PERIODICA POLYTECHNICA SER. CHEM. ENG. VOL. 40, NO. 1-2, PP. 9-16 (1996)

# 75 YEARS IN THE SERVICE OF THE HUNGARIAN FOOD SCIENCE[1]

Radomir LÁSZTITY

Department of Biochemistry and Food Technology
Technical University of Budapest
H-1521 Budapest, Hungary

## Abstract

A review is given about research activity of Department of Biochemistry and Food Technology from its foundation in 1921 till 1996. Among the results particularly the cereal protein research and the development and adaptation of up-to-date analytical methods are summarized. The most interesting references are collected at the end of paper.

*Keywords:* food, food science, food research, higher education.

At the end of nineteenth and beginning of twentieth century, Hungarian agriculture and food industry has been faced a big challenge. In the market of traditional Hungarian export goods (cereals, meat, wine) a very intensive presence of competitors was observed both from Europe and overseas. Under such conditions big efforts were needed to improve the quality of products and to modernize the processing in order to save the competitiveness. In the solution of the problems an important role was played by research institutions and universities.

This was the reason why the idea arose of founding a new department at the Technical University of Budapest with a food science profile. Although the First World War delayed the foundation of this department, as it was explained in the lecture and paper of Professor Törley [1], in 1921 the new department was established with a name: Food Chemistry. It was not unexpected that Mihály Vuk, a well known specialist in the field of food analysis and cereal chemistry, was nominated to head of the new department.

The work of Mihály Vuk and his coworkers was part and continuation of a research and development activity, which led to the development of the first instrumental quality control methods of cereals and made Hungarian

[1]Paper presented at the the Jubilee Symposium on the occasion of the 75-th anniversary of the foundation of the Department, June 17, 1996.

research and technological development in this field well known world wide. The Hankóczy Brabender Farinograph, the first instruments measuring dough and gluten extensibility, the later Valorigraph and Laborograph, the Pekár flour colour measuring method, etc. became widely known, together with the earlier technological developments in milling industry (e.g. Ganz roller mills, Haggenmacher planar sieves, high-milling procedure, etc.). Vuk published the first wheat and wheat flour chemistry book in Hungarian [2].

László Karácsonyi achieved internationally known results in investigations of bread staling [3, 4]. In addition to flour and cereal chemistry , an important contribution was made to the research work on wine. This important research work was connected, together with Professor Vuk, with the name of a young scientist Dezső Törley (who, together with his father developed the well known champagne Törley which is still produced).

Under leadership of Mihály Vuk (and also later) the Department played an important role in the development of Hungarian food analysis and food quality control. Together with his coworkers (Zoltán Sándor and Károly Vas) he published the first books in Hungarian on food chemistry and food analysis [5, 6]. Many papers were published in the field of quality control, detection of food falsification, food preservation, aroma compounds, vitamins, synthetic food colourants.

The new head of the Department, nominated in 1951 after Mihály Vuk, Professor Telegdy Kováts supported both traditional research and new ways in the food science. Thus, the research on cereal chemistry and technology was continued involving new coworkers (R. Lásztity, J. Nedelkovits, J. Varga, F. Örsi, M. Kárpáti, J. Szabó-Gaugecz).

This research conducted under improved conditions resulted in some internationally highly estimated results. The research connected with structure and rheological properties of gluten, new findings related to the role of disulfide bond system in gluten should be mentioned. E.g. a procedure was elaborated to produce gluten preparations with tailored rheological properties. (*Fig. 1*). As a result of these investigations a model was proposed for the structure of gluten proteins and the gluten complex (*Figs. 2* and *3*).

One of the interesting results of cereal research was the isolation and determination of the amino acid sequence of avenothionine, a purothionine analogue from oats [7] (*Fig. 4*).

Intensive research was also done in the field of protein-lipid and protein-phytic acid interaction. The research mentioned above was the basis of a monograph (The Chemistry of Cereal Proteins) written by Professor Lásztity [8], successor of Professor Telegdy Kováts, the second edition [9] was published some months ago. The book: Aminoacids Composition and

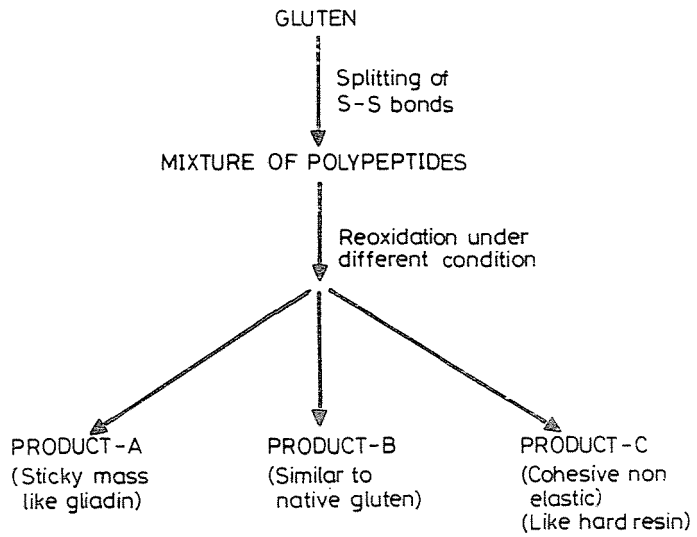


*Fig. 1.* Scheme of the production of gluten with tailored rheological properties

Biological Value of Cereal Proteins [10] is also based on research done in the Department.

Stimulated by the growing need for new protein sources, the research activity in this field continuously increased. First of all, cereal germ proteins and proteins of other seeds were studied, including also the functional properties [11]. In cooperation with the Central Food Research Institute in Budapest the potential use of yeast biomass in food production was studied and a book was published by CRC Press Inc in 1991 [12].

Investigations related to variety identification of wheat cultivars grown in Hungary should also be mentioned. The results were summarized in a catalogue of electrophoretic patterns of wheats grown in Hungary [13]. The cooperation with factories producing instruments for wheat quality control was also important.

This was a period of stepwise involvement of our research activity in the international world of science starting with activity in ICC (International Association for Cereal Chemistry). Telegdy Kováts and since 1978 Professor Lásztity were the members of the Executive Committee of this international organization. Professor Lásztity acted also as president of ICC. The Department was involved in the activity of FAO/WHO Codex Alimentarius and Food Division of the Federation of European Chemical Societies. The Department organized more international symposia including the Third International Gluten Workshop in 1987 and a symposium on Non Food Uses of Cereals.

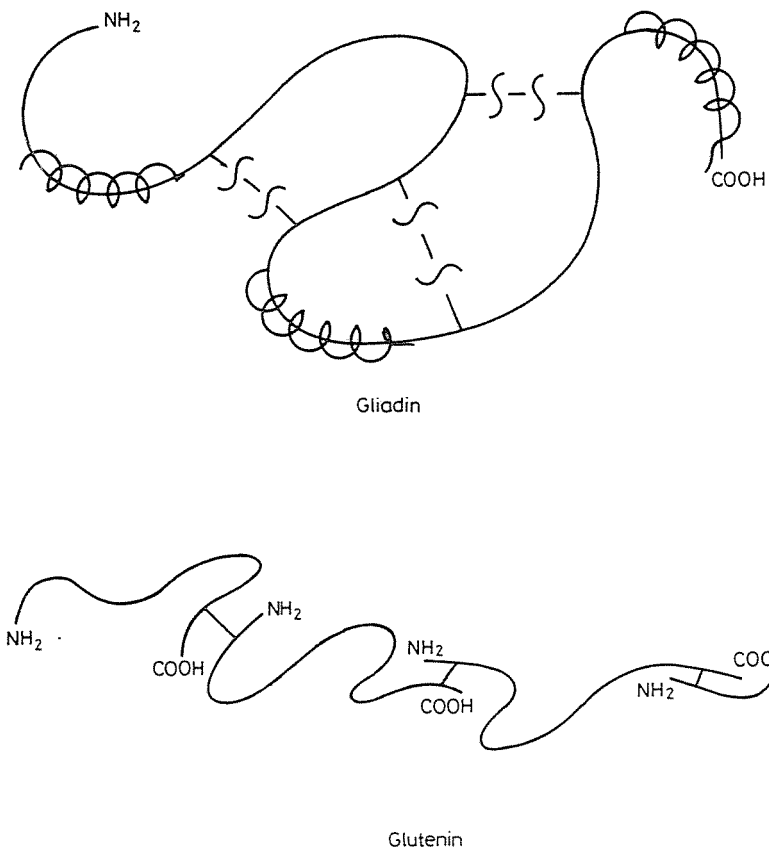


*Fig. 2.* The structure of the main components (gliadin and glutenin) of the gluten complex

The research on methods of food analysis and food quality control and also the related teaching activity has always been in the front of activity of the Department. This was required both for the high-level education of engineers in this field and by the Hungarian food industry, exporting high-quality food products. Telegdy Kováts initiated the studies for improving the mathematical statistical evaluation of sensory food quality control. This work has been continued by Professor Örsi. The results of investigations contributed to the wide use of multicomponent analysis methods and to the improvement of procedures used in sensory quality control [14].

The research done at the Department contributed also to the involvement of modern analytical methods such as capillary GC, HPLC, automated procedures, etc. in the everyday practice of Hungarian food quality

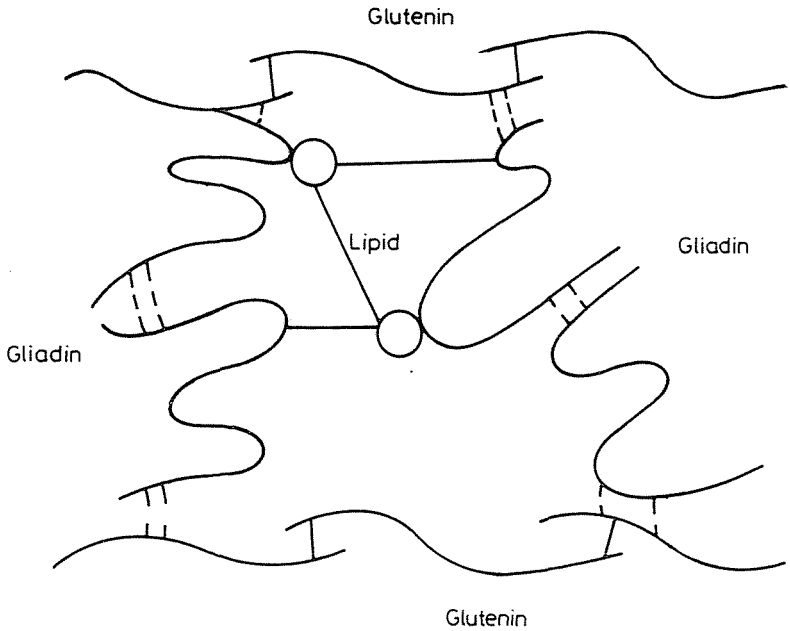


*Fig. 3.* Proposed scheme of the gluten complex

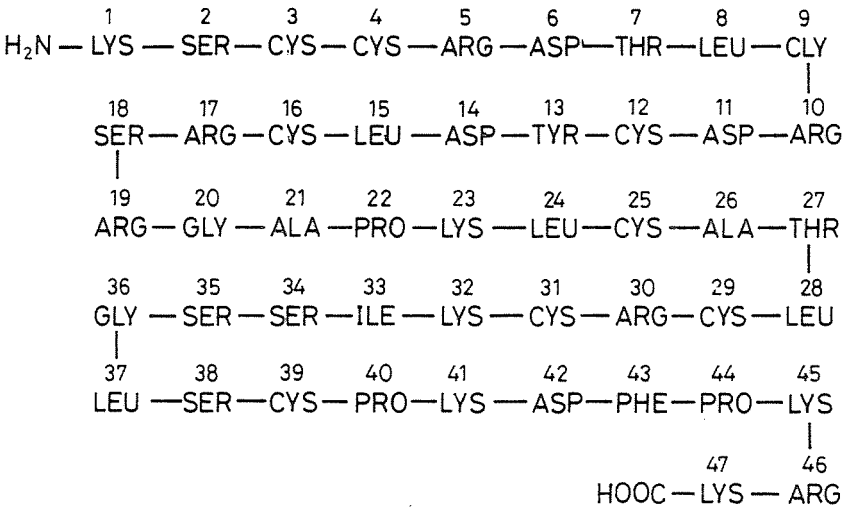


*Fig. 4.* Primary structure of avenothionine

control. Results achieved in the analysis of aminoacids, aminoacid derivatives, mono- and oligosaccharides, mycotoxins and vitamins may be mentioned (L. Sarkadi, F. Örsi, A. Bata, E. Berndorfer, J. Varga) [15–20].

In 1980s, particularly by the initiation and leadership of Professor András Salgó (who was nominated to head of the Department in 1993), research started at the department to study the analytical methodology representing the newest trends such as non-destructive analysis, multicomponent analysis, flow-injection analysis, immunochemical methods, PCR-analysis, capillary electrophoresis, etc. (A. Salgó, K. Ganczler, G. Szalai). Among the results first of all the studies connected with the use of NIR and NIT technique may be mentioned [21–24]. After elaborating and adapting methods for determination of microcomponents, the detection of some minor components was solved (e.g. antinutritive factors).

It seems that more important results were achieved in the study of some physiological processes in raw materials with non-destructive methods (e.g. germination process of cereal seeds). Very promising methods are in preparation for complex quality evaluation by a non-destructive procedure (e.g. baking quality of wheat) [25].

Professor Salgó and his coworkers (S. Tömösközi, J. Varga, G. Szalai, K. Ganczler, P. Merész, T. Lovász) published many papers in this field [21–25]. Some of the results were presented in posters and the abstracts were published [1].

The review of the results should not be complete without mentioning the rheological studies out at the Department on dough and bread (R. Lásztity, J. Major, J. Nedelkovits, J. Varga), and investigations of the functional properties of protein preparations (S. Tömösközi, J. Nagy, T. Bajkai), and fruits (T. Lovász, P. Merész, J. Major). Finally, methods of control of packaging materials (L. Telegdy Kováts, M. Szilas-Kelemen, F. Örsi [26], and some histochemical procedures may be mentioned (D. Törley, E. Györei-Vadon).

Studies of the changes of food raw materials during processing started in 1950s with the investigations of Maillard reaction and other browning processes (L. Telegdy Kováts, F. Örsi, D. Karácsony) [27] in the laboratory and later on the industrial level (baby foods, coffee, sugar production). An interesting part of this work was connected with the clarification of the role of methylglyoxal (F. Örsi) and the improvement of the technology of production of roasted coffee and baby foods.

Pioneering work was done by the Department, in cooperation with other institutions, in the survey of radioactive contamination of foods in Hungary (J. Kovács, J. Major).

Studies on postharvest changes of apples constitute an important part of research in the last years. Among the results, the study of structural

changes, the ion transfer during storage may be mentioned which permit evaluation of the storability of some apple varieties.

The youngest part of the research work of the Department is the research in molecular biology. Among these studies first the research work connected with the PSE meats may be mentioned. As it is known, the early selection of stress-sensitive animals may be a significant step in solving the problems connected with exudative meats. As a result of investigations it was possible to identify the gene responsible for stress-sensitivity and to develop a simple method for its detection (G. Szalai).

In cooperation with the Agricultural Research Institute in Martonvásár we have studied for several years the genetical basis of the resistance of wheat to osmotic stress and low temperatures. We succeeded in detecting some biochemical markers (particularly polyamines), which are in connection with resistance. It was also possible to detect the role of chromosome-D5 in the resistance to osmotic stress (L. Sarkadi, A. Salgó, F. Örsi, G. Galiba) [28, 29]. Experiments are in progress to study protein synthesis during kernel development of wheat (J. Varga, M. Kárpáti).

After a break for some years we renewed experiments (in cooperation with colleagues from Finland and Australia) related to molecular biology of wheat proteins. The aim of studies of the production of HMW glutenin subunits using recombinant technique is a contribution to the improvement of breeding procedures of wheat in Hungary.

## References

1. LÁSZTITY, R. – SALGÓ, A. – TÖMÖSKÖZI, S. (Eds.): Abstracts of the Jubilee Symposium 75 Years of Cereal Chemistry and Food Quality Control, Budapest, 1996.
2. VUK, M.: A magyar búza és a búzaliszt összetétele (Composition of the Hungarian Wheat and Flour) (in Hungarian), Budapest, 1929.
3. KARÁCSONYI, L.: Staling and Hydrogen-Ion Concentration. Cereal Chemistry, Vol. 5, p. 477, 1928.
4. KARÁCSONYI, L. – BAILEY, C. H.: Effect of Overgrinding of Flour upon the Keeping Quality of Bread. *Cereal Chemistry*, Vol. 8, p. 44, 1931.
5. VUK, M. – SÁNDOR, Z.: Élemiszerkémia (Food Chemistry), (In Hungarian) Budapest, 1941.
6. VUK, M. – SÁNDOR, Z. – VAS, K. : Élelmiszerek vizsgálata (Control of Foods), (In Hungarian) Budapest, 1943.
7. BÉKÉS, F. – LÁSZTITY, R.: Isolation and Determination of Aminoacid Sequence of Avenothionine, a Purothionine Analogue from Oats. *Cereal Chemistry*, Vol. 58, p. 360, 1981.
8. LÁSZTITY, R. : The Chemistry of Cereal Proteins, CRC Press, Inc., Boca Raton, 1984.
9. LÁSZTITY, R.: The Chemistry of Cereal Proteins 2-nd. Ed., CRC Press Inc., Boca Raton, 1996.
10. LÁSZTITY, R. – HIDVÉGI, M. (eds.): Aminoacid Composition and Biological Value of Cereal Proteins, Reidel Publ Co., Dordrecht, 1985.

11. LÁSZTITY, R. – TÖMÖSKÖZI, S. – NAGY, J. – BAJKAI, T. – SARKADI, L.: Investigation of Some Functional and Nutritive Properties of Cereal Germ Proteins, *Periodica Polytechnica, Chem. Eng.*, Vol. 39, p. 63, 1995.
12. HALÁSZ, A. – LÁSZTITY, R.: Use of Yeast Biomass in Food Production, CRC Press Inc., Boca Raton, 1991.
13. LÁSZTITY, R. – VARGA, J. – SZABÓ, M. – KEMÉNY, S. – HUSZÁR, M. – ÖRSI, F.: Magyarországon termesztett búzafajták gélelektroforézises azonositásának katalógusa (Catalogue of Electrophoretic Spectra for Identification of Wheat Varieties Grown in Hungary) (In Hungarian), Statisztikai Kiadó, Budapest, 1985.
14. ÖRSI F.: Sensorik. Mehrdimensionale mathematisch-statistische Methoden, Flüssiges Obst, Vol. 50, p. 182, 1983.
15. SIMON-SARKADI, L. – HOLZAPFEL, W. H.: Determination of Biogenic Amines in Leafy Vegetables by Aminoacid Analyzer. *Lebensm. Untersuch. u. Forschung*, Band 198, S. 230, 1994.
16. BATA, A. – FEKETE, J. – HARRACH, B.: Method for the Determination of Naturally Occuring Trichotecene Toxins. In:*Chromatographia* 1984, Kalász, H. and Ettre, L.S., Eds., Akadémiai Kiadó, Budapest, 1986, p. 325.
17. BATA, A.: Occurrence of Patulin in Hungarian Apple Products, In. *Proc. EURO FOOD III*, Antwerpen, 1985, p. 303.
18. BERNDORFER, E.: Vitamin meghatározási módszerek, MÉTE Kiadó, Budapest, 1971 and 1977.
19. SZEMAN, K. – GANCZLER, K. – SALGÓ, A. – SZEJTLI, J.: Studying the Effect of Degree of Substitution of Cyclodextrin Derivatives on the Chiral Separation Using HPLC and Capillary Electrophoresis., *Proc HPLC 95.*, Innsbruck, 1995.
2o. ÖRSI, F. – HOMOKI, P. – VU NAM PHONG: Bestimmung von Methylglyoxal in Karamel Proben. *Die Nahrung*, Band 39, S. 90, 1995.
21. LOVÁSZ, T. – SALGÓ, A. – MERÉSZ, P. – SASS, P. : Determination of Apple Maturity by NIT. *Acta Horticulturae*, Vol. 368, p. 276, 1994.
22. SALGÓ, A.: Industrial Use of the Infrared Analyzer for Control in Corn Germ Processing. *Focus*, Vol. 17, p. 18, 1993.
23. SALGÓ, A. – TÖRÖK, SZ. – SÁNDOR, SZ.: Microstructure of Extruded Cereals and Oilseed Processing Residues. *Food Microstructure*, Vol. 8, p. 245, 1989.
24. SZEMAN, J. – SALGÓ, A. – DELI-SZABÓ, GY. – SZEJTLI, J.: NIRS a Novel and Simple Tool for Characterization of Cyclodextrin Complexes and CD-Derivatives. *Proc. 7. Int. Symp. on Cyclodextrins.* Tokyo, 1994.
25. SALGÓ, A. – BÉKÉS, F. – GORE, P. – STEFÁN, J.: Characterization of Some Functional Properties in Wheat by Near Infrared Technique. In: Gluten Proteins 1993, Cereal Research Center, Detmold, 1994, p. 560.
26. TELEGDY KOVÁTS L. – SZILAS-KELEMEN, M.: Élelmiszerek burkoló csomagolása (Packaging of Foods), (In Hungarian) Budapest, Műszaki Könyvkiadó, 1962.
27. ÖRSI, F.: Thermogravimetrische Untersuchung der Maillard Reaktion. *Ernahrung* (Nutrition), B. 7, p. 18, 1980.
28. SIMON-SARKADI, L. – SALGÓ, A. – GALIBA, G. – SUTKA, J.: Genetic Basis of the Osmoregulation in Wheat. In: Gluten Proteins 1993, Cereal Research Center, Detmold, 1994, p. 614.
29. GALIBA, G. – SIMON-SARKADI, L. – KOCSY, G. – SALGÓ, A. – SUTKA, J. : Possible Chromosomal Location of Genes Determining the Osmoregulation in Wheat. *Theor. Appl. Genet.*, Vol. 85, p. 415, 1992.