SYMPOSIUM ON CHARACTERIZATION OF PROTEINS

Introduction

In 1838 Mulder, at the suggestion of Berzelius, assigned the word "protein" to those complex organic nitrogenous substances found in all cells, animal or plant. The word protein was derived from the Greek word meaning primary or first. But it soon became apparent that proteins had no single primary function in the cell; rather they contributed in numerous ways to both the architecture and physiological state of the animal or plant. Proteins serve as structural elements in the various membranes and walls of the cell and as protective coatings in the hair, wool, and connective tissue of the animal. Proteins also function in both regulatory and defensive mechanisms. Proteins are enzymes, hormones, carriers of oxygen and essential elements, and antibodies. They are participants in energy transfer, that is, muscle contraction and photosynthesis, and in the transfer of genetic information.

Proteins also serve another function which is of major interest to this Division of Agricultural and Food Chemistry. Proteins, when consumed as food, provide essential nutrients for growth and maintenance. A listing of our basic food sources—milk, meat, fish, egg, and seeds, which include both cereals and oilseeds—shows that proteins are a significant factor in our dietary patterns. However, this selection cannot be delegated to a natural preference for the proper nutrients. It is rather the result of a highly subjective selection based on aroma, flavor, texture, and satiable characteristics which, in many instances, are due to the physical characteristics of the food proteins. As the role of the food industry shifts from one of food preparation to one of food formulation and fabrication, these physical functional characteristics will assume even greater importance.

Irrespective of the function which proteins serve, be it physiological, physical, or nutritional, the major objective of protein chemistry has been to understand the relationship between protein composition and structure, and protein functionality. It seemed to us particularly appropriate, therefore, that the new protein subdivision of the Agricultural and Food Division present a symposium on the characterization of proteins. An in-depth evaluation of all methods under development in this rapidly expanding field would be beyond the scope of this symposium. We have, however, attempted to highlight certain developing areas in the logical sequence of: (1) methods of separation; (2) methods of analysis of primary composition and structure; and (3) methods for evaluation of the secondary and tertiary structure of the protein molecule. By this approach we hoped to provide a timely overview of the analytical methodology of proteins.

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Columns for Large-Scale Gel Filtration on Porous Gels

Fractionation of Rape Seed Proteins and Insulin

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At the Institute of Biochemistry in Uppsala we have for several years been working on the technical problems encountered with the scaling up of gel filtration columns. The difficulties are especially noticeable when gels of high water regain are used in columns with diameters larger than about 20 cm. Two new columns for gel filtration on a preparative scale with porous gels are presented in this paper, the so-called compact and stacked sectioned column types, respectively. They are characterized by their unconventional dimensions, very short and with large diameters, *e.g.*, 15 × 45 cm. Several column sections are connected in series and the two types mentioned differ in the way these are connected to each other. The problem of sample application on large diameter columns is briefly discussed. An example of automation of a gel filtration experiment is given. The following applications are presented—the fractionation of rape seed proteins, serum proteins, and insulin.

Gel filtration is nowadays a well-established technique in chemical and biological laboratories all over the world. It is used both for analytical and preparative purposes for the separation and fractionation of low molecular weight substances, as well as high molecular weight material such as proteins, nucleic acids, polysaccharides, and even particles. Many thousands of publications have dealt with this technique in the last decade and the applications are numerous. A complete list of references is available from Pharmacia Fine Chemicals AB, Uppsala, Sweden, covering the use of their dextran gel Sephadex and their agarose gel Sepharose.

This paper is intended to provide examples from our own research of how gel filtration with Sephadex gels can be

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