INTERACTION OF Cu^{++} IONS WITH DNA, ITS CONSTITUENTS AND RELATED COMPOUNDS

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SUMMARY

Three distinct types of DNA-Cu^{++} complexes have previously been distinguished as native DNA-Cu^{++}, single strand DNA-Cu^{++} and DNA denatured in the presence of Cu^{++} ions, and have been studied independently in the work presented in this thesis. The native DNA-Cu^{++} interaction was investigated extensively by determining the binding parameters using the techniques of gel exclusion chromatography and Cu^{++} ion potentiometry, and by following the accompanying conformational changes (by viscometry and ultracentrifugation) and spectrophotometric changes. The dependence of the binding parameters of the native DNA-Cu^{++} interaction with ionic strength was confirmed, and a dependence of two types of interactions with the (G + C) content of DNA was established. The binding parameters for the other two types of DNA-Cu^{++} complexes were also determined, those for the single strand DNA-Cu^{++} interaction being the same as for the native DNA-Cu^{++} interaction.

All of the binding parameters were determined from Scatchard plots by means of an objective geometrical analysis. The presence of more than one type of site was indicated by curvature of an electrostatically corrected Scatchard plot, from which an apparent intrinsic constant, K_o, was obtained and compared to K_o determined by an independent procedure, thereby confirming the accuracy of the electrostatic correction function.

The interpretation of the nature of the individual complexes involved in the various DNA-Cu^{++} complexes was clarified from hyperchromicity and binding studies of more simple structures resembling DNA (the homo-polynucleotides, poly G, poly I, poly C and poly A) and from determinations of the stability constants for the oligo- and mono-nucleotide constituents of DNA and similar compounds.