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THE INTERLOCKING PEPTIDE AND NUCLEOTIDE CYCLE INITIATED BY N-PHOSPHOAMINO ACIDS

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In our previous work, it was found that the series of compounds N-phosphoamino acids were chemically active species characterized the bio-minic reactivity, such as phosphoryl donor, amino acids carrier[1-2]. Since N-phosphoamino acids are the existing component for bio-synthesis in biology system, and they were obtainable by reacting the amino acids with pyrophosphate and metaphosphate in aqueous condition[3], it is important to investigate their interaction with biomolecules.

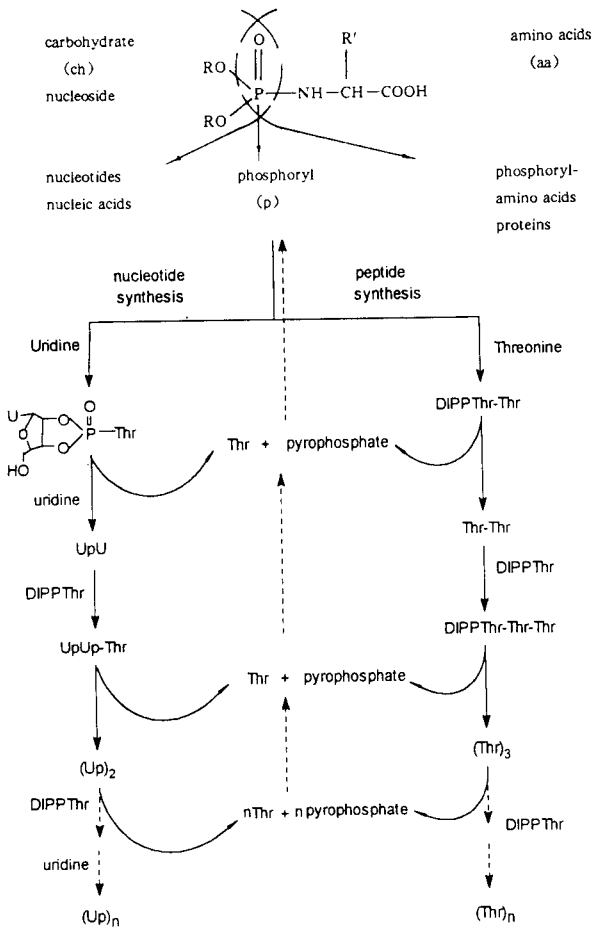
In this paper, the interaction between N-(O, O-diisopropyl) phosphoamino acids and four nucleosides adenosine, uridine, cytidine and guanosine at room temperature in aqueous as well as anhydrous pyridine were studied. It was found that in addition to the peptides, there were nucleotides aminoacyl-nucleotide formed. The peptides yields were varied as the nucleoside changed. Also, the nucleotides yields were fluctuated as the N-phosphoamino acids were differentiated.

The mechanism study showed that the self-assembly peptides synthesis required α-amino acids specifically. The non-protein amino acids, such as β- and γ- amino acids were unable to carry out the similar reaction. The peptides elongation process is comparable to the biosynthesis of protein in vivo.

Scheme 1 showed the collaboration between the peptides and nucleic acids synthesis initiated by N-phosphoamino acids. Furthermore, the pyro-phosphate side product generated by the cycle could reconstruct the N-phosphoamino acids. Hence, the three components, amino acids, phosphorus and the nucleosides would work together in a cooperative fashion to maintain the catalytic cycle active. The life time of the interlocking cycle is dependent on the regeneration of the N-phosphoamino acids.

It is more interesting that the nucleic acids, RNA or DNA were cleaved by N-phosphoamino acid[4]. Therefore, the cycle in Scheme 1 is a reversible one, which could be considered as a most remote molecular assembly ancestor of protein and nucleic acids. A general expression to explain this

dynamic chemical architecture constructed from amino acids $f(aa)_k$, carbohydrate or hydroxyl portion $f(ch)_j$ and the phosphoryl part $f(p)_i$ is illustrated in equation 1.



Scheme 1 : the loop to link the formation of nucleotides and oligopeptides

$$F(p)=\sum_{i,j,k=1}^{n} f(p)_i \cdot [f(ch)_j + f(aa)_k] \qquad \text{(equation 1)}$$

1. Zhao, Y.F. and Ju. Y. , et al.: 1995, Int. J. Peptide Protein Res., 45, 514-518.
2. Wang, Q. and Zhao, Y.F.: 1995, Science in China (B), 25, 684-688.
3. Yoshinobu, B and Mitsutomo, T. et al.: 1990, Trends in Organic Chemistry, 1, 53-75.
4. Li, Y.F, and Ma, Y., et al.: 1995, Biochemical Biophysics Res. Commun. 213, 875-880.