and a phenol and its reaction with GSH and poly(G) shows that the metabolite is an epoxide. The formation of products with the chromatographic characteristics of *trans*-5,6-dihydro-5,6-dihydroxy-7,12-dimethylbenz[a]anthracene and 5-hydroxy-7,12-dimethylbenz[a]anthracene justifies its identification as the 'K'-region epoxide 7,12-dimethylbenz[a]anthracene 5,6-oxide. The 'K'-region dihydrodiol is formed in small amounts in the metabolism of 7,12-dimethylbenz[a]anthracene, although the major product is the non-'K'-region dihydrodiol 8,9-dihydro-8,9-dihydroxy-7,12-dimethylbenz[a]anthracene (Boyland & Sims, 1967). 7,12-Dimethylbenz[a]anthracene 8,9-oxide was not detected in these experiments, probably because it decomposed on the alumina column.

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Tertiary-Structure Transitions of Supercoiled Deoxyribonucleic Acid

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The solution structure of supercoiled DNA with respect to its superhelix density, σ (Bauer & Vinograd, 1968), is still a subject of controversy. Recently the complete form of the plot of sedimentation coefficient against σ from -0.085 to 0 has been established (Upholt *et al.*, 1971). This suggested there are at least three different structures of superhelical DNA in different superhelix density regions. However, a previous attempt to correlate sedimentation coefficient with solution structure (Gray, 1967) had limited success, and Upholt *et al.* (1971) resorted to electron microscopy. They proposed that from $\sigma = -0.035$ to -0.018 supercoiled DNA had a rigid straight interwound structure, and from -0.018 to -0.005 a spherically coiled form. However, light-scattering investigations on bacteriophage ϕ X174 RFI DNA at

$\sigma = -0.025$ has ruled out the straight interwound structure and suggested a Y-shape structure as the most likely (Campbell & Jolly, 1972; Jolly & Campbell, 1972). It was therefore decided to follow the structure transition with changing σ by light-scattering.

The superhelix density was altered by temperature change. Increasing temperature unwinds the DNA duplex, thus decreasing the absolute value of σ , by a fairly accurately known amount per °C (Upholt *et al.*, 1971; Wang, 1969a,b).

In all experiments the molecular weight was $3.21 \times 10^6 \pm 0.1 \times 10^6$. Between 14.9°C and 53.4°C, i.e. $\sigma = -0.0265$ to $\sigma = -0.0207$, no great structural changes were apparent from either the root-mean-square radius values or the reciprocal of the scattering factor at scattering angle θ , $P(\theta)^{-1}$, against $\sin^2(\theta/2)$. The root-mean-square radius varied from 85.4 nm at 14.9°C through 95.2 nm at 45°C to 83.2 nm at 53.4°C. However, at 74.5°C and $\sigma = -0.0175$ the root-mean-square radius decreased to 41.5 nm and the $P(\theta)^{-1}$ curve altered considerably, evidence of some structural change. None of the previously suggested models, the Y-shape, the straight interwound model or the toroid, seems appropriate here for what is apparently a very compact molecule. It could be a very short fat interwound cylinder, or more probably a form of very compact toroid with a very large 'small' radius.

As the root-mean-square radius falls rapidly, the sedimentation coefficient starts to fall also; this is the opposite of what would be expected and implies that the molecule has become more 'free-draining' (Tanford, 1961).

The findings also show that the results obtained with formaldehyde temperature titrations of supercoiled DNA (Follet & Crawford, 1967; Rhoades & Thomas, 1968) are artifacts, since these indicate structure transition at lower temperatures.

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