Palmieri, after having proposed some changes which he believed to be necessary, on the death of Melloni, from cholera, in 1861, took charge of the building himself, which at that time stood only under his supervision. In the same year he placed in the observatory the electro-magnetic seismograph which he had invented, an instrument which indicates the slightest movement or oscillation of the ground, and which he holds to be the only sure indicator of an increase of the volcanic action of the mountain. He also founded the valuable Vesuvius library, of which the basis was formed by the purchase of Prof. Secchi's precious collection of books treating on Vesuvius.

The scientific body of the observatory at present consists of the director himself, two assistants, and one adjunct.

Palmieri in his publication gives a complete list of the valuable instruments with which the building is supplied, good illustrations accompanying the description of the principal ones.

The benefits rendered to science by the observatory are described by the author as follows:

1. By means of this observatory it has become possible to study the different phases of the volcanic eruptions, in their connection and succession.

2. The peculiar condition and composition of the lava-streams, and their accompanying phenomena, have been more closely investigated.

3. The laws of the formation of the so-called *fumaroles* have been determined.

4. Not only the conditions of the sublimates which form the *fumaroles* have been ascertained, but some perfectly new ones have been discovered.

5. It has been proved that several phenomena accompanying the eruptions, which were hitherto considered accidental, are constantly accompanying them.

6. Many opinions hitherto maintained by scientists have been found to be erroneous, among others, the opinion that ammonia is never found near the crater or other highly elevated portions of the mountain.

7. Finally the close studies of and improvements made in observation-instruments have been made possible by the observatory, and a knowledge of electro-meteoric phenomena has been greatly extended.

It will only be just to make a few remarks in regard to the writer of the pamphlet himself, who has obtained so much fame in the scientific world.

Luigi Palmieri was born April 21, 1807, at Farchia, a small city of the Terra di Lavoro. His first instructions he received from his father, who was a great Latin scholar. Later, he entered the seminary of Cayazzo, and finally went to Naples, where he finished his studies. His remarkable talents procured for him the situation as Professor of Physics at the Royal Lyceum of Naples. In 1845 he obtained a similar situation at the Marine College, and after the death of Pasquale Galuppi, he obtained the chair of physics at the University of Naples, which this renowned scientist had hitherto occupied.

After the death of Secchi Palmieri was elected member of the Meteorological Central Bureau, having been previously elected to the Senate by the Government of Victor Emanuel.

For 25 years he has been Director of the Observatory of Vesuvius, and in this post he has many a time risked his personal safety for the benefit of science. Several times the observatory has been surrounded by the glowing lava-stream, and its inhabitants cut off from all help. In 1850 Palmieri had a very narrow escape from the fate of Empedocles and Plinius the Elder, and in 1873 he also encountered many dangers as the brilliant description of the convulsion of this year published in the "Annali dell'Osservatorio Vesuviano" shows.

THE BORDER-LAND OF CHEMISTRY AND BIOLOGY.

It has become an almost trite saying that just as important minerals are most readily discovered along the meeting-line of different geological formations, and as animal species are most numerous along the edge of the forest or of the river, so the most interesting results are often obtained along what may be called the boundary of two sciences. Of this truth a striking instance is afforded by the researches of Dr. James Blake. This experimentalist has for forty years been engaged with the study of a class of phenomena having both a chemical and a biological aspect, and he has obtained results of great value alike to organic and inorganic science. As far back as 1839 he showed, in a paper read before the Academy of Sciences in Paris, that the physiological action of solutions of different salts injected into the blood of living animals depended mainly upon the electro-positive or basic element of each salt, and were little modified by the electro-negative element or acid. Thus, to take a simple instance, the effects of sodium sulphate differ less from those of sodium nitrate than they do from those of magnesium sulphate.

Again, in a memoir communicated to the Royal Society, in June, 1841, Dr. Blake proved that the action of inorganic substances conveyed directly into the blood of living animals depended on their isomorphous relations—those bodies which can replace each other in a crystalline compound without disturbing its form having similar physiological action.

A third step was taken in a discourse delivered before the California Academy of Sciences in 1873, the author showing that among metallic bodies the physiological activity of those belonging to one and the same isomorphous group is proportionate to the atomic weights; the higher the atomic weight the more intense is the physiological action.

Finally, in a paper communicated to the German Chemical Society, on February 7th of the present year, Dr. Blake sums up the whole of his results. The first point to be noticed is that the effects obtained were the same in all the species operated upon—horses, dogs, cats, rabbits, geese, and hens. It might, indeed, have been wished that some ruminant animal and some species of monkey had been inserted in the list. The hedgehog, also, in virtue of his alleged immunity from the action of poisons, would have been a desirable subject. Some cold-blooded animal, such as that "martyr of science" the frog, should have been included. These omissions are the more to be regretted since any extension or verification of Dr. Blake's researches is now rendered practically impossible. So far, however, as experiment has gone, we may conclude that the indifference of certain animals to the action of various poisons when

introduced into the stomach is due mainly to non-absorption.*

The substances employed were salts of forty-one of the chemical elements. They were dissolved in water, and injected into a vein or artery in known quantities. The fatal doses for each individual were carefully noted, and a kymograph was connected with the femoral artery. The curves described by this instrument were strikingly characteristic for some of the isomorphous groups.

Among the monatomic metals tried were lithium, sodium, rubidium, thallium, and silver. All agreed exactly in the mode of their physiological action, but the fatal dose for rabbits, which was 1 grm. per kilo of the weight of the animal for lithium sulphate, fell to 0.06 grm. for silver nitrate. In other words, lithium sulphate, to kill, must be introduced in the proportion of 1 part per thousand of the living weight, while of silver nitrate 6 parts per 100,000 suffice.

Among the group of the diatomic metals Dr. Blake experimented with the salts of magnesium, iron, manganese, cobalt, nickel, copper, zinc, and cadmium. Here, again, the physiological action is similar, the fatal dose being 0.97 grm. per kilo for magnesium sulphate, and only 0.08 grm. per kilo for cadmium sulphate.

The salts of calcium, strontium, and barium agree also in their physiological action, which is intensified from 0.47 grm. per kilo in calcium chloride to 0.043 grm. in barium chloride. The salts of this group produce contractions of the voluntary muscles, even thirty to forty minutes after the action of the heart has ceased. The reactions of lead salts resemble exactly those of the barium group, but at the same time they agree in some respects with those of the salts of silver.

Among the tetratomic metals the author examined those of thorium, palladium, platinum, osmium, and gold. All have very intense physiological action, ranging from 0.029 grm. per kilo in thorium sulphate to 0.003 grm. for gold chloride. The characteristic of this group is their effect on the action of the heart. Salts of gold introduced into the blood, even in the minute proportion of 0.003 or 0.004 grm. per kilo, keep up the action of the heart for several hours after death, though the body may have cooled down as far as 55° F. below its normal temperature. We may here ask if this is not the explanation of the action of platinum chloride in prolonging the life of animals bitten by the cobra?

Among the hexatomic metals the salts of glucinum, aluminium, and iron (ferric) were found to agree in their physiological action, the death-dose being 0.023 grm. per kilo in the first, 0.007 in the second, and 0.004 for iron, all in the form of sulphates.

Here we are, in the first place, struck with the difference between iron in its two classes of salts, the ferrous and the ferric. Of the former the fatal quantity is 0.115 grm. per kilo, or twenty-eight times as much of the latter.

We next perceive that the distinction between poisonous and non-poisonous substances is reduced to a mere question of proportion. The dogma that "whatsoever is poisonous in large doses is poisonous also in the smallest, though the injury done may escape notice," falls at once to the ground if we reflect that the very salts which naturally occur in and form necessary parts of our blood become deadly in a somewhat larger quantity!

Among the non-metallic bodies the compounds of chlorine, bromine, and iodine were found accordant in their physiological reactions, but the increase of intensity accompanying the atomic weight was not observed—a most puzzling exception. The identity of action here noted is also peculiar, since bromides taken internally have a very different action from the corresponding chlorides, *e. g.*, in the treatment of sea-sickness. Phosphorus, arsenic, and antimony occasion no immediately perceptible physiological reaction, though if arsenious acid is injected in the proportion of 0.56 grm. per kilo it arrests the pulmonary circulation. Sulphur and selenium agree in their physiological action; the latter, having the higher atomic weight, is the more powerful.

A curious exception to the rule that isomorphous substances agree in their physiological action is afforded by the salts of potassium and ammonium. The effects of the latter approach those of certain nitrogenous alkaloids.

The author suggests that if—as is far from impossible—the carbon-compounds present similar phenomena in their influence upon animal life, a new key to the molecular relations of organic bodies is placed in the hands of the chemist. It is especially to be remembered that in alcohols of one and the same series the intensity of the physiological action rises with the atomic weight, as has been shown by Dujardin. The question in what manner the isomorphous relations and the atomic weights of substances can influence their physiological action can scarcely as yet be entertained.

Still Dr. Blake's researches are exceedingly valuable, both as pointing out a new method of chemical research and as overturning certain erroneous conceptions concerning the nature of poisons.—*Journal of Science*.

REPORT ON ANALYTICAL CHEMISTRY.

ZINC.—*Separation from Cadmium.*—A. YVER.†—The solution containing the two metals as acetates is treated with two or three grammes of acetate of sodium and a few drops of acetic acid and then subjected to electrolysis. The battery used consists of two Daniell's cells of the usual form. The cadmium is completely precipitated upon the negative pole, while all of the zinc remains in solution. The deposition takes place in the cold and is complete within three or four hours, when the quantities of the metals range between 0.180 and 0.210 gramme.

Separation from Copper.—G. LARSEN.‡—A single precipitation with sulphide of hydrogen suffices for a complete separation of the two metals, provided the solution is acid with hydrochloric acid and hot when treated with the gas, and the precipitate is washed with a hot solution of sulphide of hydrogen containing hydrochloric acid.

CADMIUM.—*Separation from Copper.*—G. VORTMANN.§—The dilute solution is treated with hyposulphite of sodium until it becomes colorless, and then heated to the boiling point. The copper precipitates as sulphide.

SILVER.—*Electrolytic Deposition.*—H. FRESSENIUS and F. BERGMANN.||—The tendency of silver to precipitate in a spongy or flocculent condition when deposited from an acid

solution by electrolysis can be avoided by employing a weak current and dilute solution. The following conditions were found to be the most satisfactory: A solution containing in 200 c.c. from 0.03 to 0.04 gramme of silver and from 3 to 6 grammes of nitric acid; a separation of the electrodes of one centimeter; a current sufficient to yield from 100 to 150 c.c. of electrolytic gas per hour. From a dilute neutral solution the silver deposits in a flocculent condition however weak the current.

Separation from Lead.—E. DONATH.*—The solution is treated with 4 or 5 c.c. of glycerine, an excess of ammonia, and finally with 10 or 15 c.c. of concentrated caustic potassa or soda. Complete solution ensues. The whole is then boiled four or five minutes, with constant stirring. Lead, also bismuth and copper, remains in solution, while the silver is completely precipitated as metal. The precipitate is washed with hot water, then with hot dilute acetic acid, and finally with hot water again. The washing with acetic acid is necessary in order to remove any carbonate of lead which may have formed in the filter during the first washing with water.

MERCURY.—*Detection in Dilute Solutions.*—J. LEFORT.†—It was shown by Orfila that the gold-tin voltaic couple of Smithson, devised for the detection of minute quantities of mercury, might lead to erroneous conclusions in consequence of the deposition of a portion of the tin upon the gold. It is, however, easy to distinguish a deposit of mercury from one of tin, since by placing the strip of gold foil in a narrow glass tube and heating, the former is readily sublimed, and its presence can be confirmed by exposing the sublimate to the vapors of iodine. A more curious difficulty presents itself when the solution to be examined contains arsenic. The couple reduces the compounds of arsenic quite readily with precipitation, first upon the tin and then upon the gold. When the latter is heated the arsenic sublimes, and cannot be easily distinguished in the sublimate from mercury, especially since the vapors of iodine convert it into a compound whose color resembles that of the iodide of mercury. This chance of mistaking arsenic for mercury should not be lost sight of when defective analyses are seemingly establishing the wide diffusion of mercury in mineral waters.

NICKEL AND COBALT.—H. FRESSENIUS and F. BERGMANN.‡ have undertaken to ascertain the conditions most favorable for the electrolytic deposition of nickel and cobalt. They recommend for both a solution containing in 200 c.c. from 0.1 to 0.15 gramme of the metal as sulphate, from 2.5 to 4.0 grammes of ammonia (NH₃), and from 6 to 9 grammes of sulphate of ammonium; a current equivalent to 300 c.c. of electrolytic gas per hour, and a separation of $\frac{1}{2}$ or $\frac{1}{3}$ c.m. for the electrodes. If less ammonia is used the results are not good. Larger quantities retard the deposition, but do no further harm.

Qualitative Separation of Nickel and Cobalt.—F. REICHEL.§—Both metals are precipitated by caustic potassa. The precipitate, filtered but not washed, is placed in a test tube. A piece of solid potassium hydroxide and just enough water to dissolve it are added. On boiling the cobalt dissolves, and imparts a blue color to the solution. In this way minute quantities of cobalt can be expeditiously detected.

IRON.—*Precipitation by Succinate of Ammonium.*—||—The statement of Fresenius that the precipitate of iron by succinate of ammonium is partially redissolved by heating has been found to be incorrect. The filtrate contains less iron than when the precipitation has been effected in the cold. Hot succinic acid dissolves very little of the precipitate, whether the precipitation has been effected in hot or cold solutions, but more in the latter than in the former case. Cold succinic acid dissolves more than hot. It is therefore recommended to precipitate from hot solutions and to boil two or three minutes before filtering.

ALUMINUM.—*Separation from Iron.*—E. DONATH.†—The neutral or slightly acid solution is treated with hyposulphite of sodium until all ferric compounds have been reduced. A solution of cyanide of potassium having twice the volume of the iron-aluminum solution, and containing from 15 to 20 grammes of cyanide of potassium, is heated to boiling, and the iron-aluminum solution slowly poured into it. The solution is then quickly cooled, acidified with acetic acid, and the aluminum precipitated with carbonate of ammonium. If the aluminum hydroxide has not a pure white color, it must be dissolved and reprecipitated. The separation is quantitative.

MANGANESE.—*Use of Permanganate in Presence of Hydrochloric Acid.*—C. ZIMMERMANN.**—The usefulness of permanganate of potassium in volumetric analysis is considerably diminished by the fact that it cannot be used in solutions containing hydrochloric acid. The author has discovered that, by adding manganous sulphate, this difficulty can be wholly obviated. The solution in which the titration is to be made must, however, contain no free sulphuric acid.

Quantitative Determinations by Potassium Permanganate in Alkaline Solution.—E. DONATH.††—Hitherto this compound has been employed only in neutral or acid solution. Preliminary experiments, however, indicate that it can be successfully used in alkaline solution for the determination of both chromium and manganese. The reactions supposed to take place are as follows:

The standard solution of permanganate is rendered alkaline by addition of sodium carbonate and caustic soda, and heated nearly to boiling. The neutral solution of the chromous or manganous compound is then allowed to flow in until complete reduction of the permanganate has been effected.—H. N. Morse, in *American Chemical Journal*.

GLYCOLIC ACID FROM SUGAR.

By H. KILIANI.

LEVULOSE and dextrose in aqueous solution are oxidized by silver oxide to glycolic, oxalic, and carbonic acids, even at common temperatures. Cane-sugar is reduced with the aid of heat, but mere traces of glycolic acid are formed unless the sugar has been previously inverted.—*Liebig's Annalen*.

* Monatshefte für Chemie, 1, 789.

† Zeitsch. an. Ch., 1880, 314.

‡ Compt. Rend., 90, 141.

§ Zeitsch. an. Ch., 1880, 468.

|| Jour. Chem. Soc., 1880, 674.

¶ Berichte d. deutsch. chem. Gesellsch., 1881, 779.

** Monatshefte für Chemie, 1, 785.

†† Berichte d. deutsch. ch. Gesellsch., 1881, 982.

* An English translation of the description was published by Robert Molet in London.

* This view can scarcely be admitted in case of the remarkable toleration of the salts of morphine in certain apes. That it really enters the circulation is proved by its subsequent appearance in their urine.—*Ed. J. S.*

† Bull. de la Soc. Chim., 34, 18.

‡ Monatshefte für Chemie, 1, 952.

§ Dingler's Jour., 239, 239.

|| Zeitsch. f. analyt. Ch., 1880, 324.