VIII. " Researches on Organo-metallic Bodies." Third Memoir. —On a New Series of Organic Acids containing Nitrogen. By EDWARD FRANKLAND, Ph.D., F.R.S. Received June 19, 1856.

(Abstract.)

The author, in pursuing the line of research indicated in his former memoirs, has investigated the action of zincethyl and zincmethyl upon binoxide of nitrogen, and has succeeded in producing a new series of organic acids, by the substitution of oxygen in binoxide of nitrogen by methyl, ethyl, &c. Binoxide of nitrogen is slowly absorbed by zincethyl, and the sole product of the reaction is a body which is deposited in magnificent rhomboidal colourless crystals. This body has the composition expressed by the formula

$$N_2 C_4 H_5 O_4 Zn + C_4 H_5 Zn,$$

and consists of the zinc salt of a new acid, for which the author proposes the name *dinitroethylic acid*, united with zincethyl. The dinitroethylate of zinc and zincethyl is produced from binoxide of nitrogen and zincethyl according to the following equation,

$$\left.\begin{matrix} 2(Zn\,C_4 H_5) \\ 2NO_2 \end{matrix}\right\} = N_2 C_4 H_5 O_4 Zn + C_4 H_5 Zn.$$

The crystals of dinitroethylate of zinc and zincethyl instantly become opake on exposure to the air, owing to the formation of an oxidized product. They are tolerably soluble in anhydrous ether without decomposition, but are instantly decomposed by anhydrous alcohol and by water. Exposed to the gradually increasing heat of an oil-bath, dinitroethylate of zinc and zincethyl fuses at 100° Cent., froths up, and begins slowly to evolve gas. At 180° the colour darkens, a small quantity of a highly alkaline liquid distils over, and a large amount of gas is evolved. The latter consists of carbonic acid, olefiant gas, hydride of ethyl, nitrogen and protoxide of nitrogen. When brought into contact with water, dinitroethylate of zinc and zincethyl is immediately decomposed with lively effervescence, due to the evolution of pure hydride of ethyl. An opalescent solution is formed, possessing a powerfully alkaline reaction and a

peculiar bitter taste. The opalescent solution contains only basic dinitroethylate of zinc, and the reaction is expressed by the following equation:—

$$N_2 C_4 H_5 O_4 Zn + \left.\begin{matrix} C_4 H_5 Zn \\ HO \end{matrix}\right\} = \left\{\begin{matrix} C_4 H_5, H \\ N_2 C_4 H_5 O_4 Zn + Zn O. \end{matrix}\right.$$

Carbonic acid decomposes this basic salt, precipitating carbonate of zinc, and leaving the neutral salt in solution.

Dinitroethylate of zinc and zincethyl is also decomposed by dry oxygen according to the following equation:—

$$N_2 C_4 H_5 O_4 Zn + \left.\begin{matrix} C_4 H_5 Zn \\ O_2 \end{matrix}\right\} = \left\{\begin{matrix} N_2 C_4 H_5 O_4 Zn \\ ZnO\, C_4 H_5 O. \end{matrix}\right.$$

When the product of oxidation is treated with water, basic dinitroethylate of zinc is produced along with alcohol.

Neutral dinitroethylate of zinc crystallizes in minute colourless needles containing half an equivalent of water. It fuses at 100° Cent., and gradually becomes anhydrous. It is very soluble in water and in alcohol. Heated suddenly in air to about 300° Cent. it burns rapidly with a bluish green flame.

Dinitroethylic acid can only exist in dilute solution; it can be prepared, either by decomposing the zinc salt with dilute sulphuric acid and distilling *in vacuo*, or by decomposing the baryta salt by an exact equivalent of dilute sulphuric acid. The dilute acid thus prepared possesses a pungent odour, somewhat resembling that of the nitro-fatty acids, and an acid taste. It reddens litmus paper strongly, and gradually decomposes even at ordinary temperatures. Neutralized by the carbonates of the various bases, it yields the corresponding salts. The silver and magnesian salts thus prepared were analysed.

The salts of dinitroethylic acid are all soluble in water and in alcohol, and most of them crystallize with more or less difficulty. They are all violently acted upon by concentrated nitric acid, the dinitroethylic acid being entirely decomposed and a nitrate of the constituent base produced. Dilute nitric acid acts in the same manner, but more slowly. They all fuse at a temperature little above 100° Cent. The potash, soda, lime, and baryta salts deflagrate explosively, like loose gunpowder, at a temperature considerably below redness.

The following salts have been prepared and analysed :—

	Formulæ.
Dinitroethylate of silver	$N_2 C_4 H_5 O_4 Ag$
Double nitrate and dinitroethylate of silver	$N_2 C_4 H_5 O_4 Ag + NO_6 Ag$
Dinitroethylate of copper	$2(N_2 C_4 H_5 O_4 Cu) + HO$
Dinitroethylate of zinc (crystallized)	$2(N_2 C_4 H_5 O_4 Zn) + HO$
Dinitroethylate of zinc (anhydrous)	$N_2 C_4 H_5 O_4 Zn$
Dinitroethylate of zinc (basic)	$N_2 C_4 H_5 O_4 Zn + ZnO$
Dinitroethylate of zinc and zincethyl	$N_2 C_4 H_5 O_4 Zn + C_4 H_5 Zn$
Dinitroethylate of baryta	$N_2 C_4 H_5 O_4 Ba$
Dinitroethylate of lime	$N_2 C_4 H_5 O_4 Ca + 3HO$
Dinitroethylate of magnesia	$N_2 C_4 H_5 O_4 Mg$
Dinitroethylate of soda	$N_2 C_4 H_5 O_4 Na$.

Dinitromethylic acid.—When binoxide of nitrogen is absorbed by zincmethyl, dinitromethylic acid is produced, and forms a series of salts homologous with those of dinitroethylic acid. The formula of this acid is

$$N_2 C_2 H_3 O_4 H,$$

and the following salts have been examined :—

Dinitromethylate of zinc	$N_2 C_2 H_3 O_4 Zn + HO$
Dinitromethylate of soda	$N_2 C_2 H_3 O_4 Na + 2HO$
Dinitromethylate of zinc and zincmethyl	$N_2 C_2 H_3 O_4 Zn + C_2 H_3 Zn$?

It is difficult to arrive at any satisfactory conclusion relative to the rational constitution of this series of acids; they may be regarded as belonging to the type of nitrous acid, containing a double equivalent of nitrogen, and in which one atom of oxygen has been replaced by an alcohol radical, thus,

$$N_2 \begin{cases} Cn\,Hn+1 \\ O \\ O \\ O \end{cases}$$

or they may be viewed as constructed upon the hyponitrous acid type, one equivalent of oxygen being replaced by an alcohol radical, and a second by binoxide of nitrogen, thus,

$$N \begin{cases} Cn\,Hn+1 \\ NO_2 \\ O \end{cases}$$

Without attaching much value to either hypothesis, the author prefers the latter, and remarks in conclusion that there can be little doubt that many new series of organic acids may, by analogous processes, be produced from inorganic acids by the replacement of one or more atoms of oxygen by an alcohol radical; in fact his pupil, Mr. Hobson, is now engaged in the study of a new series containing sulphur, produced by the action of zincethyl and its homologues upon sulphurous acid. These acids are formed by the replacement of one equivalent of oxygen, in three equivalents of sulphurous acid, by an alcohol radical.

IX. "On the Action of Urari and of Strychnia on the Animal Economy." By Professor Albert Kölliker of Würzburg. Communicated by Dr. Sharpey, Sec. R.S. Received May 31, 1856.

The communication which I now offer to the Royal Society contains a brief statement of the results of a series of experiments which I lately made on the action of the urari poison and of strychnia on the animal economy.

I. Urari.

The urari is the well-known poison from Guiana, also called Curare and Woorara. That which I employed in my experiments I owe to the liberality of my friend Professor Christison of Edinburgh. The following are the conclusions at which I arrived respecting its operation :—

1. The urari causes death very rapidly when injected into the blood or inserted into a wound; when introduced by way of the mucous membrane of the intestinal canal its effects are slow and require a large dose for their production, especially in mammalia. When applied to the skin of frogs it is altogether inoperative.

2. Frogs poisoned with very small doses of urari may gradually recover, even after it has produced complete paralysis of the nerves. Mammalia may also be restored, even after large doses, provided respiration is maintained artificially.

3. The urari, *acting through the blood, destroys the excitability*