COMMENTS
by Readers

In reply to Dr. Wright's criticism (*Science*, 1946, **104**, 190) of our note on the cause of nonresolvability of compounds of the type CabcCabc when the two asymmetric carbon atoms have opposite configurations (*Science*, 1945, **102**, 508), we are of the opinion that the concept of nonsuperimposability of mirror images is not a "trick" or a mere analogy, but is the necessary and sufficient condition for the existence of optical activity. The type of asymmetry necessary for mirror images of a molecule or crystal to be nonsuperimposable also is necessary for the retardation of one form of circularly polarized light with respect to the other and the production of a rotation of the plane of polarization of the resultant plane polarized light.

The assumption that the theory of Boys or of Kuhn can be applied to each half of the molecule CabcCabc separately, and added together algebraically when restricted rotation exists, assumes that the extent of rotation of the plane of polarization is independent of the path through the molecule. The theoretical treatments of Boys and of Kuhn deal only with models containing a single asymmetric carbon atom. Boys (*Proc. roy. Soc. Lond.*, 1934, **A144**, 655) postulates that the tetrahedral sets are distributed entirely at random in order to deal with an isotropic medium, thereby implying that the rotations of the individual molecules depend on their orientation. Kuhn (*Trans. Faraday Soc.*, 1930, **26**, 297, 302) states specifically that the rotation produced by the asymmetric molecule is dependent on the orientation of the molecule with respect to the light ray falling on it. In the discussion of Wolf's paper on restricted rotation (*ibid.*, p. 352) Kuhn points out that the rotation of one group with respect to the other will change the rotatory power of the molecule.

Our whole argument in the case of the compounds of the type CabcCabc is based on the fact that rotation is restricted and that the two halves of the molecule have a definite orientation with respect to each other. When this orientation is such that the mirror image is superimposable, the rotation produced by the molecule will be zero, regardless of the angle of incidence of the ray; but if the orientation of the two halves of the molecule is such that its mirror image is not superimposable, the rotation will be dependent on the angle of incidence. In the latter case the average rotation of randomly distributed molecules will be finite, because turning the molecule 180° through any axis does not influence the sign or extent of rotation of the individual molecules. If one wishes to consider the effects of the two halves of the molecule, the orientation of the two halves in the first case is such that the extent of rotation of the incident ray by one half is equal and opposite to that

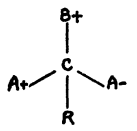

FIG. 1

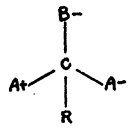

FIG. 2

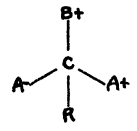

FIG. 3

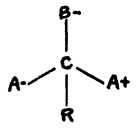

FIG. 4

by the second half regardless of the angle of incidence; but in the second case the orientation of the two halves is such that the rotatory contributions of the two halves are equal in only two directions. Accordingly, if rotation is sufficiently restricted, we should expect one inactive, one *d*, and one *l* form when the configurations of the two asymmetric carbon atoms are enantiomorphic. Furthermore, the active forms resulting from restricted rotation when the two asymmetric carbon atoms have like configurations would have different rotations.

While there seems to be little hope of preparing α,β-dibromo-α,β-diiodosuccinic acid, which we suggested might be separable into active isomers, we believe that a somewhat similar case is subject to experimental treatment. Figs. 1, 2, 3, and 4 represent 4 of the 8 forms possible for compounds of the type CAABR, where A and B are asymmetric groups, and R is a nonasymmetric atom or group. The molecules represented by Figs. 1 and 2 are enantiomorphic, as are those represented by Figs. 3 and 4. Shriner and Adams (Gilman's *Organic Chemistry*. (2nd ed.), p. 239) suggest that molecules represented by Figs. 1 and 3 should differ in physical properties but have identical rotations. It is our opinion that the rotations will not necessarily be identical, and we have been working intermittently over several years on the preparation of diastereoisomers of this type. The same considerations apply to Figs. 2 and 4.

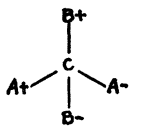

FIG. 5

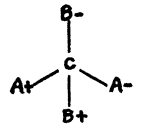

FIG. 6

An even closer analogy of the compounds of the type CabcCabc exists in the case of the forms of the compound CAABB, represented by Figs. 5 and 6. If the view of Shriner and Adams is correct with regard to the compound CAABR, then molecules corresponding to Figs. 5 and 6, which are enantiomorphs, should have zero rotation. It should be possible to synthesize compounds of this type also and decide the question by experimental results. (C. R. NOLLER, *Department of Chemistry, Stanford University.*)

Due to an oversight, in my article on "Origin and Evolution of Meiosis" (*Science*, March 14, 1947) the words meiosis and fertilization in diagram 5 were transposed. The reading should have been *"gametogenesis, fertilization, meiosis."* (L. R. CLEVELAND, *Harvard University, Cambridge, Massachusetts.*)