PROTEIN CHEMICAL STUDIES IN PLANT BIOCHEMISTRY AND MEDICINE

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Plant photosynthesis is the main process of solar energy conversion on earth leading to reduced organic compounds on the one hand and the release of oxygen on the other. This process fuels the wheel of aerobic metabolism permitting the survival of heterotrophic organisms. Carbon dioxide assimilation (the dark reaction of photosynthesis) is ignited by the enzyme D-ribulose bisphosphate carboxylase/oxygenase (rubisco), a quaternary protein complex of ca. 550 kDa mass consisting of 8 large (L) and 8 small (S) subunits. The complete primary structure of rubisco has been assembled by manual sequencing using the DABITC/PITC double coupling technology (Chang et al. (1978) FEBS Lett. 93, 205). S subunits from many cultivated plants are heterogeneous as a result of multi-gene family expression. Chemical crosslinking of intact membrane protein cores of the light-driven photosynthetic machinery yields information on the topology of constituent polypeptide subunits; identification of conjugates is facilitated by the use of reversible cross-linkers or analysis of the cross-linked partners by specific antibodies and internal sequencing, examples will be presented for the cytochrome b_{6}f complex and photosystem II.

The most modern development of protein chemistry is proteome analysis, i.e. separation of all proteins of a cell or an organ by high resolution two-dimensional gel electrophoresis followed by protein identification using a combination of high sensitivity Edman degradation, MALDI (matrix assisted laser desorption/ionization) mass spectrometry and intensive data bank research via the internet. Proteome research is in particular useful for differential analysis of certain pathological conditions in medicine; examples for the characterization of cardiac low mass heat shock proteins and myocard patterns in hypertension will be presented.