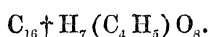


VIII. "Additional Observations on the Proximate Principles of the Lichens." By JOHN STENHOUSE, LL.D., F.R.S. Received October 3, 1862.

The Lichens on which I have recently been experimenting are two in number, namely, the South American variety of *Roccella tinctoria*, which is imported in considerable quantities from the neighbourhood of Lima and Valparaiso, and is known in commerce as "Lima weed;" and the *Roccella tinctoria* var. *fusciformis*, the same which I had formerly designated *Roccella Montagnei*; it is the "Angola weed" of commerce.

Soon after the publication in 1848 of my first paper on this subject, Dr. Schunck* threw out the hypothesis that the various compounds produced by boiling lecanoric, erythric, alpha- and beta-orsellinic acids with alcohol were all one and the same ether—the pseudo-erythrin of Heeren. No further light was thrown upon this obscure subject till the publication of Hesse's able paper in the March Number of Liebig's 'Annalen' for 1861. The Archil-lichen which Professor Hesse investigated was that from Angola. He extracted its colour-yielding principle—to which, from its feeble acid properties, he restores the name of erythrin originally given it by Heeren—by treating it with milk of lime, and precipitating either with carbonic or hydrochloric acid. On drying and boiling the erythrin with strong alcohol, he produced the ether which he terms orsellinic ether, the composition and properties of which he found to correspond precisely with those which Schunck and I had previously ascertained. Hesse's formula for this ether is



By treating it with chlorine and bromine, he succeeded in replacing two equivalents of hydrogen by these elements, producing what he termed the bichloro- and bibromo-orsellinic ethers. I have repeated Hesse's experiments, so far as the preparation of the bibrominated ether is concerned, and find, as will be seen by the subjoined analyses, that his statements are perfectly correct.

I. 0.7960 grm. substance, dried *in vacuo* over sulphuric acid, gave in the usual manner 0.8390 grm. Ag Br.

* Philosophical Magazine, October 1848.

† C=6 &c. *et seq.*

II. 0.6735 grm. gave 0.8400 grm. CO_2 and 0.1740 grm. Aq.

The following is a comparison of the theoretical and experimental percentages :—

Theory.		Experiment.	
		I.	II.
$\text{C}_{20} = 120$	.... 33.89	—	34.00
$\text{H}_{10} = 10$	.... 2.83	—	2.87
$\text{Br}_2 = 160$	.... 45.19	44.79	—
$\text{O}_8 = 64$	.... 18.09	—	—
	<hr/> 354 100.00		

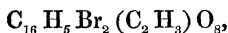
I likewise prepared a quantity of the corresponding methylic ether, by boiling erythrin in wood-spirit. When an alcoholic solution of this ether was treated with excess of bromine, the bibrominated orsellinate of methyl was produced. It crystallized in colourless flat needles, and furnished on analysis the following results :—

Dried *in vacuo* over sulphuric acid,

I. 0.3135 grm. substance gave 0.3463 Ag Br.

II. 0.3555 grm. gave 0.4155 CO_2 and 0.0850 Aq.

These results correspond with the formula



as is manifest from the following comparison :—

Theory.		Experiment.	
		I.	II.
$\text{C}_{18} = 108$	.... 31.77	—	31.87
$\text{H}_8 = 8$	.... 2.35	—	2.65
$\text{Br}_2 = 160$	.... 47.06	47.00	—
$\text{O}_8 = 64$	.... 18.82	—	—
	<hr/> 340 100.00		

I likewise prepared some alpha-orsellic acid from the South American variety of the *Roccella tinctoria*. On treating the ethyl-compound obtained from this acid with bromine, a body was formed which in properties and composition was exactly the same with the bibrominated ethyl-compound obtained from erythrin by Hesse, as may be seen by the following analytical details :—

I. 1.1890 grm. substance gave 1.2658 grm. Ag Br.

II. 1·0415 grm. gave 1·2970 grm. CO_2 and 0·2860 grm. Aq. Or, expressed in percentages,

	Found.		Theory.
	I.	II.	
C .. ———	33·96		33·89
H .. ———	3·05		2·83
Br.. 45·30	———		45·19

The circumstance that the ethers, whether obtained from erythrin or from alpha-orsellie acid, have not only the same properties and percentage composition, but likewise the same atomic weights, affords a very strong confirmation of the correctness of Dr. Schunck's hypothesis.

Orsellinate of Amyl.

On boiling dried erythrin with amylie alcohol for several hours, and removing the excess of alcohol by distillation, the residue yielded on standing a crystalline mass, which, however, I was unable to free entirely from resinous matter. Consequently it could not be analysed. It formed platy crystals of considerable lustre. There is every reason to believe, therefore, that it was the amyl-compound in question. The attempt to form a bromine-derivative, which it was expected might be more easily purified, did not furnish satisfactory results, though such a body was apparently produced.

Formation of Erythroglucine.

I have already shown* that when the ethyl-compound of erythrin, then known as erythric ether, is boiled with potash or baryta, alcoholic vapours are given off, while orcin and erythroglucine remain in the solution. I have recently found that though alpha-orsellie acid, as I had already established, when boiled with alkalis yields orcin but no erythroglucine whatever, yet when the ethyl-compound obtained from it is boiled with lime or any of the alkalis for five or six hours, erythroglucine as well as orcin is produced. In order to verify this very unexpected result, the erythroglucine, which was obtained with all its characteristic properties, was subjected to analysis.

Dried at 100° C,

0·5315 grm. substance gave 0·7670 grm. CO_2 and 0·4185 grm. Aq.

* Philosophical Transactions, 1848, p. 74.

The following is a comparison of theory and experiment :—

Erythro- glucine.	Theory.	Experiment.
$C_8 = 48 \dots$	39·35	39·35
$H_{10} = 10 \dots$	8·19	8·74
$O_8 = 64 \dots$	52·46	—
	<hr/> 122	<hr/> 100·00

As therefore the ether produced from two different sources, namely, from erythrin and alpha-orsellic acid, when boiled with alkalis yields erythroglucine, I think there is every reason to expect that the ethers derived from lecanoric and other lichen acids, when similarly treated, will likewise yield orcin and erythroglucine, thus affording still further confirmation of the correctness of Dr. Schunck's hypothesis. It now naturally occurred to me to treat the methylic ether obtained from alpha-orsellic acid with lime, in order either to procure a homologue of erythroglucine, or to attain results which might throw some light on the constitution of erythroglucine itself. The result of this experiment was somewhat unexpected ; for though several trials were made on a considerable scale, and the boiling with lime was continued, as before, till the ether was entirely decomposed, much orcin but no erythroglucine was produced. The same negative results were obtained when the methylic ether prepared from erythrin was subjected to a similar treatment. It appears therefore that ethyl is necessary to the formation of erythroglucine from alpha-orsellic acid, and that it cannot be replaced by methyl.

From the very great analogy which erythroglucine bears to ordinary mannite (being, in fact, the mannite of the lichen series), I was induced to submit it to the action of hydriodic acid, in precisely the same way adopted by Wanklyn and Erlenmeyer with mannite. A considerable quantity of erythroglucine was introduced into a retort and distilled with a great excess of strong hydriodic acid, while a current of carbonic acid gas traversed the hot liquid. A dark-coloured oil of an ethereal odour, and heavier than water, mingled with abundance of free iodine, passed over into the receiver, while a large quantity of a black humus-like body remained in the retort. The latter substance was evidently an organic compound containing much iodine ; but as it was insoluble in all the usual solvents, such as

water, alcohol, and ether, it was impossible to purify it. The oil was agitated with metallic mercury, to remove free iodine, then washed with water, dried over chloride of calcium, and redistilled. The quantity obtained in this manner was extremely small. The specimen examined was almost colourless, and boiled at 90° C. The residue in the retort contained another oil, boiling, with rapid decomposition, at a much higher temperature. Analysis furnished the following results :—

0·3615 grm. substance gave 0·3630 CO₂ and 0·1870 Aq, corresponding to 27·39 Carbon and 5·75 Hydrogen per cent.

These numbers approximate to those which iodide of propyl or iodide of butyl should furnish ; but owing to the very small quantity of substance at my disposal, I was unable to subject this curious oil to a thorough examination.

Tribrom-beta-orcin.

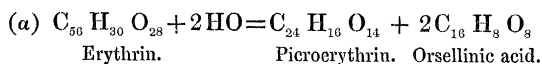
I have ascertained that when bromine is added to an aqueous solution of beta-orcin, a brominated derivative is formed, which crystallizes in needles. It is but slightly soluble in water, very soluble in alcohol and ether. It is perfectly similar in its properties to tribromorcin, derived from ordinary orcin, and most probably resembles it in constitution. Unfortunately the small amount of beta-orcin in my possession prevented me obtaining the tribrom-beta-orcin in sufficient abundance to submit it to analysis.

In the present state of our knowledge, the following equations will serve to throw light upon the constitution of a few of the more important lichen-derived compounds :—

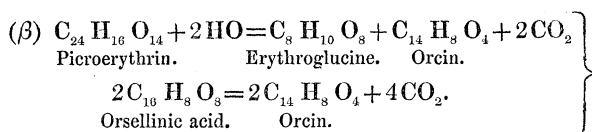
(1) When alcohol is boiled with erythrin, the following reaction takes place :—



(2) When erythrin is boiled with alkalis, the following transformations ensue :—



The picroerythrin is then transformed into erythroglucine, orcin, and carbonic acid, and the orsellinic acid into carbonic acid and orcin :—



These equations have been established either by myself or other observers.

IX. "On the Theory of Parallels." By Lieut.-General T. PER-
RONET THOMPSON, F.R.S. Received August 4, 1862.

More than thirty published efforts, from Ptolemy downwards, attest the satisfaction with which the Theory of Parallels would be seen established without merging the difficulty into an axiom.

As many of these are certainly not elementary, it amounts to an admission that any knowledge on the subject would be acceptable, even though it left the necessity of beginning from the axiom with freshmen.

Believing that the generation of the straight line with the impossibility of two enclosing a space, and of the plane with the straight line joining any two points lying wholly in the surface, may be rigidly demonstrated from the property of the sphere, which Plato calls its "perfection," or the faculty of turning about its centre without change of place,—I am induced to submit whether some light may not be offered by the following :—

Place two equal circles in the same plane, and let a straight line rest upon them (spheres and a superincumbent plane might be taken, but it is conceived the other is easier). The centres remaining at rest, let the circles dilate as by inflation, preserving always the equality of the diameters to one another.

It would appear to be deducible from the Platonic property, that the motion of any point in the circumference during the inflation must be perpendicular to the circumference, and consequently at any instant to the straight line which touches the circumference. Also the touching point in that straight line is at any instant impelled in a direction perpendicular to the circumference and to the touching line; out of which it seems impossible that the points of contact in the circumference and in the touching line should ever separate; for that would imply a motion other than perpendicular in one or both.

If this was supposed allowed, it would follow from making the