

March 1, 1866.

Lieut.-General SABINE, President, in the Chair.

In accordance with the Statutes, the names of the Candidates for election into the Society were read, as follows :—

Patrick Adie, Esq.	Edward Hull, Esq.
Alexander Armstrong, M.D.	+ John William Kaye, Esq.
George Bishop, Esq.	John Robinson McClean, Esq.
Sir Charles Tilstone Bright.	+ Hugo Müller, Ph.D.
Samuel Brown, Esq.	+ Charles Murchison, M.D.
Francis T. Buckland, Esq.	James Robert Napier, Esq.
+ John Charles Bucknill, M.D.	Rear-Admiral Erasmus Ommaney.
Lieut.-Col. John Cameron, R.E.	George Wareing Ormerod, Esq.
Sir Thomas Edward Colebrook,	+ William Henry Perkin, Esq.
P. R. Asiat. Soc.	Thomas Lambe Phipson, Ph.D.
W. Boyd Dawkins, Esq.	+ Ven. Archdeacon Pratt, M.A.
Henry Dircks, Esq.	Charles Bland Radcliffe, M.D.
Thomas Rowe Edmonds, Esq.	+ Capt. George Henry Richards, R.N.
+ Rev. Frederick William Farrar,	Benjamin Ward Richardson, M.D.
M.A.	+ Thomas Richardson, M.A.
Alexander Fleming, M.D.	+ William Henry Leighton Russell,
Peter Le Neve Foster, Esq.	Esq.
Sir Charles Fox.	+ Rev. William Selwyn, D.D.
William Withey Gull, M.D.	+ Rev. Richard Townsend, M.A.
+ William Augustus Guy, M.B.	Rev. Henry Baker Tristram.
Julius Haast, Ph.D.	Edward John Waring, M.D.
Capt. Robert Wolseley Haig, R.A.	+ Henry Watts, Esq.
+ James Hector, M.D.	Charles Wye Williams, Esq.
Jabez Hogg, Esq.	Henry Worms, Esq.

The following communication was read :—

“Researches on Acids of the Lactic Series.—No. I. Synthesis of Acids of the Lactic Series.” By E. FRANKLAND, F.R.S., and B. F. DUPPA, Esq. Received February 14, 1866.

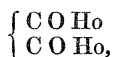
(Abstract.)

In the first part of this paper the authors give the details of the synthetical production of numerous acids of the lactic family, which have been briefly described in a series of notes already published in these Proceedings during the years 1863, 1864, and 1865. In the concluding portion of the present paper, they discuss the theoretical considerations which arise out of these investigations. They call attention to the existence of a group of elements, to which they give the name oxalyI and the formula (C O Ho),

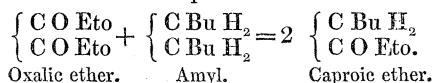
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and which exists not only in all acids of the lactic series, but also in nearly every known organic acid. The isolated molecule of this radical is oxalic acid,



in proof of which they show that when oxalic ether is acted upon by nascent amyl, it is converted into caproic ether :



Oxalyl is closely related to cyanogen, the two radicals passing into each other in a host of reactions ; hence the production of cyanides from the ammonium-salts of the fatty acids on the one hand, and the synthesis of acids from certain cyanogen compounds on the other,—a reaction first pointed out by Kolbe and Frankland\*, and which has of late yielded such important results in the hands of Maxwell Simpson† and of Kolbe and of Hugo Müller‡.



The researches of these chemists prove that the introduction of cyanogen into an organic compound, and its subsequent transformation into oxalyl, converts that compound into an acid, or, if already an acid, increases its basicity by unity (for each atom of oxalyl so developed), this result being apparently quite independent of the position of the oxalyl in the molecule. The atom of oxalyl (as the above molecular formula shows) may be regarded as methyl (C H<sub>3</sub>), in which two atoms of hydrogen have been replaced by one of oxygen, and the third by hydroxyl (Ho).

It may be objected that the group of elements, which is thus invested with radical functions, lacks one of the fundamental characteristics of a radical by its proneness to change ; but this characteristic is exhibited by the commonly received radicals in a very varied degree. And even methyl itself, which certainly possesses it in the most marked manner, readily permits of its hydrogen being replaced by chlorine or bromine on the one hand, and by sodium on the other. All compound radicals, the authors remark, are purely conventional groupings of elements intended to simplify the expression of chemical change ; and in this respect they believe the group oxalyl, entering as it does into the constitution of nearly every organic acid, has as valid a claim to a distinct name as the most universally recognized radical. Its admission renders possible the following very simple expression of the law governing the basicity of nearly all organic acids—an organic acid containing *n* atoms of oxalyl is *n* basic.

The authors classify all acids of the lactic series at present known, or

\* Memoirs of Chem. Soc. vol. iii. (1847) p. 336.

† Phil. Trans. 1861, p. 61 ; and Journ. Chem. Soc. vol. xviii.

‡ Journ. Chem. Soc. vol. xvii. p. 109.

which could be obtained by obvious processes, into the following eight divisions :—

	General formula.
1. Normal acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R} \text{H} \text{Ho} \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$
2. Etheric normal acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R} \text{H} \overset{\pm}{\text{Ro}} \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$
3. Secondary acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R}_2 \text{Ho} \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$
4. Etheric secondary acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R}_2 \overset{\pm}{\text{Ro}} \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$
5. Normal olefine acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R} \text{H} \text{Ho} \\ (\text{C} \text{H}_2)_n \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$
6. Etheric normal olefine acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R} \text{H} \overset{\pm}{\text{Ro}} \\ (\text{C} \text{H}_2)_n \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$
7. Secondary olefine acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R}_2 \text{Ho} \\ (\text{C} \text{H}_2)_n \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$
8. Etheric secondary olefine acids . . . . .	$\begin{Bmatrix} \overset{+}{\text{C}} \text{R}_2 \overset{\pm}{\text{Ro}} \\ (\text{C} \text{H}_2)_n \\ \text{C} \text{O} \text{Ho} \end{Bmatrix}$

A *normal acid* of the lactic series may be defined as one in which an atom of carbon is united with oxalyl, hydroxyl, and at least one atom of hydrogen. In the above general formula for these acids  $\overset{+}{\text{R}}$  may be either hydrogen, or any alcohol hydrogen.

An *etheric normal acid* is constituted like a normal acid, but contains a monatomic organic radical, chlorous or basylous, in the place of the hydrogen of the hydroxyl.

A *secondary acid* is one in which an atom of carbon is united with oxalyl, hydroxyl, and *two* atoms of an alcohol radical.

An *etheric secondary acid* stands in the same relation to a secondary, as an etheric normal does to a normal acid.

A *normal olefine acid* is one in which the atom of carbon united with oxalyl is *not* united with hydroxyl, and in which the atom of carbon united with hydroxyl is combined with not less than one atom of hydrogen. In this formula  $\overset{+}{\text{R}}$  may be either hydrogen or a monatomic alcohol radical, and the olefine, or diatomic radical of these acids, may belong to either the ethylene, or the ethylidene series.

An *etheric normal olefine acid* differs from a normal olefine acid only in

having the hydrogen of the hydroxyl replaced by an organic radical positive or negative.

A *secondary olefine acid* is one in which the atom of carbon united with oxalyl is not combined with hydroxyl, and in which the atom of carbon united with hydroxyl is also combined with two monatomic alcohol radicals.

In the above formula  $\overset{+}{R}$  must be a monatomic alcohol radical.

An *etheric secondary olefine acid* is related to the secondary olefine acids in the same way as the etheric normal olefine acids are related to the normal olefine acids.

The numerous cases of isomerism in the lactic series are next examined and explained; and the authors then show how the radicals which are employed for the production of the synthesized acids may again be separated, thus affording analytical as well as synthetical proof of the constitution of these acids.

These investigations have conducted the authors to the following conclusions:—

1. All acids of the lactic series are essentially monobasic.
2. These acids are of four species, viz. normal, secondary, normal olefine, and secondary olefine acids; and each of these species has its own etheric series of acids, in which the hydrogen of the hydroxyl contained in the positive or basylous constituent of the acid is replaced by a compound organic radical, either positive or negative.
3. The normal acids are derived from oxalic acid by the replacement of one atom of oxygen, either by two atoms of hydrogen, or by one atom of hydrogen and one atom of an alcohol radical.
4. The secondary acids are derived from oxalic acid by the replacement of one atom of oxygen by two atoms of monatomic alcohol radicals.
5. The olefine acids are derived from oxalic acid by a like substitution of two monatomic positive radicals for one atom of oxygen, with the addition of a diatomic radical ( $C_n H_{2n}$ ) between the two atoms of oxalyl.
6. The acids of the lactic series stand in the very simple relation to the acids of the acetic series first pointed out by Kolbe, viz. that by the replacement, by hydrogen, of the hydroxyl, ethoxyl, &c. contained in the positive radical of an acid of the lactic series, that acid becomes converted into a member of the acetic series.
7. The acids of the lactic series stand in an almost equally simple relation to those of the acrylic series, as is seen on comparing the two following formulæ:—

