ueber die Sulfurirung der Phenylhydrazine. (Inaug.-Diss.) Breslau, 1886. 8vo.

GARREAU, L. Des attractions moléculaires que les gaz chimiquements inertes exercent entre eux et de leurs effets comme agents de dissociations. Lille, 1886. 8vo.

GAUTIER, A. Sur les alcaloïdes dérivés de la destruction bactérienne, ou physiologique des tissus animaux. Ptomaïnes et leucomaïnes. Paris, 1886. 8vo.

GAY, J. Sur l'absorption du bioxyde d'azote par les sels de protoxyde de fer. Paris, 1885. 4to.

GAYON et DUPETIT. Recherches sur la réduction des nitrates par les infiniment petits. Nancy, 1886. 8vo.

GÉRARDIN, A. Chimie organique. 3e année. Ouvrage rédigé conformément au programme officiel du 3 août 1881 et aux instructions ministérielles du 18 octobre 1881. Paris, 1886. 18mo.

GERLACH, G. TH. Ueber Alkohol und Gemische aus Alkohol und Wasser. Wiesbaden, 1885. 8vo.

Gilkinet, A. Traité de chimie pharmaceutique. Liège, 1885. 8vo.

Gladysz. Sur une nouvelle méthode de régénération du soufre des marcs de soude. Marseille, 1885. 8vo.

Godefroy, L. Recherches relatives à l'action du chlore sur un mélange de dichromate de potassium et d'alcool. Paris, 1886. 8vo.

Goppelsroeder, Friedrich. Ueber die Darstellung der Farbstoffe sowie über deren gleichzeitig Bildung und Fixation auf den Fasern mit Hilfe der Elektrolyse. Reichenberg, 1885.

Gossels, W. Die Nitrate des Thier- und Pflanzenkörpers. Berlin, 1886.

Gossart, J. Le contrôle chimique de la fabrication du sucre. Lille, 1886. 8vo.

Grämer, G. Ueber die Oxydationsprodukte des Chinolaethylbromids. Freiburg i. B., 1886. 8vo.

Grandeau, H. De l'action de sulfate de potasse à température élevée sur les phosphates métalliques. Paris, 1886. 4to.

Grandval, A., et H. Lajoux. Nouveau procédé pour la recherche et le dosage rapide de faibles quantités d'acide nitrique dans l'air, l'eau, le sol, etc. Reims, 1886. 8vo.

Grimaux, E. Chimie organique élémentaire. 4e édition refondue. Paris, 1885. 8vo.

Grollo, A. Nozioni di chimica secondo le teorie moderne. 2a ediz. Messina, 1885. 8vo.

Groshans, J. A. Sur quelques analogies nouvelles entre les températures d'ébullition et de fusion. Leide, 1885. Roy. 8vo.

Guareschi, I. Nuove ricerche sulla naftalina: nota. Torino, 1885. 8vo.

—— Sulla γ dicloronaftalina e l' acido ortomonocloroftalico. Torino, 1886. 8vo.

Gucci, P. Prodotti della reazione fra la *m*-fenilendiamina ed il solfuro di carbonio. Pisa, 1886. 8vo.

—— Separazione del nichelio dal cobalto. Pisa, 1886. 8vo.

Guerin, G Origine et transformations des matières azotées chez les êtres vivants. Paris, 1886. 8vo.

Guillaume, E. Fabrication de l'amidon, description des diverses opérations. Paris, 1886. 8vo.

Gusenburger, H. Die Untersuchungen der Schmieröle und Fette mit specieller Berücksichtigung der Mineralöle. Luxemburg, 1886.

Haarmann, Rudolph. Ein Beitrag zur Kenntniss der Isozuckersäure. Inaug.-Diss. Berlin, 1886.

Häller, M. Ueber einige Derivate des Metaamidoanthrachinons. Freiburg i. B., 1886. 8vo.

Hagemann, G A Studier over nogle Molekulvolumen. Kjøbenhavn, 1886. 8vo.

—— Studien über das Molekularvolumen einiger Körper. Aus dem dänischen übersetzt von P. Kundsen. Berlin, 1886.

Haller, Stephan. Beiträge zur Kenntniss des Pseudocumidins. Inaug.-Diss. (Freiberg). Berlin, 1886.

Hammarsten, O. Kortfatted lärebok i farmaceutisk kemi med hänsyn till Svenska farmakopens preparat jemte handledning i titreringsanalysen. Afd. 1. Upsala, 1886. 8vo.

Hand, A. Beiträge zur Kenntniss einiger Benzolderivate. Jena, 1886. 8vo.

Handbuch der chemischen Technologie. Herausgegeben von P. A. Bolley; fortgesetzt von K. Birnbaum. Band VI. Braunschweig, 1886. 8vo.

Handwörterbuch (Neues) der Chemie. Bearbeitet und redigirt von H. von Fehling u C. Hell. Braunschweig, 1885–'86. Lieferungen 50, 51, 52, 53, 54, 55.

Hartley, W. N. The Absorption Spectra of the Alcaloids. London, 1886. 4to.

Hartmann, F. Beiträge zur Kenntniss des Paramycylphenylketons. Freiburg i. B, 1886. 8vo.

—— Das Verzinnen, Verzinken, Vernickeln, Verstählen und das Ueberziehen von Metallen mit anderen Metallen überhaupt. 2. verbesserte und sehr vermehrte Auflage. Wien, 1886.

Harz, Kurt. Ueber die Propylaldehyd und den drei isomeren Toluidinen entstehenden Chinolinabkömmlinge. Inaug.-Diss. (Wurzburg). München, 1885.

Haushofer, K. Beiträge zur mikroskopischen Analyse. I. Ueber die Anwendung der concentrirten Schwefelsäure in der mikroskopischen Analyse. München, 1886. 8vo.

—— Ueber einige mikroscopisch-chemische Reactionen. München, 1886. 8vo.

Heaton, C. W. Experimental Chemistry, founded on the work of J. Stöckhardt. New edition, revised. London, 1886. 8vo.

Hedin, S. G. Om pyridinens platinabaser. Akad. afhandl. Lund, 1886. 4to.

Hegel, Sigmund. Synthese von Indolderivaten. Inaug.-Diss. (Erlangen). Würzburg, 1885.

Heinzerling, C. Abriss der chemischen Technologie mit besonderer Rücksicht auf Statistik und Preisverhältnisse. Kassel, 1886, 8vo.

—— Die Gefahren und Krankheiten in der chemischen Industrie und die Mittel zu ihrer Verhütung und Beseitigung. Heft 6 and 7. Halle, 1886. 8vo.

Heinzerling, C. Phosphorfabrication, Zündhölzer und Explosivstoffe. Halle, 1886. 8vo.

Hélène, M. La poudre à canon et les nouveaux corps explosifs. 2e édition. Paris, 1886. 18mo.

Henninger, A. Sur quelques dérivés de l'erythrite et les formines des alcools polyatomiques. Paris, 1886.

Henrici, J. Kleiner Grundriss der Elementar-Chemie. Leipzig, 1886. 8vo.

Hesekiel, A. Die Pyridinbasen in der chemischen Literatur. Hamburg, 1886.

Heurich, F. Tabellen zur qualitativen chemischen Analyse. Wiesbaden, 1886. 8vo.

Heusel, J. Eine neue Theorie der Lebens-Chemie in typischen Figuren veranschaulicht. Für Aerzte, Apotheker und Chemiker. Christiania, 1886. 8vo.

Hjelt, E. Die intramoleculare Wasserabspaltung bei organischen Verbindungen. Monographisch dargestellt. Helsingfors und Berlin, 1886. 4to.

Hjortdahl, T. Begyndelsesgrundene af den kvalitative Analyse. Kortfattet veiledning for de studerende ved Universitets Laboratorium. 2den gjennemsude Udgave. Christiania, 1886. 8vo.

Hobein, F. Ueber Benzanhydroisodiamidotoluol und zwei gebromte Derivate. Inaug.-Diss. Göttingen, 1885.

Hoff, H. J. van 't. Bijdrage tot de kennis der inaktieve appelzuren van verschillende afkomst. Rotterdam, 1886. 8vo.

Hoffa, A. Die Natur des Milzbrand-Giftes. Wiesbaden, 1886.

Hofmann, A. W. Ueber die Einwirkung des Ammoniaks und der Amine auf den Sulfocyanursäuremethylaether und das Cyanurchlorid. Normale alkylirte Melamine. Ueber die den Alkylcyanamiden entstammenden alkylirten Isomelamine und über die Constitution des Melamins und der Cyanursäure. 2 Abhandlungen. Berlin, 1885. 8vo.

——. Zur Geschichte der Cyanursäureäther. Nachträgliches über das chlorirte Methylisocyanurat und die Constitution der Cyanursäuren. Zwei Abhandlungen. Berlin, 1886.

Hommage à Monsieur Chevreul à l'occasion de son centenaire. Paris, 1886. 4to.

Hüetlin, E. Beiträge zur Kenntniss des Papaverins. Freiburg i. B., 1886.

Hugounenq, L. Les alcaloïdes d'origine animale. Paris, 1886. 8vo.

Hummel, J. J. The Dyeing of Textile Fabrics. London, 1885. 12mo.

Husband, H. A. Aids to the Analysis of Food and Drugs. London, 1885. 12mo.

Industries. Journal of Engineering, Electricity, and Chemistry for the manufacturing trades. Manchester. 4to.

Isbert, A. Zur Kenntniss des Acetessigäthers und einiger seiner Abkömmlinge. Jena, 1886. 8vo.

Israel, A. Ueber den Propiopropionsäureäthyläther. Jena, 1886.

Iwig, Friedrich. Ueber Oxydation des Mannits mit übermangansaurem Kalium in alkalischer und saurer Lösung und über trockene Destillation von essigsaurem Silber. Inaug.-Diss. Würzburg, 1884.

Jacobsen, O. Die Glycoside. Breslau, 1886. 8vo.

Jacoby, Otto. Beitrag zur Kenntniss der kohlenstoffreicheren aliphatischen Verbindungen. Inaug.-Diss. Berlin, 1886.

Jagnaux, R. Traité de chimie générale, analytique et appliquée. 4 vols. Paris, 1886. 8vo.

Jago, W. The Chemistry of Wheat, Flour, and Bread, and Technology of Bread-Making. London, 1886.

Joannis, A. Note sur les oxydes de cuivre. Bordeaux, 1885. 8vo.

Jochum, Paul. Ueber die Einwirkung des unterschwefligsauren Natrons auf Metallsalze. Berlin, 1885.

Johnston, G. Stillingfleet. Elementary Nitrogen. London, 1885.

Joly, A. Cours élémentaire de chimie et de manipulations chimiques. Paris, 1886. 12mo.

Jorissen, A. Les phénomènes chimiques de la germination. Liège, 1886. 8vo.

Jungfleisch, E. Manipulations de chimie. Guide pour les travaux pratiques de chimie de l'École supérieure de pharmacie de Paris. Partie 2. Paris, 1885. 8vo.

Kahn, M. Ueber die Einwirkung von Normalbutylaldehyd auf Anilin bei Gegenwart rauchender Salzsäure. Erlangen, 1886. 8vo.

Kaiser, A. Ueber Mononitroderivate der Para- und Metaacetamidbenzoesäure sowie deren Reductionsproducte (Anhydrosäuren). Göttingen, 1886. 8vo.

Kees, Alfred. Ein Beitrag zur Kenntniss des Helicins. Inaug.-Diss. Berlin, 1886.

Keyser, C. J. Metallerna och deras Föreningar. Haefte 1. Stockholm, 1886. 8vo.

Klement, C., et A. Renard. Réactions micro-chimiques à cristaux et leurs applications en analyse qualitative. Bruxelles, 1886. 8vo.

Kleyer, A. Die Chemie in ihrer Gesamtheit und die chemische Technologie der Neuzeit. Bearbeitet nach eigenem System unter Mitwirkung der bewährtesten Kräfte. Mit zahlreichen Illustrationen. Stuttgart, 1886. 8vo.

Knorr, L. Ueber die Bildung von Kohlenstoff-Stickstoff-Ringen durch Einwirkung von Amin-und Hydrazinbasen auf Acetessigester und seine Derivate. Erlangen, 1885. 8vo.

Koehler, O. Beitrag zur Kenntniss der Paraxylenderivate. Inaug.-Diss. Göttingen, 1885.

Kollrepp, A. Ueber einige Derivate der beiden gechlorten Para-Nitrophenole. Halle, 1886.

Koninck, L. L. de, et E. Prost. Exercices d'analyse chimique qualitative. Liège, 1886. 8vo.

Kopp, H. Aus der Molecular-Welt. Eine Gratulationsschrift an Robert Bunsen. 3. Auflage. Heidelberg, 1886. 8vo.

——. Die Alchemie in älterer und neuerer Zeit. Ein Beitrag zur Culturgeschichte. 2 vols. Heidelberg, 1886. 8vo.

—— Mémoire sur les volumes moléculaires des liquides. Remarques sur un mémoire de Bartoli publié dans les Annales de chimie et de physique, 6ᵉ série, mars 1886. Avec un avant-propos expliquant pourquoi ce mémoire n'est pas publié dans les mêmes annales, et contenant quelques remarques concernant "Les origines de l'alchimie" de Berthelot et les "Beiträge zur Geschichte der Chemie" de H. Kopp. Heidelberg, 1886. 8vo.

Κοπέλλα, Ανδρ. *Χρωματολογία ἤτοι περὶ φύσεως, ὀνομασίας καὶ τῆς χημικῆς συστάσεως των χρωμάτων παρά τε τοῖς αρχαίοις καὶ τοῖς νεωτέροις.* Ἐν Ἀθήναις, 1886.

Koppeschaar, W. F. Leerboek der Chemie en van eenige harer Toepassingen. Deel II. Anorganische Chemie. Metalen. 4. druck. Leiden, 1886.

Kramer, T. Ueber Nitro- und Amido-Derivate des Chinolins. Freiburg i. B., 1886. 8vo.

Krätzer, H. Chemische Unterrichts-Briefe. Für das Selbst-Studium Erwachsener. Mit besonderer Berücksichtigung der neuesten Fortschritte der Chemie und unter Mitwirkung hervorragender Fachmänner und Gelehrten herausgegeben. I. Cursus: Die anorganische Chemie. Leipzig, 1886. 8vo.

—— II. Cursus: Die organische Chemie, oder die Chemie der Kohlenstoffverbindungen. Mit besonderer Berücksichtigung der chemischen Technologie. Unter Mitwirkung der Herren Landerer, Herrburger, W. A. Herrmann, Alwin Engelhardt, F. Eichbaum, etc., bearbeitet. Leipzig, 1886. 8vo.

—— Wasserglas und Infusorienerde, deren Natur und Bedeutung für Industrie, Technik und die Gewerbe. Wien, 1886.

Kreusser, H. Das Eisen, sein Vorkommen und seine Gewinnung. Weimar, 1886.

Krobatin, A. von. Lehrbuch der Chemie für die k. k. Cadeten-Schulen. Im Auftrage der k. k. Reichs-Kriegs-Ministeriums verfasst. Wien, 1886. 8vo.

Krohn, C. W. Ueber einige Derivate des Monochlorpseudocumols. München, 1885. 8vo.

Krukenberg, C. F. Compendio di analisi chimico-medico. Trad. c. note di D. Gibertini. Parma, 1885. 8vo.

Krüss, G. Untersuchung über das Atomgewicht des Goldes. München, 1886. 8vo.

Kunz, Hermann. Beiträge zur Kenntniss der chemischen Bestandtheile der Atropa belladonna und des Extractum belladonnæ. Inaug.-Diss. Freiburg, 1886.

Kurzgefasste Anleitung zur qualitativen chemischen Analyse. Giessen, 1886.

Labat, A. Du degré de certitude de l'analyse des eaux. Paris, 1885. 8vo.

Ladureau, A. Recherches sur le ferment ammoniacal. Lille, 1885. 8vo.

Landolt, H. Ueber die Zeitdauer der Reaction zwischen Jodsäure und Schwefligersäure. Berlin (Mitth. Akad.), 1886. 8vo.

Lange, O. Ueber Methylderivate des Pyridins. Ein Beitrag zur Kenntniss der Pyridinbasen. Kiel, 1886. 8vo.

Langguth, F. O. Beiträge zur Kenntniss der Parabibromcymolsulfonsäure. Freiburg i. B., 1886. 8vo.

Langlebert, J. Química. Trad. de la última edicion francesa por L. Elizage. Paris, 1886. 12mo.

Larbalétrier, A. Les engrais chimiques et les matières fertilisantes d'origine minérale; emploi pratique des engrais chimiques. Paris, 1885. 18mo.

Larsen, E. Ueber Paraxylylphenylketon und seine Ueberführung in Betamethylanthracen. Freiburg i. B., 1886. 8vo.

Larsson, A. Nagot om den kemiska industrien i Sverige. Helsingborg, 1886. 8vo.

László, E. D. Chemische und mechanische Analyse ungarländischer Thone mit Rücksicht auf ihre industrielle Verwendbarkeit. Ungarisch und Deutsch. Budapest, 1886. 8vo.

Lawes, Sir J. B., and J. H. Gilbert. On the Valuation of Unexhausted Manures. London, 1886.

Leclerc, A. Recherches sur la déperdition de l'ammoniaque dans les sols fumés au sulfate d'ammoniaque. Nancy, 1885. 8vo.

Ledebur, A. Die Metalle, ihre Gewinnung and ihre Verarbeitung allgemein fasslich dargestellt. Mit 64 in den Text eingedruckten Holzschnitten. I. Lieferung. Stuttgart, 1886. 8vo.

Lederer, L. Synthese von Pyrrolderivaten. Erlangen, 1886. 8vo.

Leeds, Albert R. A Chemical, Biological, and Experimental Inquiry into the proposed future Water Supply of the City of Albany. New York, 1886. 8vo.

Leemans, C. Papyri græci musei antiquarii publici Lugduni-Batavi. Regis augustissimi jussu edidit, interpretationem latinam, adnotationem, indices et tabulas addidit. Lugduni-Batavorum, 1885. 4to.

Tomus II contains: "Papyrus X, Excerpta chemica," the earliest text on chemistry.

Leidié, —. Les éthers. Paris, 1886.

Liebrecht, A. Ueber Nicotin. Kiel, 1886. 8vo.

Liebreich, O. Ueber den todten Raum bei chemischen Reactionen. Berlin (Mitth. Akad.), 1886. 8vo.

Liepmann, H. K. Die Mechanik der Leucipp-Democritischen Atome unter besonderer Berücksichtigung der Frage nach dem Ursprung der Bewegung derselben. Leipzig, 1886. 8vo.

Liès-Bodart. Conférence et manipulations chimiques. Paris, 1885. 12mo.

Linnemann, E. Ueber ein neues Leuchtgas-Sauerstoffgebläse und das Zirkonlicht. Wien, 1886. 8vo.

List, Reinhold. Zur Condensation von Thioharnstoff und Acetessigäther. Inaug.-Diss. Leipzig, 1886.

Liveing, G. D. Chemical Equilibrium the Result of the Dissipation of Energy. Cambridge & London, 1886. 8vo.

Loew, P. Ueber Formaldehyd und dessen Condensation. Leipzig, 1886. 8vo.

Lomas, J. Manual of the Alcali Trade, including the Manufacture of Sulphuric Acid, Sulphate of Soda, and Bleaching Powder. Second edition, with additions. London, 1886.

Loo, H. van. Ueber das Betadichinolylin. München, 1885. 8vo.

Lotman, G. Handboek voor het onderzoek van grondstoffen en producten der suikerindustrie. 2. verm. druk. Amsterdam, 1886. 8vo.

Löw, W, Ueber Terephtalaldehyd. Erlangen, 1886. 8vo.

Löwig, C. Arsenikvergiftung und Mumifikation. Gerichtlich-chemische Abhandlung. Breslau, 1886.

Lutoslawski, W. Das Gesetz der Beschleunigung der Esterbildung. Beitrag zur chemischen Dynamik. Halle, 1885. 8vo.

Lutz, Erich. Ueber den Abbau der Myristinsäure bis zur Laurinsäure. Inaug.-Diss. Berlin, 1886.

Mahrenholtz, A. Die praktisch-chemischen Uebungen an Landwirtschaftsschulen. Zum Gebrauch bei den analytischen Arbeiten im Laboratorium zusammengestellt. Liegnitz, 1886. 8vo.

Maindron, Ernest. L'œuvre de Jean-Baptiste Dumas, avec une introduction par Schützenberger, accompagné d'un portrait de Dumas. Paris, 1886. 8vo.

Malosse, Th. Calorimétrie et thermométrie. Paris, 1886.

Manuel de chimie inorganique à l'usage des élèves du pensionnat des frères des écoles chrétiennes de Reims. Reims, 1886. 8vo.

Marchand, V. Le. Chimie de l'unité. Etude comparative des mathématiques cosmiques par la science de l'arithmétique naturelle. Caen, 1886. 8vo.

Mascareñas, Eugenio, y Jaime Santomá. Estudio analítico de vinos catalanes. Barcelona, 1885.

Maschke, Leopold. Ein Beitrag zur Kenntniss des β-Naphtylamins. Ueber einen neuen Kohlenwasserstoff. Inaug.-Diss. Berlin, 1886.

Masing, M. E. Elemente der pharmaceutischen Chemie. Ein Leitfaden für den Unterricht. Dorpat und St. Petersburg, 1885. 8vo.

Maumené, E. Leçons sur la théorie générale de l'action chimique, professées à l'École de médecine. Amiens et Paris, 1886. 12mo.

Mauthner und Suida. Zur Gewinnung von Indol aus Derivaten des Orthotoluidins. Wien, 1886. 8vo.

Maybury, A. C. The Student's Chemistry. Part i. Non-metallic Elements. London, 1885. 12mo.

Mayer, A. Lehrbuch der Agriculturchemie in 40 Vorlesungen. Nebst Anhang: Lehrbuch der Gährungschemie. 3. verbesserte Auflage. Heidelberg, 1886. 8vo.

Mays, K. Notiz über eine bequeme Bereitungsweise der neutralen Lackmuspapieres. Heidelberg, 1885. 8vo.

Mazzara, G. Ricerche sulla trasformazione del timol in carvacrol: nota. Torino, 1886. 8vo.

Mazzara, G., e G. Discalzo. Bromoderivati del timol, del timochinone e dell' ossitimol: nota. Torino, 1886. 8vo.

MAZZARA, G. e G. POSSETTO. Sopra il diamilossimetiltrifenilmetano. Torino, 1885.

MEADS, S. P. Chemical Primer; an elementary work for use in high schools, academies, and medical colleges. 4th edition. Oakland, California, 1885. 12mo.

MEDICUS, LUDW. Kurze Anleitung zur Gewichtsanalyse. Uebungsbeispiele zum Gebrauche beim Unterricht in chemischen Laboratorien. 3. Auflage. Tübingen, 1886. 8vo.

MEISSNER, FRANZ. Ueber die beim Benetzen pulverförmiger Körper auftretende Wärmetönung. Inaug.-Diss. (Strassburg). Leipzig, 1886.

MENSCHUTKIN, N. Analytische Chemie für den Gebrauch im Laboratorium and für Selbststudium. Deutsche Ausgabe unter Mitwirkung des Verfassers übersetzt von O. Bach. 2. verbesserte Auflage. Leipzig, 1886. 8vo.

MERCK, W. Ueber Cocaïn. Kiel, 1886. 8vo.

MESSWARB, W. Ueber Acetanhydroisodiamidotoluol (Aethenylisotoluylendiamin). Göttingen, 1886.

MEUSEL, E. Die Quellkraft der Rhodanate und die Quellung als Ursache fermentartiger Reaktionen. Gera, 1886. 8vo.

MEYER, E. VON. Untersuchungen über Isatosäure und Abkömmlinge derselben. Leipzig, 1886. 8vo.

MEYER, L. Ueber die neuere Entwickelung der chemischen Atomlehre. Tübingen, 1886. 8vo.

MEYER, P. Ueber Amido- und Oxyphenanthrenchinone. Bonn, 1886. 8vo.

MEYER, R. Ueber die intramolekuleren Umlagerungen in den Cymol-und Cuminreihe. Leipzig, 1886. 8vo.

MILANI, ANTONIO. Sulla preparazione farmaceutica del nitrato d' amile. Roma, 1885.

MILANI, G. La chimica in famiglia con cinquanta disegni originali di E. Mazzanti. Firenze, 1886. 16mo.

MILLER, W. VON, und H. KILIANI. Kurzes Lehrbuch der analytischen Chemie. München, 1886. 8vo.

MILLS, E. J. Destructive Distillation, or the Paraffin, Coal Tar, Resin, Oil and kindred Industries. 3d edit. London, 1886. 8vo.

MÖNKEBERG, K. Einwirkung von Chlorameisensäureäther auf Nitrotoluiden. Inaug.-Diss. Göttingen, 1885. 8vo.

MOLISCH, H. Zwei neue Zuckerreactionen. Wien, 1886. 8vo.

MORLEY, H. FORSTER. Outlines of Organic Chemistry. London, 1886. 8vo.

MÜHLBERG, F. Der Kreislauf der Stoffe auf der Erde. Basel, 1885. 8vo.

MUIR and WILSON. The Elements of Thermal Chemistry. London, 1885. 8vo.

MUNROE, CHARLES E. Index to the Literature of Explosives. Part I. Baltimore, 1886. 8vo.

MUSPRATT. Theoretische, praktische und analytische Chemie, in Anwendung auf Künste und Gewerbe. Encyclopädisches Handbuch der technischen Chemie, herausgegeben von F. Stohmann und B. Kerl. 4. Auflage. Band I. Braunschweig, 1886. 8vo.

MUTHMANN, WILH. Ueber niedere Oxyde des Molydäns. Inaug.-Diss. München, 1886.

NICOLAYSEN, CARL. Zur Kenntniss des Phenylacridins. Freiburg i. B, 1885.

NIETZKI, R. Organische Farbstoffe. Breslau, 1886. 8vo.

On the influence of fluctuations of atmospheric pressure on the evolution of fire-damp. Report of experiments concerning this question carried on in the Archduke Albert's coal mines near Karwin, in Austrian Silesia. Teschen, 1886. 4to.

OPPENHEIMER, HUGO. Beiträge zur Kenntniss des Terephtaldehydes. Inaug.-Diss. München, 1886.

ORME, TEMPLE. Rudiments of Chemistry. London, 1886. 8vo.

PAAL, C. Das Acetophenoaceton und seine Derivate. Erlangen, 1886. 8vo.

PACTOW. ULRICH. Ueber Benzylarsenverbindungen. Rostock, 1885.

PALMERI, P. Sulla nitrificazione del piombo. [Napoli], 1886.

PALMERI, P., e E. CASORIA. Vini adulterati. Analisi e determinazioni quantitative, e delle materie coloranti estranee e specialmente dell' oricello. 2 memorie. [Portici], 1886.

PARMENTIER. Molybdène, vanadium, et titane. Paris, 1886. 8vo.

PARNELL, E. A. The Life and Labors of John Mercer, the self-taught Chemical Philosopher, including numerous Recipes used at the Oakenshaw Calico Print Works. London, 1886. 8vo, with portrait.

PARONE, S. Corso di nozioni fisico-chimiche e di materie prime. 2 vols. Torino, 1886. 8vo.

PATHE, K. Ueber die Einwirkung von Brom auf die Pseudocumol (5) sulfonsäure in verdünnter wässeriger Lösung und einige Derivate des Pseudocumols. Freiburg i. B., 1886. 8vo.

PATERNO, E., e R. NASINI. Sulla determinazione del peso moleculare delle sostanze organiche per mezzo del punto di congelamento delle loro soluzioni. Roma, 1886. 4to.

PAUCKSCH, H. Beiträge zur Kenntniss des Ortho- und Paraamidoäthylbenzols (Ortho- und Paraphaenaethylamins). Freiburg i. B., 1886. 8vo.

PAWLEWSKI, BRONISLAW. Sposoby oceniania wartości nafty. Warszawa, 1885.

PEALE, ALBERT C. Lists and Analyses of the Mineral Springs of the United States. [A preliminary study.] Bulletin No. 32 of the U. S. Geological Survey, Department of the Interior. Washington, 1886. 235 pp. 8vo.

PENDLETON, J. H. Ueber Isomerie in der Thiophenreihe. Göttingen, 1886. 8vo.

PÉTERMANN, A. Recherches de chimie et de physiologie appliquées à l'agriculture. Analyses des matières fertilisantes et alimentaires. 2^{me} édition, revue et augmentée. Bruxelles, 1886.

PETERS, HERMANN. Aus pharmaceutischer Vorzeit in Bild und Wort. Berlin, 1886.

PEYRAUD, H. Études expérimentales sur la composition de l'air de Vichy. Bordeaux, 1886. 8vo.

PFEIFFER, E. Die Analyse der Milch. Anleitung zur qualitativen und quantitativen Untersuchung dieses Secretes für Chemiker, Pharmazeuten und Aertzte. Wiesbaden, 1886. 8vo.

PFORDTEN, O. VON DER. Untersuchungen über das Titan. Strassburg, 1886. 8vo.

PFUNGST, A. Ueber die Einwirkung der Nitroethane auf die chlorhydrine mehrwerthiger Alkohole. Leipzig, 1886. 8vo.

PHILLIPS, S. E. Old or New Chemistry, which is fittest for survival? And other essays in chemical philosophy. London, 1886.

PHIPSON, T. L. Outlines of a New Atomic Theory. Fourth edition. London, 1886.

PICKEL, J. M. Propionylanhydroisodiamidotoluol (Propenylisotoluylenamidin.) Inaug.-Diss. Göttingen, 1885. 8vo.

PICKEL, M. Beitrag zur Kenntniss der Condensation der Phenylhydrazin. Erlangen, 1886. 8vo.

PINNER, A. Repetitorium der organischen Chemie. 7. Aufl. Berlin, 1886. 8vo.

PIZZI, A. I pesi atomici e le proprietà fisiche principali dei corpi indecomposti, od elementi chimici che nello state presente della scienza si conoscono. Reggio nell' Emilia, 1886. 3 vols. 4to.

POSADSKY, S. Practische Modification der Pettenkofer-Nagorsky'schen Methode zur Bestimmung des Kohlensäuregehalts der Luft. Mit Tabellen: I. Der Bestimmung des Kohlensäure-Volumens der Luft nach Abnahme der alkalischen Reaction der Barytlösung, und II. Zur Reduction eines Gasvolumens auf 0° Temperatur und auf 760^{mm} Luftdruck. St. Petersburg, 1886. 8vo.

PRIETO, C. F., DE LANDERO Y R. Dinamica química. Guadalajara, 1886. 8vo.

Proceedings of the Third Annual Convention of the Association of Official Agricultural Chemists, August 26 and 27, 1886. Department of Agriculture, Division of Chemistry, Bulletin No. 12. Methods of Analysis of Commercial Fertilizers. Washington, 1886. 8vo.

Putchett, I. Qualitative Chemical Analyses (Inorganic and Organic). Part I. Elementary stage for schools and science classes. Leeds, 1886. 12mo.

Rammelsberg, C. F. Handbuch der Mineralchemie. Ergänzungsheft zur 2. Auflage. Leipzig, 1886. 8vo.

—— Die chemische Natur der Mineralien. Systematisch zusammengestellt. Berlin, 1886. 8vo.

—— Leitfaden für die quantitative chemische Analyse, besonders der Mineralien und Hüttenproducte, durch Beispiele erläutert. 4. umgearbeitete Auflage. Berlin, 1886. 8vo.

Ramsauer, P. Petroleum. Oldenburg, 1886. 8vo.

Raske, Karl. Zur chemischen Kenntniss des Embryo. Berlin, 1886.

Rathke, A. Bibliothek für Zucker-Interessenten. Band I und V. Magdeburg, 1886. 8vo.

Recoura, A. Recherches sur les chlorures de chrome. Paris, 1886. 4to.

Reese, A. Ueber aromatische Antimonverbindungen. Freiburg i. B., 1885. 8vo.

Regodt, H. Notions de chimie applicables aux usages de la vie (programmes officiels). 27e éd. Paris, 1886. 12mo.

Reh, A. Ueber die Einführung von Brom in Benzoesäure und die Einwirkung von Natrium auf Metabrombenzoësäureäthylester. Darmstadt, 1886. 8vo.

Remsen, Ira. An Introduction to the Study of Chemistry. New York, 1886. 8vo.

—— Einleitung in das Studium der Kohlenstoffverbindungen, oder Organische Chemie. Tübingen, 1886.

Renk, F. Die Luft. (Aus dem Handbuch der Hygiene.) Leipzig, 1886. 8vo.

Renotte, F. Petite chimie agricole à la portée des cultivateurs. Entretien familier sur la vie des plantes et spécialement sur la culture rationnelle de la betterave et sur les champs d'expériences. Louvain, 1886. 8vo.

Reuss, W. Beiträge zur Kenntniss der salpetersauren Quecksilberoxydulsalze. Braunschweig, 1886. 8vo.

Richards, Edgar. Principles and Methods of Soil Analysis. Bulletin No. 10, Department of Agriculture, Division of Chemistry. Washington, 1886. 8vo.

Richards, Ellen H. Food Materials and their Adulterations. Household Manuals No. II. Boston, 1886.

Richardson, A. On the Determination of the Vapor Pressure of Organic Alcohols and Acids and the Relations existing between the Vapor Pressures of Organic Alcohols and Acids. Bristol, 1886. 8vo.

Richter, V. v. Lehrbuch der anorganischen Chemie. Mit 89 Holzschnitten und I Spectraltafel. 5. neu bearb. Auflage. Bonn, 1886. 8vo.

—— Chemistry of the Carbon Compounds, or Organic Chemistry. Translated from the fourth German edition by E. F. Smith. Philadelphia, 1886.

Rischbieth, P. Ueber die Raffinose oder den sogenannten Pluszucker aus Melasse und aus Baumwollensamen. Göttingen, 1886. 8vo.

Rivot. Docimasie; Traité d'analyse des substances minérales. Tome V. Paris, 1886.

Romen, C. Bleicherei, Färberei und Appretur der Baumwoll und Leinen- Waaren. Berlin, 1886. 8vo.

Rosa, A., ed E. Perroncito. Relazione sull' analisi chimica e biologica su alcune acque proposte per provedere di acqua potabile la città di Aosta. Aosta, 1886. 16mo.

Roscoe, Henry E. Lessons in Elementary Chemistry, Inorganic and Organic. New edition. London, 1886.

Roscoe, H, und C. Schorlemmer. Kurzes Lehrbuch der Chemie nach den neuesten Ansichten der Wissenschaft. 8. Aufl. Braunschweig, 1886. 8vo.

Rosenberg, J. Beiträge zur Kenntniss der Thiophengruppe. Anhang über die Anhydride der aromatischen Sulfonsäuren. Göttingen, 1886. 8vo.

Rosenthal, T. Ueber die Betasulfopropionsäure. Inaug.-Diss. Halle, 1886. 8vo.

Rudelius, C. Platinapropylsulfinföreningar. Akad. afhandl. Lund, 1886. 4to.

Rüdorff, E. Anleitung zur chemischen Analyse für Anfänger. 7. Aufl. Berlin, 1886. 8vo.

Rydberg, J. R. Om de kemiska grundämnenas periodiska system. Stockholm, 1885. 8vo.

Sacc, F. Trabajos del laboratorio nacional de química en Cochabamba. La Paz, 1886. 12mo.

Sadtler, S. P. Die Gewinnung des Theers und Ammoniakwassers. Uebersetzt und mit einem Anhange versehen von G. Bornemann. Leipzig, 1886. 8vo.

Salmonowitz, S. Beiträge zur Kenntniss der Alkaloide des Aconitum lycoctonum. Inaug.-Diss. Dorpat, 1885.

Sänger, A. Ueber einige Aether und eine neue Bildungsweise der Unterphosphorsäure. Jena, 1886. vo.

Saucerotte. Petite chimie des écoles, simples notions sur les applications de cette science à l'industrie, à l'agriculture, et à l'économie domestique. 6ᵉ édition, revue et modifiée. Paris, 1885. 18mo.

Sbriziolo, M. Trattato teorico-pratico di tossicologia generale e speciale medico-clinico-legale. Napoli, 1885.

Schafft, A. Uebersichtstafeln zum Unterricht in der anorganischen Chemie und Mineralogie. Bielefeld, 1886. 8vo.

Schafs, A. Notes des aides-chimistes pour sucreries. St.-Trond, 1885. 8vo.

Scheurer-Kestner. Nicolas Leblanc et sa soude artificielle. (Conférence de la Société chimique de Paris.) Paris, 1886. 8vo.

Schmid, Jacob. Ueber das Fisetin, den Farbstoff des Fisetholzes. Inaug.-Diss. Zürich, 1886.

Schmieder, Johannes. Ueber Bestandtheile des Polyporus. Inaug.-Diss. (Erlangen). Hannover, 1886.

Schmidt, E. Beiträge zur Kenntniss der isomeren Mono- und Dinitroderivate der unsymmetrischen (α)-m-xylolsulfonsäure. Freiburg i. B., 188 . 8vo.

Schmidt, M. Ueber die Einwirkung von Phenylcyanat auf Phenole und Phenoläther bei Gegenwart von Aluminiumchlorid. Göttingen, 1886. 8vo.

Schmitz, P. Ueber Parajodphenylmercaptursäure. Freiburg i. B., 1886. 8vo.

Schomacker, J. Beitrag zur forensisch-chemischen Nachweise der Resorcin und Brenzcatechin im Thierkörper. (Inaug.-Diss.) Dorpat, 1886. 8vo.

Schöpff, Martin. Ein Beitrag zur Kentniss der Amidoxime und Azoxime. Inaug.-Diss. Berlin, 1886.

Schreiber. Grundriss der Chemie und Mineralogie. 4. vollständig umgearbeitete Auflage. Berlin, 1886. 8vo.

Schultz, G. Die Chemie des Steinkohlentheers. 2. Aufl. Band I. Die Rohmaterialien. Braunschweig, 1886. 8vo.

Schulz, Otto. Ueber Benzenylazoxime und Benzenylazoximcarbonsäuren. Ein Beitrag zur Kenntniss der ringförmig geschlossenen Verbindungen. Inaug.-Diss. Berlin, 1886.

Schunk, Hermann. Ueber einige Salze der α-Phenylmichsäure und über einige Nitro- und Amidoderivate derselben Säure. Inaug.-Diss., Basel. München, 1886.

Sedna, L. Das Wachs und seine technische Verwendung. Wien, 1886. 8vo.

Sefferth, E. Zur Kenntniss der Picolinsäure und Nicolinsäure. Leipzig, 1886. 8vo.

Sell, E. Ueber Kunstbutter. Ihre Herstellung, sanitäre Beurtheilung und die Mittel zu ihrer Unterscheidung von Milchbutter. Beiträge zur Kenntniss der Milchbutter und der zu ihrem Ersatz in Anwendung gebrachten anderen Fette. (Aus den "Arbeiten des kaiserl. Gesundheitsamtes, Band I.") Berlin, 1886. 4to.

Seltner, E. Die Indigoküpen, deren Anstellung, Gebrauch und praktische Behandlung. Leipzig, 1886. 8vo.

Serrant, Emile. Sozolic Acid; its chemical, physiological, and therapeutical properties. Paris, 1886.

Sestini, F., e A. Funaro. Elementi di chimica ad uso degli istituti tecnici secondo i nuovi programmi governativi del 21 giugno 1885. Livorno, 1886. 16mo.

Setschenow, J. Ueber die Absorptionscoefficienten der Kohlensäure in den zu diesem Gase indifferenten Salzlösungen. St. Petersburg, 1886.

Sexton, A. Humboldt. Outlines of Quantitative Analysis. For the Use of Students. London, 1886.

Shenstone, W. A. A Practical Introduction to Chemistry, intended to give a practical acquaintance with the elementary facts and principles of chemistry. London, 1886.

Siebert, G. Kurzer Abriss der Geschichte der Chemie. Wien und Leipzig, 1886. 8vo.

Skraup, Z. H. Farbenreaction zur Beurtheilung der Constitution von Carbonsäuren der Pyridin-, Chinolin- und verwandten Reihen. Wien, 1886. 8vo.

Snijders, A. J. C. Scheikundige brieven. Leercursus ter beoefening der chemie door zelfonderricht. Volgens de nieuwste uitkomsten der wetenschap, naar aanleiding van Krätzer's Chemische Unterrichts-Briefe. Zutphen, 1886. Roy. 8vo.

Solari, L. Sur les naphtalines bichlorées α, δ. Genève, 1886. 8vo.

Spady, Johann. Ueber α- Isobutyl- β- isopropylchinolin und dessen Umwandlungsproducte. (Inaug.-Diss., Basel.) München, 1885.

Spring, W., et L. Roland. Recherches sur les proportions d'acide carbonique continues dans l'air. Liège, 1885. 8vo.

Staats, F. Ueber Asaron. (Inaug.-Diss.) Breslau, 1885.

Stahl, W. Ueber Raffination, Analyse und Eigenschaften des Kupfers. Clausthal, 1886. 8vo.

Stefan, J. Ueber die Beziehung zwischen den Theorien der Capillarität und der Verdampfung. Wien, 1886. 8vo.

Stevenson, Thomas. Spirit Gravities with Tables. Calculated from the tables of Gilpin. London, 1886. 8vo.

Stolz, Friedrich. Ueber die Jodpropriolsäure. Inaug.-Diss. (Erlangen). München, 1886.

Striegler, M. Ueber die Melanurensäure. Leipzig, 1886. 8vo.

Stutzer, A. Der Chilisalpeter, seine Bedeutung und Anwendung als Düngemittel. Unter Berücksichtigung der Schrift von A. Damseaux bearbeitet und herausgegeben von P. Wagner. Berlin, 1886. 8vo.

Sutton, Francis. A Systematic Handbook of Volumetric Analysis, or the quantitative estimation of chemical substances by measure applied to liquids, solids, and gases; adapted to the acquirements of pure chemical research, pathological chemistry, pharmacy, metallurgy, manufacturing chemistry, photography, etc., and for the valuation of substances used in commerce, agriculture, and the arts. Fifth edition. London, 1886. 8vo.

Steinfeld, W. Ueber die Wirkung des Wismuths auf den thierischen Organismus. Inaug.-Diss. Dorpat, 1885.

Tableaux servant à l'analyse chimique. Deux parties. Traduites de l'allemand par J. Krutwig. Bonn, 1885. Lex 8vo.

Taylor, R. L. Analysis Tables for Chemical Students. London, 1886.

Teplow, M. N. Die Schwingungsknoten-Theorie der chemischen Verbindungen. Uebersetzt von L. Jawein. St. Petersburg, 1886.

Thalén, R. Sur le spectre du fer, obtenu à l'aide de l'arc électrique. Upsal, 1885. 4to.

Thomsen, J. Thermochemische Untersuchungen. Band iv. Organische Verbindungen. Leipzig, 1886. 8vo. [Completing the work.]

Thudichum, L. J. W. Grundzüge der anatomischen und klinischen Chemie. Analecten für Forscher, Aerzte und Studirende. Berlin, 1886. 8vo.

Theis, F. C. Zur Kenntniss der Dioxyamidoanthrachinonsulfonsäure. Freiburg i. B., 1886. 8vo.

Trinkwasser (Das) der Stadt Kiel auf Grundlage von Analysen aller Brunnenwasser Kiels, ausgeführt i. J. 1883 im Auftragen der städtischen Gesundheits-Commission durch das agriculturchemische Laboratorium der landwirtschaftlichen Versuchsstation zu Kiel. Kiel, 1886. 4to.

Troilius, Magnus. Notes on the Chemistry of Iron. New York, 1886. 8vo.

Troost, L. Tratado elemental de química arreglado al programa official de la segunda enseñanza con las principales aplicaciones á las artes, industria, medicina é higiene. Version castellana con autorizacion por A. Sanchez de Bustamente. 6ª ed. Paris, 1885. 8vo.

Tyler, Harry W. Entertainments in Chemistry. Easy lessons and directions for safe experiments. Chicago, 1886.

Tyson, J. A Guide to the Practical Examination of the Urine, for the use of physicians and students. Fifth edition. Philadelphia, 1886. 12mo.

Uffici d' analisi, reclamati dalla salute pubblica, dall' industria enologica e dal commercio. Conferenza dall' avo. F. Casella. Piacenza, 1885.

Urech, F. Itinerarium durch die theoretische Entwicklungsgeschichte der Lehre von der chemischen Reactionsgeschwindigkeit. Berlin, 1885.

Valeur, Fredrik. Ueber Chinolindisulfonsäuren und Derivate derselben. Inaug.-Diss. (Tübingen). Aachen, 1886.

Van Aubel, E. Note sur la transparence du platine. Bruxelles, 1886.

Vannuccini, G. Letame e concimi chimici; considerazioni e raffronti, lettura ecc. Città di Castello, 1885. 8vo.

Vanuccini, E. Analisi chimica delle nuove polle acqua del risorgimento di Montecatini in Val di Nievole. Prato, 1885. 8vo.

Vermorel, V. Le sulfure de carbone, ses propriétés, sa fabrication, ses falsifications, moyens pratiques de vérifier sa pureté. Tours, 1886. 8vo.

Verneuil, A. Recherches sur quelques combinaisons azotées du sélénium. Paris, 1886. 4to.

Very y Lopez, V. Breves nociones de química orgánica. Madrid, 1885. 8vo.

Vierteljahresschrift über die Fortschritte auf dem Gebiete der Chemie, der Nahrungs und Genussmittel, der Gebrauchsgegenstände, sowie der hierher gehörenden Industriezweige. Unter Mitwirkung von Degener, Hochstetter, P. Lohmann, Benno Martiny, Paack, Proskauer, Würzburg, L. Aubry, R. Sendtner, H. Will, von Peters, Weigmann, J. Mayrhofer, E. von Raumer, Röttger, herausgegeben von A. Hilger, R. Kayser, J. König, E. Sell. Berlin, 1886. 8vo.

Villejean, A. Recherches expérimentales sur les propriétés chimiques et physiologiques du chlorure de méthylène. Paris, 1886.

Vincent, L. Du rôle industriel de la magnésie. Marseille, 1886. 8vo.

Vlasto, E. Les origines de l'alchimie, par M. Berthelot. Extrait des Bulletins de la Société des ingénieurs civils. Paris, 1886. 8vo.

Waeber, R. Leitfaden für den Unterricht in der Chemie. 5. Auflage. Leipzig, 1885. 8vo.

Wagner, A. Lehrbuch der organischen Chemie. München, 1886.

Wagner, L. von. Die Stärkefabrikation in Verbindung mit der Dextrin-und Traubenzuckerfabrikation. 2. durch Nachträge vermehrte Auflage. Braunschweig, 1886. 8vo.

Wagner, Rudolph von. Handbuch der chemischen Technologie. Bearbeitet von Ferd. Fischer. Zwölfte Auflage. Leipzig, 1886.

Wandtafel der periodischen Gesetzmässigkeit der Elemente nach Mendelejeff. Lithographie. Wien, n. d. Imp. fol.

Wandtafeln der Atomgewichte der chemischen Elemente H = I. 2 Blatt. Lithographie. Wien, n. d. Fol.

Wanklyn, J. Alfred. Milk-Analysis: a practical treatise on the examination of milk and its derivatives, cream, butter, and cheese. Second edition. London, 1886.

—— The Gas Engineer's Chemical Manual. London, 1886.

Wanklyn, J. A., and E. T. Chapman. Water-Analysis: a practical treatise on the examination of potable water. Sixth edition. London, 1884.

Wanklyn and Cooper. Bread Analysis. New edition. London, 1886.

WATT, A. Electro-Deposition. Practical treatise on the electrolysis of gold, silver, copper, nickel, and other metals and alloys. With descriptions of voltaic batteries, magneto- and dynamo-electric machines, thermopiles, and the materials and processes used in every department of art, and several chapters on electrometallurgy. London, 1886. 8vo.

WATT'S Manual of Chemistry. (Based on Fowne's Manual.) Vol. II. Second edition. Chemistry of Carbon Compounds, or Organic Chemistry. By W. A. Tilden. London, 1886.

WELLINGTON, C. Ueber die Einwirkung des Formalaldehyds auf verschiedene organische Amine, sowie die Darstellung einiger saueren aromatischen Sulfate. Göttingen, 1886. 8vo.

WEIL, H. Synthese eines reducierten Pyrrols. Erlangen, 1886. 8vo.

WIDMAN, O. Om kumenylakrylsyrans framställning och nitrering, ortoderivat, metaderivat, etc. Stockholm, 1886. 8vo.

WIEBECKE, B. Geschichtliche Entwickelung unserer Kenntniss der Ptomaïne und verwandter Körper. Berlin, 1886. 8vo.

WILBRAND, F. Leitfaden für den methodischen Unterricht in der anorganischen Chemie. 5. Auflage. Hildesheim, 1886.

WILDER, HANS M. List of Tests (Reagents) arranged in alphabetical order according to the names of the originators. Designed especially for the convenient reference of chemists, pharmacists, and scientists. New York and London, 1885. 12mo.

WILEY, HARVEY W. The Economical Aspects of Agricultural Chemistry. An address before the American Association for the Advancement of Science, at the Buffalo meeting, August, 1886. Cambridge, 1886. 8vo.

WILL, E. Tavole per l' analisi chimica qualitativa; traduzione da G. Carnelutti sull' ultima edizione tedesca. Milano, 1885. 8vo.

WILLS, G. S. V. A Manual of Practical Analysis. Eighth edition. London, 1885. 8vo.

WILLSON, A. R. Chemical Notes for Pharmaceutical Students. Second edition. London, 1886. 8vo.

WINKLER, CLÉMENT. Manuel pratique de l'analyse industrielle des gaz. Traduit de l'allemand par C. Blas. Paris, 1886.

WÖHLER, F. Grundriss der organischen Chemie bearbeitet von R. Fittig. 11. Aufl. Leipzig, 1886. 8vo.

WOLFF, LAWRENCE. Applied Medical Chemistry, containing a description of the apparatus and methods employed in the practice of medical chemistry, the chemistry of poisons, physiological and pathological analysis, urinary and fecal analysis, sanitary chemistry, and the examination of medicinal agents, foods, etc. Philadelphia, 1886. 8vo.

WOLFF und BAUMANN. Tabellen zur Berechnung der organischen Elementaranalyse. Berlin, 1886. 8vo.

WOLLNER, ROBERT. Ueber Methyl-*p*-Xylylketon. Inaug.-Diss. Freiburg i. B., 1885.

WOOTEN, H. Three Hundred Problems in Chemical Physics and Specific Gravities, with Key. London, 1886. 8vo.

WUNDERLICH, AEMILIUS EDWIN. Ueber Carbamincyamide. Inaug.-Diss. Würzburg, 1886.

WUNDERLICH, A. Configuration organischer Moleküle. Leipzig, 1886. 8vo.

WURTZ, A. Dictionnaire de chimie pure et appliquée. Supplément. Fascicule 11 (et dernier). Paris, 1886. 8vo.

—— La théorie atomique. Quatrième édition, précedé d'une introduction sur la vie et les travaux de l'auteur par Ch. Friedel. Paris, 1886.

WÜST, F. Ueber einige neue Fettsäuren höheren Kohlenstoffgehaltes. Freiburg i. B., 1886. 8vo.

Zängerle, M. Grundriss der anorganischen Chemie. 3. Auflage. Braunschweig, 1886. 8vo.

—— Grundriss der organischen Chemie. 3. Auflage. Braunschweig, 1886. 8vo.

—— Kemian alkeet. Porvoosa. 1886.

—— Lehrbuch der Chemie nach den neuesten Ansichten der Wissenschaft. 2 Bände. 3. Auflage. Braunschweig, 1885. 8vo.

Zeitschrift für Nahrungsmittel-Untersuchung und Hygiene. Eine Monatsschrift für chemische und mikroscopische Untersuchung von Nahrungs- und Genussmitteln und Gebrauchsgegenständen. Beiblatt der Wochenschrift "Pharmaceutische Post." Herausgegeben und redigirt von Hans Heger in Wien. Wien, 1886.