Several recent papers, e.g. Ferracin (1981), imply, or even positively suggest, that the D series of sugars is in some way the antithesis of the L series of amino acids. This amounts to elevating a convention of chiral notation to the status of a basic principle. Some writers seem to think that D and L specify the optical rotatory power of a substance or solution. It may be worthwhile giving a brief historical account of the meaning of the convention.

Originally, the sense in which plane polarised light was rotated was specified by d and l. The idea that letters such as these should specify a series or class, rather than a direction of rotation, started with Fischer when he suggested that fructose, because of its close relationship to glucose, should be called d fructose although it is levorotary. As he and his colleagues amassed more information on the stereochemical structures of the sugars, and on their relationship to one another, many inconveniences in the d and l system became apparent. The need for a more logical system was stressed by Rosanoff (1906) who outlined a family tree of the aldoses starting from glyceraldehyde. The idea was accepted by Fischer and the hypothetical parent was called d glyceraldehyde. The relationship is most clearly seen if sugars, e.g. glucose, are drawn in the old-fashioned open chain form rather than as pyranoses.

$$\text{CHO}$$
$$\text{C}$$
$$\text{H}$$
$$\text{HCOH}$$
$$\text{CHO}$$
$$\text{HCOH}$$
$$\text{HOCH}$$
$$\text{HCOH}$$
$$\text{CH}_2\text{OH}$$

It was convenient to take C 2 as the stereochemical point of departure because it is technically easy to lengthen the carbon chain of a triose, tetrose or pentose by the cyanohydrin reaction at the pseudo-aldehyde end of the chain. Furthermore, that convention brought mannose and arabinose into the same series as glucose: that would not have happened if convention had started the series from the C 5 end. To avoid confusion with the older optical meaning of d and l, the letters D and L came to be used in this logical method for labelling a series. They were often accompanied by (+) and (−) to show the actual direction of rotation.

The important point is that, according to the convention, putting a sugar into the D series means no more than specifying that the chirality at C 2 is that of D glyceral-
dehydride. The chirality of the other carbon atoms is just as important as the chirality of C 2, and it is the mutual interactions of these chiralities that give the sugars their individual chemical characteristics. The influence of one chiral center on another, during synthesis, is clearly shown in Fischer's demonstration that the predominant sugar formed when formaldehyde is exposed to alkali is dl acrose and not a mixture of all the sugars.

Although rationalisation of nomenclature should have been easier with the amino acids because, apart from threonine and the double molecule cystine, each has only one chiral center, it actually had to wait until the 1930s. As with sugars, d and l originally specified the effect on polarised light. This led to many anomalies. Pasteur (1851) had found that asparagine was levorotatory while aspartic acid was dextrorotatory: it was later found to be levorotatory if measured at temperatures above 75°. Cysteine in neutral solution is dextrorotatory, but becomes levo on acidification, oxidation to cystine, or conversion to acetyl cysteine (Pirie and Hele, 1933). Fischer and Raske (1907; 1908) demonstrated the chiral similarity of serine, alanine and cysteine. More members were soon added to the series. But by the time it was agreed that all the amino acids that are built into proteins belong to the same chiral series, this had been positively demonstrated for only about half of them, though there was indirect evidence with the rest. The chaos of d and l terminology was resolved by the somewhat arbitrary decision to call the series L.

By chance, structures such as the one I have used for glucose, and three-dimensional drawings derived from them, which Fischer had adopted arbitrarily, proved to be correct when Bijvoet et al. (1951) determined the absolute configuration of dextrotopary sodium rubidium tartarate by X-ray analysis. From that determination it follows that D glyceraldehyde has a clockwise arrangement of the OH, CHO and CH₂OH groups when the molecule is viewed from the side opposite the H atom.

To pure chemists, the D and L notation naturally seems unpleasantly arbitrary. They have therefore tried to agree on an order in which possible substituent groups around a chiral center should be taken so that one wholly logical notation could be used for all chiral molecules. Biochemists are more accustomed to the seeming irrationality of many natural phenomena, and see little need for such a systematisation. Furthermore, some useful aspects of the D and L system would be lost. For example: according to one popular logical system, because of the effect of the massive S atom, cysteine would be moved out of the series to which the other amino acids belong. Nevertheless, attempts have been made to relate the sugar and amino acid series. Thus Brewster et al. (1950), having ruled that CHO was the equivalent of COOH, and OH of NH₂, showed that D glyceraldehyde was chirally related to D serine. On that basis, so long as attention is restricted to C 2 in the sugar series, there is an antithesis between the sugar and amino acid series. But it is illogical thus to limit attention, and it is by no means certain that organisms, in their metabolism, relate substituents to one another according to rules laid down by chemists in their wisdom.