

PROTEINOIDS, MICROSPHERE AND COACERVATES

Q.What are proteinoids?

[A polypeptide or mixture of polypeptides obtained by heating a mixture of amino acids]

In the 1950s, Fox and coworkers developed a technique in which heat could also be used to produce peptides from dry mixtures of amino acids. Depending on the kinds of amino acids in the mixture, they found that temperatures of 150°C to 180°C could produce as much as 40 percent yield of peptide like products with molecular weights between 4k and 10k daltons. Fox called these polymers **proteinoids** (also **thermal proteins**), and he and his group proposed that these compounds bear protein like features.

i) According to their analyses, the **proteinoids** possess nonrandom proportions of amino acids; that is, their compositions are not simply based on the frequency of the different amino acids in the initial mixture (Table 1).

Amino Acid	2:2:1 Proteinoid		2:2:3 Proteinoid	
	Initial Mixture	Proteinoid product	Initial Mixture	Proteinoid product
Asp	42.0	66.0	30.0	51.1
Glu	38.0	15.	27.0	12.0
Ala	1.25	2.36	2.72	5.46
Lys	1.25	0.94	2.72	3.37
Gly	1.25	1.32	2.72	2.279
Arg	1.25	1.32	2.72	2.44
His	1.25	0.95	2.72	2.03
Val	1.25	0.5	2.72	1.16
Ile	1.25	0.86	2.72	0.90

ii) They also suggest that the positions of the amino acids in the polymer are not based on their overall frequencies in the chain, since some amino acids preferentially occupy the N- and C-terminals of the proteinoids.

iii) The nonrandomness of proteinoid structure also seems supported by the finding that these polymers all show similar properties as tested by sedimentation rates, electrophoretic techniques, column fractionation, and other measurements. Thus, some preferential interaction between amino acids in proteinoid formation seems to dictate their position and frequency and lead to some degree of uniformity in the kinds of molecules produced.

iv) Although not all the amino acid bonds formed in such proteinoids are of the usual peptide variety, nor do the shapes of these molecules follow the familiar α -helix of protein structure, there still seem to be enough peptide linkages to characterize them as proteins in many tests.

v) Thus, proteinoids give positive colour tests with the same reagents that proteins do; their solubilities resemble proteins; they are perceptible with similar reagents; and Fox and Dose propose they have other protein like traits listed in Table 1. They therefore suggest that some proteinoid reactions, combined into a particular sequence, may have served as the beginnings of later metabolic systems. Thus, decarboxylation of oxaloacetic acid can be followed by decarboxylation of its product, pyruvic acid, leading to acetic acid and carbon dioxide; or amination of pyruvic acid can lead to alanine.

Furthermore, some proteinoids even show relatively sophisticated hormonal activity and can stimulate the production of melanin-producing cells.

Although researchers have debated whether the thermal synthesis of proteins could occur extensively in present natural surroundings, the exact conditions encountered on the primitive Earth are certainly not