PROTON MAGNETIC RESONANCE STUDY OF THE INTERACTION OF AMINO ACIDS AND DIPEPTIDES WITH sRNA.

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It is well-known that proteins and oligopeptides are able to form complexes with nucleic acids. It is anticipated that the sequence of amino acids will play an important role in the specificity of the complexes. Gabbay et al (1968) have demonstrated that the stereospecifity of substituted diamines play an important role in their interaction with polynucleotides. We report here some preliminary results from a proton magnetic resonance (PMR) study of the interaction of some amino acids and dipeptides with sRNA. Since the signals of bound molecules are broadened due to a decrease in mobility, PMR spectroscopy is a useful method of studying the interaction between small molecules and sRNA.(Backer et al 1969).

The proton resonances of gly-gly (Reanal) in the presence and in the absence of sRNA (Institute of Organic Chemistry, Novosibirsk, USSR) are shown in Fig.1 as a typical example. It is seen that the signals of gly-gly experience extreme line broadening in the presence of sRNA. This broadening is attributed to the sorbtion of gly-gly on sRNA due to interaction between amino groups and negatively charged phosphate groupings. Obviously, in such binding the influence of sRNA on

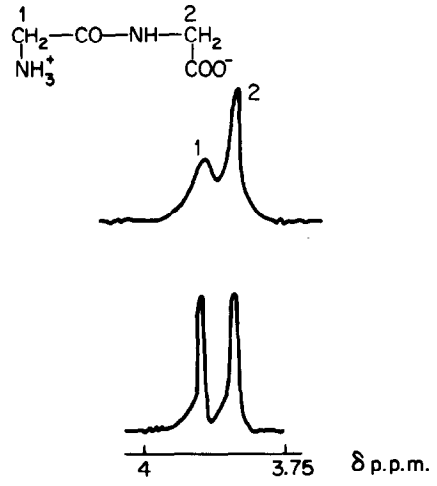

Fig.1. Proton magnetic resonance spectra of gly-gly (0,2M) in the absence (a) and in the presence (b) of sRNA in D_2O , JNM-4H-100 spectrometer, 30°.

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the mobility of different groups in amino acids and dipeptides should decrease with increasing distance from the amino group. Actually as seen from Fig.1 and Fig.2 (a,c) the linewidth of N-terminal gly α-CH_2-protons changes more than does that corresponding to the C-terminal gly. The absence of any considerable changes in the spectra of N-substituted N-acylgly and N-formylgly-gly in the presence of sRNA confirms the assumption of the electrostatic nature of the sorbtion of amino asids and dipeptydes on sRNA.It follows from these experiments that all other interactions are less important in the binding of amino acids and dipeptides by sRNA. Nevertheless as revealed by PMR the specificity of substituted amino acids manifests itself in the interaction of dipeptides with sRNA. In Fig.2(b,d) the linewidths of the α-CH_2-gly resonances in gly-DL-leu and gly-DL-ser are plotted vs. added

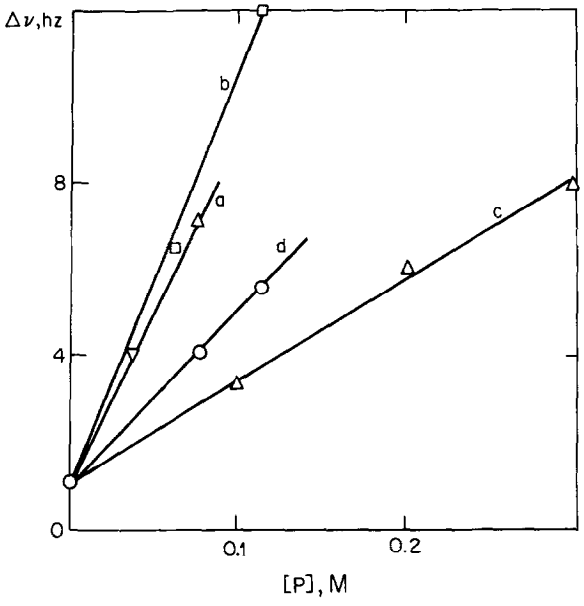

Fig.2. The influence of sRNA on the linewidths of α-CH_2--protons (a) C-gly in gly-gly(0,2M); (b)N-gly in gly-DL-ser (0,3M); (c) N-gly in gly-gly (0,2M); (d) N-gly in gly-DL-leu (0,3M).
[P] - the average concentration of nucleotides of sRNA in solution.

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sRNA concentration. The slopes of the concentration dependences for these dipeptides are different apparently because of the effect of C-terminal amino acid substituents. The nature of the side chain substituent may determine either the stability constant of dipeptide- sRNA complexes, or the mobility of the α-CH_2-gly group in these complexes.

We hope that the detailed study of selective line broadening in nucleopeptide complexes will help to understand the mechanisms of the interactions between amino acid residues and different elements of nucleic acids structure.

References

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