

Semi-Annual Status Report on NASA Grant

NsG-689/10-007-008

**UNPUBLISHED PRELIMINARY DATA**

Book on The Origins of Prebiological Systems (Fox)

During the period of record, the editor, S. W. Fox, completed the reading of proof which was the proceedings of the international conference on The Origins of Prebiological Systems as held at Wakulla Springs, Florida on 27-30 October 1963. The conference included all of the leading currently active research workers in the field, and many of the theoreticians. Physical capacity limited the latter group to a fraction of those who have been productive of conjectural papers.

Amino Acids in Thermal Locales

(Fox, Windsor, Dr. and Mrs. Wiese)

Samples of sinter taken from 2-4 inches below the surface of the cinder cone at Kilauea-Iki were examined for bacteria. In samples which had been at 120-160° C at the time of sampling, no bacteria were found. Preliminary indications that the material is bacteriostatic were obtained. Analysis of the material showed that they contained twelve to fourteen amino acids. Earlier results were confirmed. In the current studies, the amino acids were found to be almost entirely in the polymerized form.

New samples were obtained in order to check on the earlier results. Tests of temperature showed that 4 3/4 yrs. after the

Hard copy (HC) \$1.00  
Microfiche (MF) \$0.50

FACILITY FORM 602	N65-19895	
	(ACCESSION NUMBER)	(THRU)
	5	7
	(PAGES)	(CODE)
CR-57423	06	
(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)	

eruption, the cinder cone was much cooler than it was at 3 1/2 years. However, data have not been obtained to answer the question of whether the decline in temperature is linear. The total organic matter was in the range of 1 ppm of sinter when the sinter was extracted with water. When the extracted sinter was crushed and again extracted, another 1 ppm was obtained.

#### Fractionation of Thermal Proteinoid

(Nakashima, Krampitz, Fox)

Fractionation of thermal proteinoids on columns reveals a limited degree of heterogeneity which is astonishing, even though the results are in accord with earlier indications. Typically five or six major fractions are found on elution from CMC-cellulose or DEAE-cellulose. In the experiments with material from DEAE-cellulose, the proteinoid was first fully amidated by treatment in liquid ammonia. Amino acid analyses of two fractions, which are distant one from the other in the elution pattern, shows that these are almost identical in composition. The fingerprint patterns obtained by two-dimensional chromatography following proteolysis with trypsin are, also, similar.

#### Catalytic Activity in Thermal Proteinoids

(Krampitz, Harada, Stewart, Fox)

Lysine proteinoids have been found to catalyze the splitting of radiourea. Such activity is missing entirely from thermal polylysines. Intermediate degrees of activity are found in the

thermal copoly (lysine, alanine) and copoly (lysine, glutamic acid). These latter are much less active however than lysine proteinoid, suggesting that the interactions of other amino acids in the macromolecule are significant.

The hemin of hemoglobin has been found to have, without the apoenzyme, tryptophan pyrrolase activity at a level of about 1/2000 of that of the natural whole enzyme. Also, hemin can show either catalase or tryptophan pyrrolase activity, depending upon the pH.

Attributes of "Life" in Proteinoid Microspheres  
(Fox)

In the course of an evaluation prepared for a publication of the Space Science Board, approximately 25-40 attributes imputed to living systems have been tabulated. The larger number would include approximately 20 attributes testable in proteins; these tests are virtually all positive in the thermal proteinoids prepared under geologically plausible conditions. The attributes chosen for listing have, as Calvin has stated, "a certain degree of subjective arbitrariness", but in few cases does the positive nature of the test on synthetic systems seem to be open to scientific argument. Approximately 2/3 - 3/4 of the attributes included in this list have now been observed in the laboratory microparticles.

### Nutritional Quality of Proteinoids

(Everett, Windsor, Suzuki, Lewis, Fox)

In collaboration with Professor George Lewis and Mrs. P. Everett, this laboratory has been subjecting thermal proteinoids and Leuchs proteinoids to nutritional tests with Tetrahymena pyroformis. The Leuchs proteinoids may provide otherwise unobtainable information on amino acid nutrition, whereas the thermal proteinoids offer the eventual possibility of synthesis of food in extraterrestrial locales. Preliminary tests indicate that some Leuchs proteinoids are superior to casein in feeding Tetrahymena. The thermal proteinoids are used however very poorly by the microbe, in contrast to results with Lactobacillus arabinosus.

### Optical Resolution of DL-Amino Acid

(Harada)

Direct optical resolution of DL-aspartic acid was carried out through the use of an optically active amine ( $\alpha$ -methylbenzylamine). Optical resolution of DL-aspartic acid by the use of a stereoselective ligand exchange reaction was accomplished. The optical purities of the resolved aspartic acid are relatively high (95-100%). The mechanism of the stereoselective ligand exchange reactions was studied.

Optical resolution of several  $\alpha$ -amino acids by preferential crystallization from their supersaturated aqueous solutions is under investigation.

Amino Acid Formation by Pyrolysis of  
Ammonium Formate and Formamide

(Harada)

Pyrolytic decomposition of ammonium formate and formamide resulted in the formation of glycine, alanine, aspartic acid, and other  $\alpha$ -amino acids. The mechanism of the amino acid formation is now under investigation.

Studies in Fertilization

(Metz, Franklin, Brown, Stern)

Studies on the effect of enzymes on the sexual union of gametes showed that trypsin did not affect the initial flagellar union of gametes at mating but did prevent the subsequent fusion of the gametes to form the zygote. Evidently, the initial union and subsequent fusion involve quite different mechanisms. This study is in manuscript form and will shortly be submitted for publication.

Mr. Brown obtained additional electron microscopical information on sperm-egg interaction in crustacea and Mr. Stern has succeeded in obtaining good electrophoretic migration of sea urchin fertilizin on cellulose acetate. Using this method, he has for the first time demonstrated what appear to be electrophoretic mobility differences between the components of univalent and multivalent fertilizin.