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IMPROVING THE NUTRITIVE VALUE OF COLLAGEN

One of the most important problems of the rendering and meat packing industries is the improvement of the nutritive value of collagen. For the past several years FPRF has supported research designed to determine whether or not this can be accomplished by microbial fermentation. Actually this approach does not visualize the modification of collagen but rather the preferential utilization of collagen as a nitrogen source by a suitable microorganism to form protein of high nutritive quality.

Current results from the FPRF research under the direction of Dr. Jules Porsche and Dr. William Brown of the American Bacteriological and Chemical Laboratories appear quite promising. An organism has been found that utilizes hydroxyproline, a non-essential amino acid that is characteristically high in collagen, as a nitrogen source. This bacteria along with a very closely related organism grows very rapidly on collagen. However, rather large amounts of protein are lost when these two organisms are grown in a medium containing collagen or gelatin as the sole source of nitrogen and energy.

A recent experiment attempted to improve the protein yield by adding ammonium nitrate as a supplemental source of nitrogen. This did not improve the protein yield. However when both ammonium nitrate and a supplemental energy source (glucose) were added to the growth medium and the inoculating ratio of the two organisms adjusted, protein yields of nearly 50% were obtained (Table 1).

Table 1. Conversion of Gelatin Protein by Bacteria
(1% Gelatin, 1% Ammonium Nitrate, 0.1% Glucose)

Inoculum Organism A	Inoculum Organism B	Ratio A/B	Protein-mg./ml. Initial	Final	Filtrate	Cells	Protein Yield %
0	0	-	9.6	9.6	9.6	0	100
0.1	1.0	1:10	9.6	3.6	1.6	2.0	36.6
1.0	0.5	2:1	9.6	4.3	2.4	1.9	44.8
0.5	0.1	5:1	9.6	4.7	3.1	1.6	48.9

As indicated by the data slightly more than half of the protein in the medium after fermentation was in the bacterial cells.

Although these results are promising, many questions must be answered before the fermentation can be used commercially. Where does the "lost" protein (nitrogen) go and what conditions are necessary to reduce this loss? Is it possible to obtain a greater conversion of collagen (gelatin) to bacterial protein by changing the conditions of fermentation or by adding some other supplementary sources of energy and nitrogen to the medium? Does the bacterial protein have the expected good amino acid profile? Will these organisms <u>preferentially</u> use collagen in a medium containing other types of protein? (This appears unlikely since some earlier preliminary experiments gave evidence to the contrary.)

Obviously, much research remains to be done to answer these questions and solve the many problems that develop in the course of the investigation. However, the microbial production of protein from petroleum will soon be a commercial reality. To meet this competition we must develop ways to convert our collagen to a more nutritious protein. The only promising approach is through microbial conversion.