ambiguous interpretation of the relative importance of these effects would be extremely difficult without further molecular data. The fact that compounds such as PPD, which are not even expected to absorb 3371 Å radiation, show high gain suggests that dimers or excimers that absorb 3371 Å radiation may be forming in solution and lasing themselves, or their decomposition fragments may lase. This speculation is supported by the observation that some compounds, such as PPD or sodium salicylate, will only lase at quite high solution concentrations greater than 10^{-3} moles/l.

Solvents were included in the table of dyes, because the proper solvent determines, in many cases, whether or not a dye will reach lasing threshold. The effect of the solvent on lasing ability may be closely related to the singlet–triplet transition rate, which may be the limiting step in attaining threshold.

The ultraviolet dyes below 4000 Å are usually less efficient, and lase in a narrower spectral range than the visible dyes. Between 4000 and 4500 Å, conversion efficiencies of the order of 15–20 per cent have been obtained, while below 4000 Å the efficiencies so far obtained have been of the order of 1 per cent or less. Effective spectral ranges in this region are, on the average, of the order of 100–150 Å, while the visible dyes have in some cases spectral ranges as broad as 500–600 Å. Another disadvantage of a few ultraviolet dyes is that they have limitations on the rate at which they can be pulsed in our non-flowing dye cell. This indicates that these dyes may be decomposing (such effects were not observed for the visible dyes studied), and they must either flow or be cooled to perform as well as their visible counterparts.

While this list of scintillators and dyes is not complete, our success does indicate that tunable dye laser action is feasible down to, and probably well below, 3500 Å. We are continuing this work in order to improve ultraviolet dye laser performance.

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Received December 9, 1969.

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BIOLOGICAL SCIENCES

Changes in Nucleoside Conformation

Arnott and Hukins[1], and Sundaralingam[2], have recently compared the conformational parameters of nucleosides and nucleotides with those found in polynucleotide structures. Two of the parameters they discuss are the relative orientation of the sugar component with respect to the purine or pyrimidine base, and the type of pucker in the sugar ring.

I should like to draw attention to the variation of these two parameters in three nucleosides that have been studied in this laboratory. The three nucleosides are 5-bromouridine, inosine and 5-iodouridine, and they are of interest because they show differences in conformation when in different environments in a crystal. The structure of 5-bromouridine has been determined when it is complexed with adenosine[3]; when it crystallizes by itself[4]; and when it is complexed with dimethylsulphoxide[5]. Inosine has been studied in two crystal forms[6–9], and in the case of 5-iodouridine there are two molecules in the asymmetric unit which have markedly different conformations[10].

The relative orientation of the sugar and base may be described in terms of a torsion angle φ_{CN} (ref. 11), or an angle χ (ref. 1), and, like most nucleosides, the three discussed here are in the *anti* conformation. Also, the pucker of the sugar rings is either C2′ *endo* or C3′ *endo*, the most common type of pucker observed in nucleosides and nucleotides.

Haschemeyer and Rich[12] have calculated the "allowed" ranges of φ_{CN} in nucleosides with different puckers, based on a consideration of intramolecular contacts. These calculations show that the *anti* ranges for both C2′ *endo* and C3′ *endo* pyrimidine nucleosides are not very different, and, although the ranges are larger for purine nucleosides, again the allowed ranges for C3′ and C2′ *endo* puckers are similar. It is therefore surprising to find, even in the three nucleosides discussed here, that the mean value of the φ_{CN} angles for the C3′ *endo* pucker has a smaller magnitude than the mean value of φ_{CN} for those with a C2′ *endo* pucker. This result is in agreement with the conclusion of Arnott and Hukins[1], based on a survey of nucleosides and nucleotides, and also that of Sundaralingam[2]. The φ_{CN} values are given in Table 1. The mean φ_{CN} value for the C2′ *endo* pucker is $-69°$ and for the C3′ *endo* pucker it is $-15°$. In the refined molecular models of B-DNA and A-DNA structures[13] the φ_{CN} values are $-80°$ and $-19°$ respectively; in B-DNA the pucker is C2′ *endo* and in A-DNA it is C3′ *endo*. Thus the changes in the environments of the nucleosides in the crystal bring about similar changes in conformation to those occurring when DNA changes from one form to the other. Although there is this apparent correlation between the type of pucker and the mean value of φ_{CN} in nucleosides, there is an overlap of the ranges of the φ_{CN} values for the two types of pucker as may be seen from Table 1 of Haschemeyer and Rich[12].

Table 1. CONFORMATIONAL DATA ON NUCLEOSIDES

Nucleoside	φ_{CN}	Pucker	Ref.
Bromouridine			
Bromouridine + adenosine	−20°	C3′ *endo*	3
Bromouridine	−56°	C2′ *endo*	4
Bromouridine + dimethylsulphoxide	−63°	C2′ *endo*	5
Inosine			
Molecule I	−10·6°	C3′ *endo*	6, 7
Molecule IIA	−121°	C2′ *endo*	8, 9
Molecule IIB	−45°	C2′ *endo*	8, 9
Iodouridine			
Molecule I	−13°	C3′ *endo*	10
Molecule II	−59°	C2′ *endo*	10

I thank Dr Struther Arnott for showing me a draft of his manuscript with D. W. L. Hukins before publication, and Dr P. Tollin for discussion.

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Received October 27, 1969.

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