VIII. "Researhces on Organo-metallie Bodies." Third Memoir.
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 zinc-methyl 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

\[ \text{N}_2\text{C}_4\text{H}_5\text{O}_4\text{Zn} + \text{C}_4\text{H}_5\text{Zn}, \]

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

\[ 2(\text{ZnC}_4\text{H}_5) \text{NO}_2 = \text{N}_2\text{C}_4\text{H}_5\text{O}_4\text{Zn} + \text{C}_4\text{H}_5\text{Zn}. \]

The crystals of dinitroethylate of zinc and zincethyl instantly become opaque 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:

\[
N_2 C_4 H_5 O_4 Zn + C_4 H_5 Zn \rightarrow \left\{ C_4 H_5, H \right\}_2 N_2 C_4 H_5 O_4 Zn + Zn O.
\]

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:

\[
N_2 C_4 H_5 O_4 Zn + C_4 H_5 Zn + O_2 \rightarrow \left\{ N_2 C_4 H_5 O_4 Zn \right\} + ZnO C_4 H_5 O.
\]

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:—

Formulae.

Dinitroethyleate of silver .................................. $N_2C_4H_5O_4Ag$
Double nitrate and dinitroethyleate of silver $N_2C_4H_5O_4Ag + NO_6Ag$
Dinitroethyleate of copper .................................. $2(N_2C_4H_5O_4Cu) + HO$
Dinitroethyleate of zinc (crystallized) .................. $2(N_2C_4H_5O_4Zn) + HO$
Dinitroethyleate of zinc (anhydrous) ......................... $N_2C_4H_5O_4Zn$
Dinitroethyleate of zinc (basic) .......................... $N_2C_4H_5O_4Zn + ZnO$
Dinitroethyleate of zinc and zincmethyl .................. $N_2C_4H_5O_4Zn + C_4H_3Zn$
Dinitroethyleate of baryta .................................. $N_2C_4H_5O_4Ba$
Dinitroethyleate of lime ..................................... $N_2C_4H_5O_4Ca + 3HO$
Dinitroethyleate of magnesia ............................... $N_2C_4H_5O_4Mg$
Dinitroethyleate of soda .................................... $N_2C_4H_5O_4Na$.

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

$N_2C_2H_3O_4H$,

and the following salts have been examined:—

Dinitromethylite of zinc .................................... $N_2C_2H_3O_4Zn + HO$
Dinitromethylite of soda ................................... $N_2C_2H_3O_4Na + 2HO$
Dinitromethylite of zinc and zincmethyl ................ $N_2C_2H_3O_4Zn + C_2H_3Zn$

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,

$$\begin{align*}
N_2 & \left\{ \begin{array}{c}
C_nH_{n+1} \\
O \\
O \\
O
\end{array} \right. \\
O & \end{align*}$$

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,

$$\begin{align*}
N & \left\{ \begin{array}{c}
C_nH_{n+1} \\
NO_2 \\
O
\end{array} \right.
\end{align*}$$
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 pro-
cesses, 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. Re-
ceived May 31, 1856.

The communication which I now offer to the Royal Society con-
tains 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 Edin-
burgh. The following are the conclusions at which I arrived respect-
ing 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