

Table 1

Cellulose	Weight increase of deuteration (per cent)	Heat of wetting (refs. 7 and 9) (cal./gm.)	Monolayer values (refs. 7 and 9) (gm. water/100 gm.)		Accessibility (ref. 10)
			Brunauer-Emmett-Teller	Harkins-Jura	
Cotton	0.710	12.33	3.19	3.29	0.38
Mercurized cotton	1.21	20.25	5.21	5.36	0.65
Ratio, M/C	1.71	1.64	1.63	1.63	

Deuterium loading was obtained by keeping the celluloses in contact with heavy-water vapour (99.7 per cent) for several hours, and then evacuating to constant weight. After four to six loadings, there was no further increase in the evacuated dried weights. The process was completely reversed by ordinary water vapour, so that there were no 'resistant' deuterioyl groups produced<sup>3</sup>. The percentage gains in weight along with other results for the same substances<sup>7,9</sup> are given in Table 1.

Included in Table 1 are the accessibilities of the two celluloses. The accessibility is defined<sup>10</sup> as the ratio of the number of hydroxyl hydrogens exchanged to the total number in the cellulose. The accessibility of cotton cellulose to the vapour of heavy water is exactly the same as that calculated by Valentine<sup>11</sup> for the amorphous fraction. Valentine based his calculations on correlations between infra-red measurements of celluloses deuterated with heavy-water vapour<sup>3</sup> and water vapour adsorption isotherms<sup>10</sup>. The present accessibility of cotton cellulose is also similar to that for bacterial cellulose<sup>3</sup>.

The ratio of the Brunauer-Emmett-Teller monolayer molar values<sup>7,9</sup> to the moles of deuterated hydroxyls are 0.25 and 0.24 for cotton and mercurized cotton respectively. This suggests that each accessible glucose anhydride unit adsorbs about one molecule of water in the complete monolayer.

Of the three hydroxyls in the glucose unit, two are on the ring and one is on the side-chain. The tentative deduction that a maximum of one molecule is adsorbed directly on each accessible glucose unit suggests in turn that the side-chain hydroxyls may be the sites of hydrogen bonding<sup>7</sup>, and that they may be exchanged more rapidly than the ring hydroxyls. Kinetic experiments in progress appear to support the latter hypothesis.

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<sup>1</sup> Erllette, V. J., Hanle, J., and Mark, H., *J. Amer. Chem. Soc.*, **70**, 1107 (1948).

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## A Proposal for the Nomenclature of Free Radicals

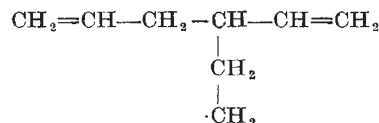
IN the course of preparation of a number of organic free radicals for mass spectrometric and electron spin resonance studies, it has become apparent that the system of nomenclature for organic compounds approved by the International Union of Chemistry<sup>1</sup> does not, in many cases, serve to identify a free radical unambiguously. As an example, there are listed below the possible butenyl radicals, the dot indicating the nominal position of the free electron. (This is not to imply that the electron is actually localized at this site.)

- |     |   |                     |
|-----|---|---------------------|
| (1) | $\dot{\text{C}}\text{H}_2\text{CH}=\text{CHCH}_2$           | } 2-butenyl         |
| (2) | $\text{CH}_2\text{CH}=\dot{\text{C}}\text{HCH}_2$           |                     |
| (3) | $\text{CH}_2=\text{CHCH}_2\dot{\text{C}}\text{H}_2$         | } 1-butenyl         |
| (4) | $\text{CH}_2=\text{CH}\dot{\text{C}}\text{HCH}_2$           |                     |
| (5) | $\text{CH}_2=\dot{\text{C}}\text{HCH}_2\text{CH}_2$         |                     |
| (6) | $\dot{\text{C}}\text{H}=\text{CHCH}_2\text{CH}_2$           | } 2-methyl propenyl |
| (7) | $\text{CH}_2=\text{C}(\text{CH}_3)\dot{\text{C}}\text{H}_2$ |                     |
| (8) | $\dot{\text{C}}\text{H}=\text{C}(\text{CH}_3)\text{CH}_2$   |                     |

The difficulty does not arise with derivatives of the radicals; for example, the chloride of (4) is 3-chloro 1-butene, and that of (8) is 1-chloro 2-methyl propene. When, however, the corresponding 'free' radicals are considered the system fails for lack of a functional group name for the free electron. We propose that the ending 'yl' be retained for the free radical and that the free electron be given the functional group name of 'el', preceded by a number to indicate its position as for any other substituent. Thus the free radical (4) becomes 1-butenyl 3-el as distinguished from (5) 1-butenyl 2-el.

The naming of di-radicals would follow the usual practice for double bonds; for example,  $\dot{\text{C}}\text{H}_2-\text{CH}=\dot{\text{C}}\text{H}$  would be called propenyl 1,3 di-el and  $\dot{\text{C}}\text{H}=\text{C}=\dot{\text{C}}\text{H}$  propadienyl 1,3 di-el.

A free radical in which the free electron is located on a side-chain, such as the (hypothetical) radical



would be named in this system (4 ethyl 2-el) 1,5 hexadiene.

At present radicals such as (1), (4) and (7) can be named as derivatives of allyl; (1) is  $\gamma$ -methylallyl, (4) is  $\alpha$ -methylallyl and (7) is  $\beta$ -methylallyl. These names, although useful in indicating the relation of these radicals to each other as derivatives of allyl by methyl substitution, may cause confusion since derivatives of the butenes are sometimes named from their relation to  $\alpha$ -butylene and  $\beta$ -butylene, in which the prefix refers to the position of the double bond rather than that of substitution.

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<sup>1</sup> *J. Amer. Chem. Soc.*, **55**, 3905 (1933).