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## Phosphorus, Sulfur, and Silicon and the Related Elements

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## N-Phospho- $\alpha$ -Amino Acids and Co-Evolution of Nucleic Acid and Protein

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N-phospho- $\alpha$ -amino acids obtainable from aqueous condition were different from their corresponding  $\beta$ -analogues intrinsically. As the self-reproduction unites, N-phospho- $\alpha$ -amino acids were capable to produce non-random oligopeptides. As the phosphoryl donor, they were able to phosphorylate the nucleosides much faster than the deoxynucleosides.

**Keywords:** N-Phospho- $\alpha$ -amino acids; self-reproduction unites; non-random oligopeptides; peptide elongation; nucleotides elongation; molecular evolution

### Non-Random Oligopeptides From N-phospho- $\alpha$ -amino acid

When the amino acids were produced through the prebiotic synthesis, they could be polymerized thermally, but the sequence of the oligopeptides were random. However, the N-phosphoamino acids<sup>1</sup> which were obtainable from the aqueous media, were able to produce a predictable peptides sequence. For example, when N-phospho- $\alpha$ -histidine incubated with serine at 40°C in aqueous media, the peptides His-ser, His-His-ser etc.. were formed. While under the same condition, when N-phospho- $\alpha$ -serine incubated with histidine there were peptides Ser-His, Ser-Ser-His etc.. produced. The N-phospho- $\alpha$ -amino acids were acted as the pentacoordinated "Charged Amino Acids" to

activate and initiate the polymerization reaction. In which the activated carboxylic center could be attacked by any nucleophile such as the amino group of an amino acid or peptide to produce the new peptides. It is indicated that the elongation of the peptide bonds was operated by repetition of this specific reaction for  $\alpha$ -amino acids. Hence, the intrinsic chemical principle beheld by the N-phospho- $\alpha$ -amino acids is the natural endowment which N-Phospho- $\beta$ -amino acid did not have such properties.

### Nucleotides From N-phospho- $\alpha$ -amino acids

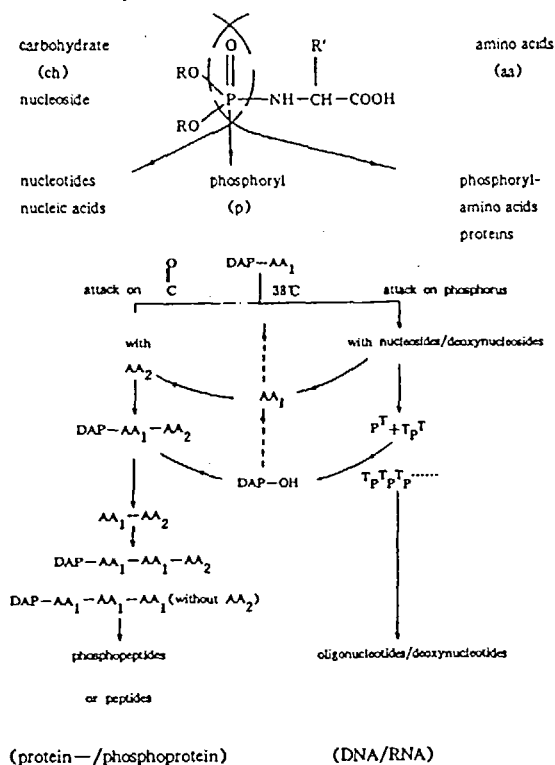
The prebiotic synthesis of purines is robust; pyrimidine synthesis is satisfied. However, the nucleosides prebiotic synthesis is more difficult. For example, under the UV and the presence of phosphate or ethyl-metaphosphate, the nucleosides could be produced from bases and ribose or deoxyribose<sup>2</sup>.

Fox<sup>3</sup> also showed that by treatment with polyphosphoric acid at 273K the nucleosides but not the deoxynucleosides could be converted into the nucleotides. Schwartz isolated the 2', 3' and 5'-AMP by mixing the adenosine with linear polyphosphoric acid<sup>4</sup>. These results demonstrated that the nucleosides were much easier to be phosphorylated than the deoxynucleosides.

In our laboratory, it was found that N-phospho- $\alpha$ -amino acids not only could self-assemble into oligopeptides, but also could phosphorylate the nucleosides or the deoxynucleosides to give mononucleotide, dinucleotides and their aminoacyl-conjugate<sup>5</sup>. The P-31-NMR, HPLC, FAB-MS, CE(Capillary Electrophoresis), CE-MS were used for multiple checks on the products. These important basic properties were only for N-phospho- $\alpha$ -amino acids. The corresponding

N-phospho-  $\beta$  -amino acids did not possess the phosphorylation ability.

In conclusion, the N-phospho-  $\alpha$  -amino acids as the combination between



Scheme: N-phospho-  $\alpha$  -amino acids and co-evolution of nucleic acid and protein

the limited nucleic acids and phosphorylated protein possess the autocatalysis ability to execute the self-reproduction and self-replication reactions which were paralleled to the contemporary biosynthesis. And the oligopeptides and nucleotides were derived from N-phospho-  $\alpha$  -amino acids simultaneously, in a predictable non-random sequence<sup>6</sup>.

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