IV. "On the Tangential of a Cubic." By Arthur Cayley, Esq., F.R.S. Received February 11, 1858.

(Abstract.)

In my "Memoir on Curves of the Third Order," Phil. Trans. vol. cxlvii. (1857), I had occasion to consider a derivative which may be termed the "tangential" of a cubic, viz. the tangent at the point (x, y, z) of the cubic curve $(*\nabla x, y, z)^3 = 0$ meets the curve in a point (ξ, η, ζ), which is the tangential of the first-mentioned point; and I showed that when the cubic is represented in the canonical form $x^3+y^3+z^3+6lxyz=0$, the coordinates of the tangential may be taken to be $x(y^3-z^3) : y(z^3-x^3) : z(x^3-y^3)$. The method given for obtaining the tangential may be applied to the general form $(a, b, c, f, g, h, i, j, k, l\nabla x, y, z)^3$: it seems desirable, in reference to the theory of cubic forms, to give the expression of the tangential for the general form; and this is what I propose to do, merely indicating the steps of the calculation, which was performed for me by Mr. Creedy.

V. "On the Constitution of the Essential Oil of Rue." By C. Greville Williams, Esq., Lecturer on Chemistry in the Normal College, Swansea. Communicated by Professor Stokes, Sec. R.S. Received February 15, 1858.

(Abstract.)

The essential oil of rue and its products of decomposition have been examined by several chemists. Will analysed it many years ago, and deduced the formula $C^{28} H^{28} O^3$ as the result of his analyses. The principal investigation of it was made by Gerhardt, who regarded it as the aldehyde of capric acid. The production of capric acid from it by the action of nitric acid, as observed by Gerhardt and also by Cahours, has been considered as corroborative of the 20 carbon formula. It is evident, however, that the formation of capric acid merely indicates the aldehyde to contain *not less* than 20 equivalents of carbon.

Some experiments made with a view to the production of certain new derivatives of capric aldehyde, led the author to believe the ideas generally entertained regarding the formula of the oil to be erroneous. Before continuing his experiments, he has therefore reinvestigated the nature of the oil itself.

In order to obtain the aldehyde in a state of purity, advantage was taken of the tendency of the aldehydes to combine with the alkaline bisulphites. The oil obtained from the ammoniacal bisulphite of the aldehyde was carefully analysed. The mean of eight very coincident analyses gave,—

	Mean.		Calculation.	
Carbon.....	77·71	C^{22}	132	77·65
Hydrogen ..	13·07	H^{22}	22	12·94
Oxygen	9·22	O^2	16	9·41
	100·00		170	100·00

The mean of two determinations of the density of the vapour* gave,—

Experiment (mean).	Theory $C^{22} H^{22} O^2 = 4$ vols.
5·870	5·874

The aldehyde, purified as above, was again converted into the ammoniacal bisulphite, from which the oil was a second time obtained. It gave on analysis,—

Carbon.....	77·67
Hydrogen	12·93
Oxygen	9·40
	100·00

It is plain, therefore, that oil of rue contains an aldehyde of the formula $C^{22} H^{22} O^2$. Recent researches having demonstrated that no acid of the series $C^n H^n O^4$ with 22 equivalents of carbon has yet been isolated, and no other derivative with a 22 carbon formula being known, the author has given the name *enodyle* to the radical homologous with acetyle contained in this substance.

Enodic aldehyde is a colourless fluid of a fruity odour, quite different to that of the rue plant. Its density is 0·8497 at 15°. Agitation

* In order to prevent oxidation of the oil, the balloons were filled with hydrogen previous to immersion in the bath.

will cause it to solidify at 7° into a snow-white mass resembling camphor. Its boiling-point is 213°.

Rue oil yields a small portion of fluid boiling at 232°, containing the aldehyde of lauric acid. It was not obtained absolutely free from the first fluid. It contained:—

	Experiment.		Calculation.		
Carbon	78·1		C^{24}	144	78·26
Hydrogen	12·9		H^{24}	24	13·04
Oxygen	9·0		O^{2}	16	8·70
	100·0			184	100·00

The oils accompanying the aldehydes, but which refuse to combine with the alkaline bisulphites, are of the terebinthinate class. The more volatile are composed chiefly of an isomer of oil of turpentine; the less volatile are hydrates apparently homologous with an isomer of borneol.

March 25, 1858.

The LORD WROTTESLEY, President, in the Chair.

The following communications were read:—

I. "On the Relative Power of Metals and their Alloys to conduct Heat." By F. Crace Calvert, Esq., F.C.S., M.R. Acad. of Turin; and Richard Johnson, Esq., M. Phil. Soc. of Manchester. Communicated by Prof. Stokes, Sec. R.S. Received February 19, 1858.

(Abstract.)

After describing the apparatus employed, and the process followed to determine the conductibility of metals and alloys, the authors give the chemical means by which they purified the metals used in the experiments. Taking silver, which is the best conductor, as