upon the wire. Therefore there is no good reason to think that any thing would have been gained at that time by the use of heavy leads, though Mr. Dall thinks it strange that they were not tried. In some of the trials a twelve-pound lead was used, and, in the last attempt, one of eight pounds, together with a thermometer, with the usual result, — a breakage of the wire.

Mr. Dall's note implies that no successful trials were made with the steel wire; but, according to the *published* log (p. 93, May 14; 1850), at least *one* sounding was made (1,050 fathoms, no bottom) when the wire was successfully recovered. A. E. VERRILL.

## *LAKE BONNEVILLE.*

MR. G. K. GILBERT'S report (*Ann. rep. U. S. geol. surv.*, 1881, 169), preliminary to the monograph (in preparation) he promises on the Great Basin, shows the following history for its old lake. The lake-deposits are chiefly a yellow clay of unknown depth, covered by a white marl ten to twenty feet thick, the two being separated at certain points along the old shore-lines by wedges of subaerial gravel-deposits, and some exposures showing erosion of the clay surface before the marl was laid on it. These deposits mark two periods of high water, separated by a time of low water, or dryness. As no cause is found in the surrounding country to account for the change from clay to marl deposit, its explanation is sought in a change from salt water of the first lake period to fresh water in the second, for which a theoretic explanation is given; but the evidence for this is not considered final. From a critical study of the superposition of many shore terraces (see the plate opposite), it is shown that the first lake did not rise high enough to reach an overflow outlet; that the greater number of terraces now visible were formed during halts in the rise of the second great lake; that the highest or Bonneville terrace, nine hundred or more feet above the present Great Salt Lake, marks a stand at the level of overflow northward to Snake River; that the next most pronounced terrace, known as the Provo, four hundred feet lower, marks a halt in the drainage of the waters when the outlet had been cut down through softer rocks to a hard limestone sill. The reduction of the lake-surface to a still lower level, as in the present shallow sheet of water, has been effected entirely by climatic change, by which the ratio of precipitation to evaporation has been decreased. When at its highest level, Lake Bonneville was three hundred miles long between latitudes 37° 40′ and 42° 20′, and one hundred and seventy miles broad between the meridians 111° 35′ and 114° 15′ of west longitude. Its shore-line was very irregular, advancing around broken promontories, and retreating into fiord-like bays. Numerous islands stood above its broad, deep, fresh waters, and from its shores the enclosing mountains rose five to eight thousand feet. Now it is represented by a mere film of brine on the borders of a desert plain. Previous to the rise of the first lake, the base-level of the basin drainage was low for a long period, as is proved by the distinct overlap of the lacustrine deposits on the eroded mountain-slopes, as shown in the second plate here copied on p. 573, or on the alluvial cones built by old streams flowing from the mountain valleys; but the conclusion that this long period had a dry climate is not fully proved. For if, as is mentioned below, a considerable tilting has already deformed the recently made Bonneville terrace, one may fairly suppose a much greater distortion in the long time since the beginning of the first lake; and this distortion may have been sufficient to raise a barrier behind which the lake-waters accumulated. The change from the prelacustrine condition would then have been orographic rather than climatic. The relation of the glaciation of the neighboring ranges to the lakes is not shown directly, although three old moraines are found within the terrace limits; for none of these give good opportunity for observation, and the one at the mouth of Little Cottonwood cañon is so dislocated by recent faulting that its attitude with relation to the terraces cannot be deciphered. Recent discoveries by Mr. I. C. Russell in the western part of the Great Basin may throw further light on this question. Volcanic eruption took place in the basin during the disappearance of Lake Bonneville; and both the Bonneville and Provo terraces have been warped from their originally level plains, and by different amounts. From measures taken along the eastern shore-lines, lines of equal deformation are constructed; and these show very clearly a relative elevation of the centre, or south-western part, of the old lake-bottom of as much as three hundred feet since the Bonneville terrace was made, and a hundred and twenty-six since the Provo. This tilting accounts for the eccentric position of the present shallow lake-remnant at the north-eastern margin of its flat desert. A fault of fifty to seventy-five feet has been made along the foot of the Wahsatch range, between Willard and Levan, since the lake lost its outlet. The author therefore concludes that volcanic activity and mountain growth have not yet ceased in this neighborhood.

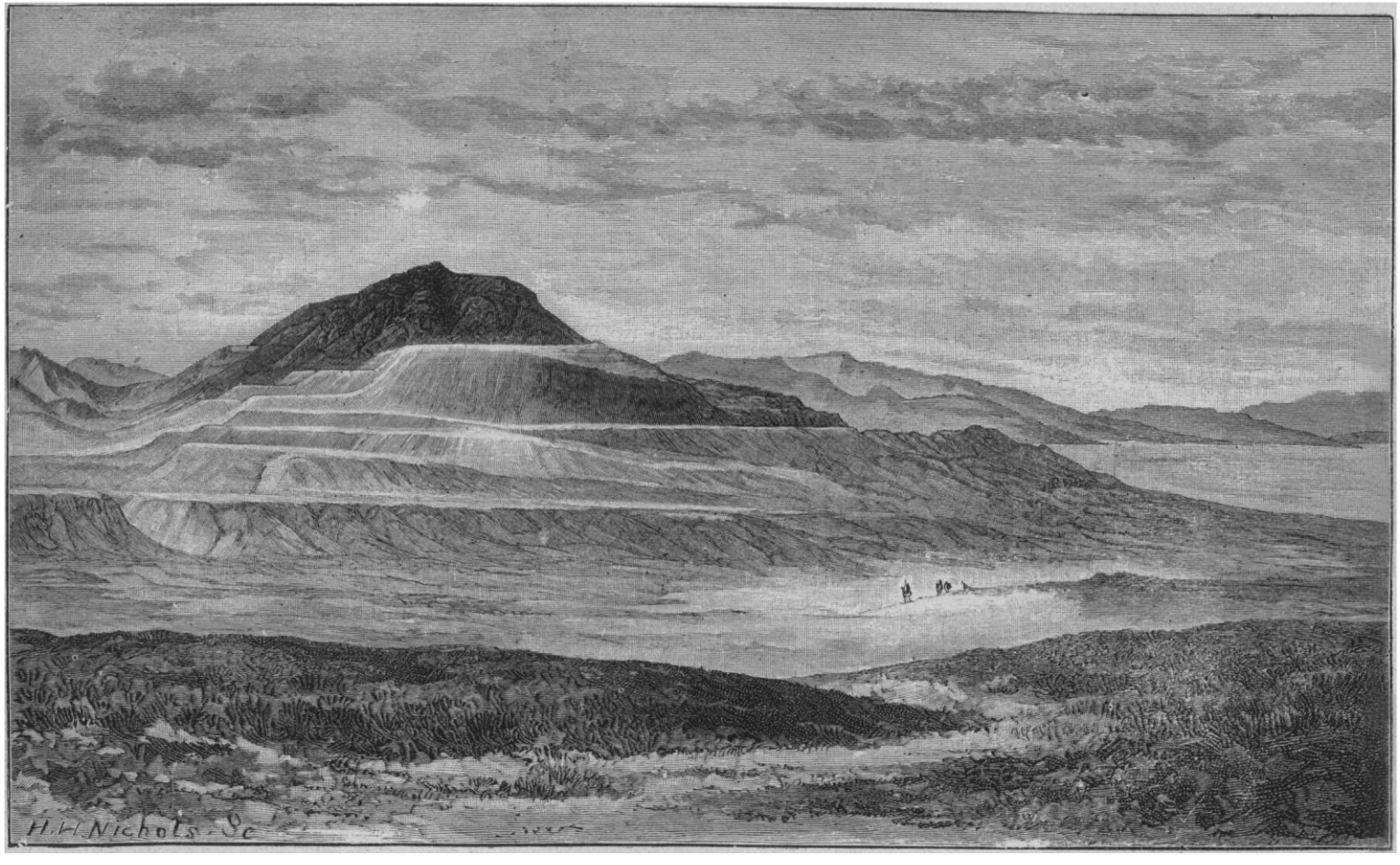
Special interest is attached to this investigation, as it is the first detailed study of an example of those great interior lakes so numerous at a comparatively recent period of the earth's history, and now so greatly reduced in area, or even converted into saline or sandy deserts. The largest of these was probably the one that united the Aral and the Caspian; another vast interior sea occupied much of what is now the desert of Gobi; and smaller examples could be named in the Argentine Republic and in northern Mexico. Central Africa, lying within the belt of heavy equatorial rains, still preserves a climate moist enough to fill its lakes to overflowing; but the recent drying-up of the outlet of Tanganyika shows that the change so distinct elsewhere is beginning to make itself felt even there. It will be long before any of these other great basins is known as well as that one so carefully studied by our government surveyors.

W. M. DAVIS.

## *CHEMICAL AND PHYSIOLOGICAL RESEARCHES ON THE PTOMAÏNES.*

DURING the last few years much attention has been directed to the study of the chemical nature and physiological action of the so-called *post-mortem* alkaloids (or ptomaïnes). These mysterious bodies, which are apparently formed in such small quantities as to make their detection and separation an extremely difficult operation, were originally regarded by both Selmi[1] and Schwanert[2] (1874) as exclusively

[1] Abstract in *Berichte deutsch. chem. gesellsch.*, vi. 142.
[2] *Berichte deutsch. chem. gesellsch*, vii. 1332.




RESERVOIR BUTTE, SHOWING TERRACES OF THE BONNEVILLE SHORELINES.

products of cadaveric putrefaction. Later, Selmi saw cause to believe that these organic bases, in serious pathological changes, might be produced in the animal organism during life, a view which was confirmed by Spica in 1881. Further experiments by Paternò and Spica on blood and egg albumen, and likewise those of Gautier on normal urine, showed, that, by the methods employed, reactions could be obtained from these healthy animal fluids similar to those which served to identify the ptomaïnes. Again: in 1881 Gautier communicated the discovery of a non-proteid, ptomaïne-like alkaloid, with poisonous properties, in normal human saliva, not destroyed by heat, and yielding crystalline gold and platinum compounds. Bujwid,[1] however, has tried physiological experiments on frogs and pigeons with the concentrated alcohol-water extract from 100 cc. of boiled saliva, and could obtain no poisonous action whatever. Griffin,[2] while endeavoring to explain Vulpian's results on the toxic action of human saliva, came to the following conclusions from injection experiments on rabbits: pure parotid saliva produces neither local nor general pathological changes when injected subcutaneously; filtered mixed saliva, containing, however, recognizable microphytes, produces no local effect, but causes an infection which finally becomes fatal; impure saliva of the mouth, collected while fasting, and injected under the skin, produces both a violent local action and a septic-like infection. The infection obtained in all of the experiments Griffin considers as a form of septicaemia, produced by a substance in solution in the saliva, and not due to microphytes. The local effects, however, produced by the impure mixed saliva, are not to be ascribed to either of the above, but to the partially putrid substances suspended in the fluid. These, when injected, are retained by the subcutaneous tissue, and thus give rise to irritation, finally producing gangrene; and, at the same time undergoing further decomposition, new putrid products are formed, which are absorbed, thus giving rise to a secondary infection. Coppola,[3] in a similar manner, has made a series of experiments on the physiological action of bases extracted from the blood of a healthy dog, which led him to believe that bodies extracted from healthy animal fluids, carefully protected from putrefactive alteration, may exhibit strong toxic properties, and therefore the albuminoid substances must be capable of undergoing certain transformations, aside from those produced by putrefaction, which may give rise to poisonous alkaloids. This view is in part substantiated by the recently published results of Brieger,[4] who found, that, by the digestion of raw fibrine with gastric juice, peptones are formed, which, although free from all products of putrefaction (indol, phenol, oxyacids, etc.), yield to alcohol and amyl alcohol an amorphous brown mass, which, even in small quantities, acts as a poison upon frogs and rabbits. .05–.1 gram of the sirupy extract was sufficient to kill a frog in fifteen to twenty minutes; while, with rabbits of one kilogram weight, .5–1 gram of the extract was required to produce the same effect by subcutaneous injection. The poisonous action is first manifested in a gradual paralysis of the extremities; after which the animal falls into a semi-comatose condition, and soon dies. The substance or substances formed in this manner react with all of the general alkaloid reagents, and are not readily decomposed by long boiling, nor by the long-continued action of hydrogen sulphide. Length of time, in the digestion of the fibrine, appears to exercise but little influence on the amount of the toxic substance formed. The same product was also obtained, in one case, from von Wittich's dry peptone. The poisonous substance does not come from the amyl alcohol, nor from the gastric juice; neither does undigested albumen yield any poisonous substance when extracted with amyl alcohol. Brieger's results thus confirm the previous statements of Schmidt-Mülheim, Hoffmeister, Fano, and others, that peptones, injected into the blood or under the skin, exert a poisonous action, though it would now appear that the action is not due to the peptones themselves, but to a substance formed simultaneously with them, and which can be partially separated by ethyl and amyl alcohol. Just here it is worth noticing the recent interesting discovery of Mitchell and Reichert, that the poisonous action of rattlesnake and moccason venom is due to the presence of two albuminous bodies, which, from their properties, they name *venom-peptone* and *venom-globulin*. Brieger also saw cause to believe that neurin, by oxidation, is changed into a body similar to, if not identical with, the extremely poisonous muscarin; also that a solution of neurin, on long standing in contact with air, is partially changed into poisonous products, which, by further putrefactive decomposition, disappear with formation of trimethylamine, and a substance volatilized when boiled with water.

It would thus appear that healthy animal fluids may contain substances capable of poisonous action, and also that albuminous matter may undergo changes other than putrefaction by which toxic substances may result; all of which tends to throw a shadow of doubt on the existence of distinctive *post-mortem* alkaloids. That poisonous bodies (or ptomaïnes) do result from the putrefaction of organic matter, there can, however, be but little question; and the recent work of Guareschi and Mosso,[1] of the university of Turin, is, in this connection, well worthy of notice. These investigators have made a systematic study of the products of the putrefaction of brain, blood, and fibrine, under varying conditions, and have fully established the formation of one or more poisonous alkaloids.

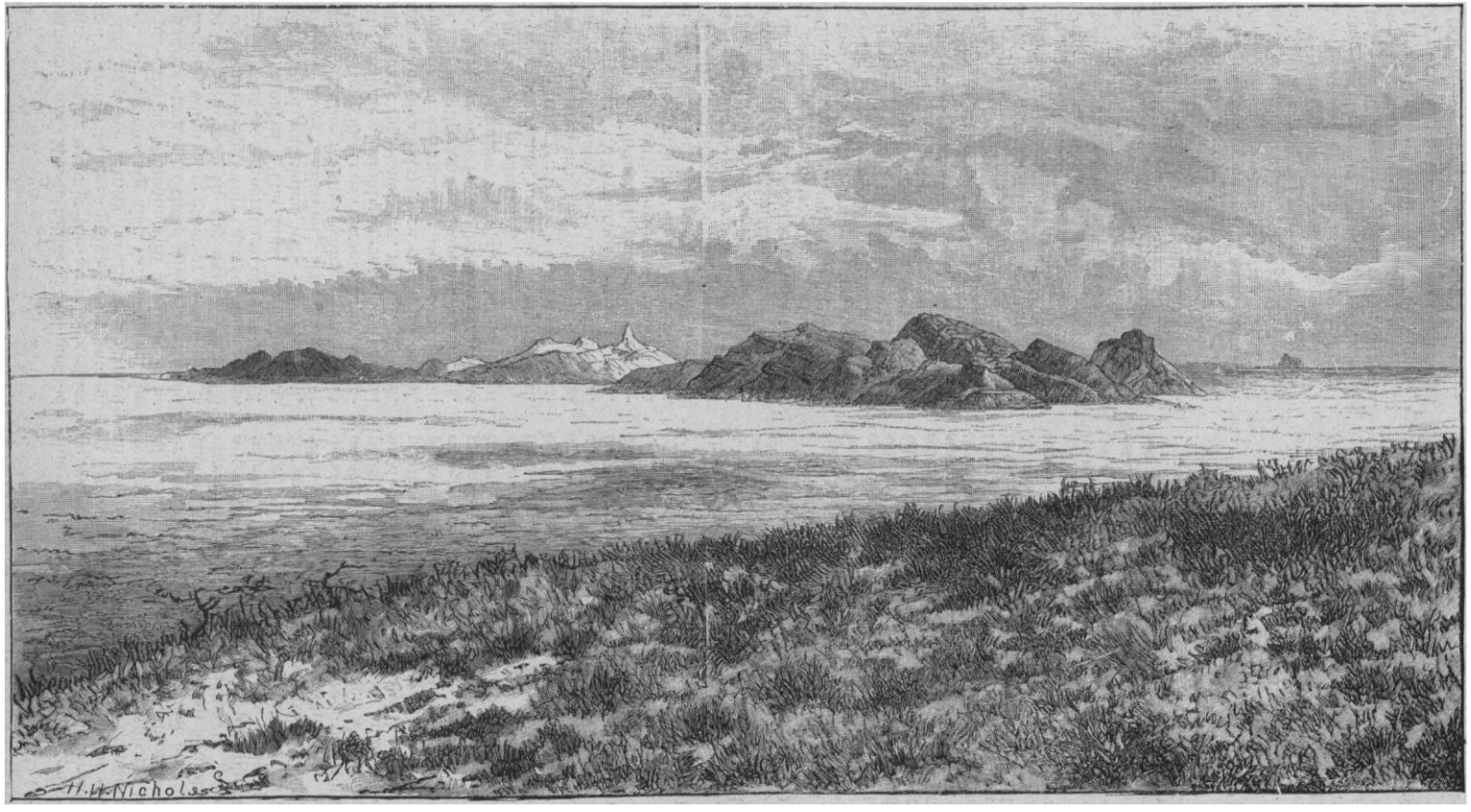
As preliminary to the actual work, a careful examination was made of the methods more commonly used for the extraction of ptomaïnes, in which it was found that the common extractives employed may contain traces of alkaloid substances. Thus, by the evaporation of large quantities of alcohol (fifty litres) in the presence of tartaric acid, a small residue was obtained, giving the alkaloid reactions with chloride of gold, phospho-molybdic acid, etc., and containing a trace of an alkaloid substance similar to pyridine, thus confirming the results of previous investigators; viz., Pinner, Krämer, and others.

In the amyl alcohol of commerce pyridine was likewise detected, in one case to the extent of 0.5 per thousand. Platinum and gold salts were made and analyzed. From six litres of crystallizable benzine a quantity of pyridine was also obtained sufficient to furnish chloroplatinates for analysis. The authors therefore conclude that all previous results obtained by different investigators from alkaline extracts by the use of either amyl alcohol or benzine, unless carefully purified, are absolutely without value as deciding the presence of ptomaïne-like bodies in fresh tissue or fluids, or their formation in the putrefaction of such material.

In the search for ptomaïnes in putrescent brain-

[1] *Virchow's archives*, xci. 190.
[2] *Archives ital. biol.*, ii. 106.
[3] Abstract in *Journ. chem. soc.*, 1883, 523.
[4] *Zeitschrift physiolog. chem.*, vii. 274.

[1] *Archives ital. biol.*, ii. 367.




VIEW ON GREAT SALT LAKE DESERT, SHOWING MOUNTAINS HALF BURIED BY LAKE-SEDIMENTS. (See page 570.)

matter, Guareschi and Mosso followed the method of Stass-Otto, applying exactly the same procedure in the control search with fresh brain-tissue; and, on account of the negative results invariably obtained in the latter, the authors are able to guarantee the absence of pre-existing ptomaïnes in fresh flesh, or of any substances similar to those which are found after putrefaction, when pure ether or chloroform is used in the extractions. In the experiments, 36 kilograms of brain-tissue were placed in a glass balloon, and left at a temperature of 10°–15° C. for one to two months. The mass was then extracted with alcohol acidulated with tartaric acid, using, in all, 147 litres of alcohol. The final ether solution left an alkaline residue, which, dissolved in dilute hydrochloric acid, gave characteristic precipitates with the general alkaloid reagents, and several well-defined colored reactions; but, though present, the ptomaïnes (or alkaloids) were in far too small quantity to admit of determining their composition by analysis. Trimethylamine, coming, doubtless, from the lecithin present in the brain-matter, was likewise obtained, together with an abundance of basic and ammoniacal products.

Physiological experiments, made on frogs with both aqueous and ether extracts, of the putrid brain-matter, led to the conclusion that the ptomaïnes formed possessed an action analogous to that of curare, though less energetic. A few drops of the extract, applied directly to the detached heart of a frog immersed in a .7 % salt solution, exercised upon it an immediate effect, diminishing the frequency of the systole and diastole, but increasing the vigor of the pulsation. In studying the action of the extract on nerves and muscles, a frog was rendered motionless by destroying the spinal cord; after which the achilles tendon was prepared in the usual manner, the sciatic nerve being placed upon the electrodes, and excited every ten seconds. .3 cc. of the ptomaïne containing extract was then injected under the skin of the back. After ten minutes, an irregularity appeared in the contraction of the gastrocnemius; and, since all the conditions of the experiment remained the same, the irregularity is to be ascribed to the poison. From this point the contractions were no longer regular: they gradually diminished little by little, and finally ceased altogether. On increasing the force of the irritation, there was still no further movement. The sciatic nerve of the other side, intact, had likewise lost its excitability, and the animal was in as complete a state of muscular relaxation as if it had been poisoned by curare. But the pupil was dilated, and the heart motionless.

In order to obtain the ptomaïnes in larger quantities, recourse was had to blood-fibrine. Large quantities of fibrine (140 kilos) were allowed to putrefy for five months; at the end of which time it was transformed into a thick fluid holding a small quantity of solid matters in suspension; the reaction being strongly acid, and the odor very intense at the commencement, but less strong later. For the extraction of the alkaloids, the method of Gautier and Étard was followed; the final slightly alkaline fluid being extracted successively with chloroform, in all, twelve times. By evaporation of the chloroform, an oily residue was left with an odor of scatol and of pyridine (or cicutine). This residue was purified by solution in tartaric acid, decolorized by extracting the acid solution with ether, and then reprecipitated by an excess of potassium hydroxide in the form of oily, brown droplets, which quickly rose to the top of the fluid. This precipitate was readily dissolved by ether, and, on evaporation, was left as an oily, brown residue with strong alkaline reaction, only slowly soluble in water, and then rapidly transformed into a resin. A hydrochlorate was readily obtained, crystallizing in fine lamellae, sometimes rectangular, resembling somewhat the crystals of cholesterin. With a solution of the hydrochlorate, auric chloride gave a yellow crystalline precipitate, followed by the reduction of the gold; platinic chloride, an abundant pale-yellow crystalline precipitate; iodine in potassium iodide, a kermes-brown precipitate; phosphotungstic acid, a pale-yellowish precipitate, etc. Chloroplatinates from seven different chloroform extractions were prepared for analysis by treating a solution of the hydrochlorate with an excess of platinic chloride. An immediate deposition of a flesh-colored precipitate, light and crystalline, insoluble in water, alcohol, and ether, took place. Dried at 100° C., the analyses of the various products showed essentially the same composition, pointing to the presence of only one ptomaïne in this putrefaction. The results correspond more or less closely with the formula $(C_{10}H_{15}N \cdot HCl)_2PtCl_4$, the ptomaïne itself being probably $C_{10}H_{15}N$. Bodies having the same apparent or closely related composition have been previously discovered: coridine, a homologue of pyridine, found in the oil of coal-tar by Thenius; a base, $C_{10}H_{15}N$, discovered by Vohl and Eulenberg in the fumes of tobacco, also termed coridine; a base obtained by Neucki[1] in the putrefaction of gelatine with pancreas, and which he deemed an isomer of collidine.

He[2] considered its constitution to be expressed by $C_6H_5 - CH \begin{matrix} \nearrow CH_3 \\ \searrow NH_2 \end{matrix}$, that is, isophenylethylamine, and that it is derived from the putrefaction of tyrosin, a normal product of pancreatic digestion, according to the following equation: —

$$C_9H_{11}NO_3 = C_8H_{11}N + CO_2 + O.$$

Gautier and Étard,[3] while studying the alkaloid-like bodies produced by putrefaction, isolated two bases, which, from the analyses of the platinum salts, corresponded to parvolin and hydrocollidin. Sonnenschein and Zuelzer[4] obtained from flesh extracts, which had become putrid by standing at 25° C. for several weeks, a small quantity of a crystalline substance, which behaved similar to atropin, dilating the pupil of the eye, and increasing the pulsation of the heart, etc. There is also a noticeable similarity between the ptomaïne obtained by Guareschi and Mosso, and the tetrahydromethylquinoline of Jackson. The physiological action of the alkaloid from putrefied fibrine is analogous to that of the ptomaïne from putrid brain-matter. Guareschi and Mosso propose to experiment further in the hopes of better establishing the nature of the ptomaïne in question, and to make clear its origin and constitution.

R. H. CHITTENDEN.

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## LETTERS TO THE EDITOR.

### Precocity in a chicken.

A BRAHMA chicken — now five weeks old, and raised by my boy — was brought into the house two weeks ago with a broken leg. On the same day a weak chicken, just out of the egg, was also brought in; and after two or three days both chickens were

[1] Ueber die zersetzung der gelatine und des eiweisses bei der faulnis mit pankreas. Bern, 1876.
[2] *Journ. prakt. chem.*, xxvi. 51.
[3] *Comptes rendus*, xciv. 1298.
[4] *Berliner klinische wochenschrift*, 1869, No. 2.