INFORMATION
For participation in Mobility of teaching and non-teaching staff
By the Food Research and Development Institute - Plovdiv
Under the Erasmus + program
ACADEMIC YEAR 2014/2015

I. Participants:
 1. Angel Ivanov Iliev - assistant, 10 years of scientific experience
II. Mobility Period and Host Organization:
 1. Period: 12.04 - 26.04.2015
 2. Host organization: - University of Corvinus Budapest Hungary Faculty of Food Science, Department of Applied Chemistry
III. Contribution to deepening and expanding research at the Food Research and Development Institute - Plovdiv and Bulgaria:
 1. One of the main problems in modern nutritional science is maintaining an adequate intake of essential elements. At present, health impacts and levels of intake of essential essential elements have been identified. The question arises is: what is the health effects of taking the various forms of organic compounds containing the essential elements. Various intermediate metabolites of organic compounds containing essential elements, have the potential for use in the treatment of many medical condition known to be influenced by the particular essential element. For example, certain selenium compounds are investigated as novel antitumor agents. In order to be studied this problem, and to identify the various intermediates in the metabolism of essential elements, in the first place are required appropriate analytical techniques for identification and quantification of these elements.

 The aim of the mobility from point 1 is to use an approach for studying the metabolites of essential elements and in particular of selenium. Approaches include so-called "3D screening" of the samples comprising three different chromatographic techniques, sequential filtering known metabolites derived from the sample, for purposes of purification and isolation of individual substances and their identification by modern mass spectrometer. At a first stage is used a preparative Size Exclusion Cromagraphy (SEC), Figure 1, connected offline with ICP-MS system, Figure 2, as detector of total selenium. The step is applied to isolate selenium-containing fractions within a given range of molecular weight. As a second phase, ICP-MS ion-exchange HPLC is used, coupled online with ICP-MS as a detector to determine the total selenium, and exclude fractions that do not contain a studied element. After identification of the seleno-compounds, and their isolation by ion-exchange HPLC on a preparative mode, the selenium containing fractions are concentrated and studied by reverse phase HPLC MS/MS, used as the third phase, figure 3.
The approach described above was applied to samples of wild mushrooms collected in Bulgaria by the genera Boletus, Marasmius, Cantharellus and Lactarius. During mobility it was found that fungi genus Boletus growing in Bulgaria, are likely to contain unknown so far selenium compownd, and require a longer-term study involving higher levels of concentration, in order to fully identify and prove if such compownd is spresent. Taking advantage of the above described approach, makes it possible to carry out such research in Bulgaria, if the appropriate equipment is available.

Figure 1: Preparative Size Exclusion Cromagraphy system

Figure 2: HPLC system coupled by ICP-MS as a detector.

Figure 3: HPLC system coupled by Q-TOF MS as a detector.

INFORMATION
about participation at Erazmus+ lector and staff-mobility from Food research and Development Institute – Plovdiv
ACADEMIC YEAR 2014/2015

I.Participant
1. Gabor Ivan Zsivanovits – Associated professor, PhD, 18 years scientific experiences

II. Period for mobility to host organization: 14-27 June 2015.
Host organization: Corvinus University, Budapest, Hungary

III. Contributions to deepening and expanding research at the Food research and Development Institute – Plovdiv and Bulgaria

– Verification and validation of method for investigation of the texture of bread (inter-laboratory test – Table 1 and figure 1.)
– Application of the electronic tongue in the food control (figure 2)
– Application of the hyperspectral vision system for non-destructive monitoring of the quality changes of food-staff during shelf-life (figure 3).

The used research technologies are new and give possibilities for higher level in quality control of the food-staff.

1.Purpose of the mobility was an inter-laboratory test for texture parameters of bread. The data is used in the frame of project of Agricultural Academy Found:

№ HTAI 128: Development and validation of accelerated test methods to specify the best before date of the main Bulgarian food (2015-2016): principal investigator of the activity: 3rd Activity: Texture characterisation of some main food-products – Bakery products (bread) and Meat products (cold meat and can products)

The method is developed for the investigation of texture properties of breadcrumb. The hardness of the food-product can be in range 0.5-500 N (50 g - 50 kg). Linear range is above 1 N. The deformation range is 1-100 mm, depending on the thickness of the measured object. Linear range is between 10-50 mm.

Published papers and scientific works, prepared in result of the mobility, financed from Erazmus+ program:

1. Zsivanovits G., A. Lambert-Meretei, J. Felföldi (2015): Validation and verification of instrumental method for characterization of bread texture.; International scientific-practical conference "FOOD, TECHNOLOGIES & HEALTH" 2015 (123-128) http://www.canri.org/conferencia_2015/docs/02-Health/19-zsivanovits_validation-bread.pdf

Abstract:
The texture of food products represents an overall assessment of external and internal parameters that describe in best way our perceptions (sensations) with eyes, nose, fingers, mouth, teeth, ears, tongue and throat. These food parameters can be studied by tasting (sensory analysis) or with instrumental methods. The uncertainty of sensory analysis depends on the experience and condition of tasters. These subjective factors do not influence the instrumental methods. The structure of the bread can be defined as a colloid of a solid foam with a plurality of carbon dioxide bubbles, uniformly distributed along its volume. Gluten is an interconnected network that supports small carbon dioxide bubbles. The final result for baking bread texture is characterized as aerated honeycomb while. Texture analysis provides a valuable result for the internal quality of the bread. The method is applied in the study of the matrix effect of gluten on staling. The aim of the present study is to optimize the laboratory

method of texture analysis for later possible accreditation. To achieve that aim commercially prepared and sliced, fresh Bulgarian and Hungarian breads were studied with the same type texture-analyser (Stable Micro Systems® UK) in the laboratories of FRDI and Corvinus University. The subjects of optimization were the diameter of applied measure-probe, the speed and deepness of the penetration and the thickness of slices.

Keywords: method optimization, physical parameter, texture analysis, description of uncertainty.

2. M. Momchilova, G. Zsivanovits (2016): Instrumental texture characterization of bread; Bulgarian Chemical Communications, Volume 48, Special Issue E (pp. 435 - 441) 2016 [if:0.229];
http://www.bcc.bas.bg/BCC_Volumes/Volume_48_Special_E_2016/Special%20Issue%20E/Statii/Pages435-441.pdf

Abstract:

Texture parameters of commercial bread samples were investigated by combined test method based on AACC 1998, modified method 74-09 – texture profile analysis (TPA) – and AIB Standard Procedure for White Pan Bread firmness – firmness measurement of bread crumb by compression with a probe. Elasticity, firmness, plastic deformation and crispness values were collected for white and semi brown Bulgarian and Hungarian breads. Combined test methods were applied with texture analyser (Stablemicrosystems TAXT2) to receive fast and precise results for several parameters. Based on the evaluated data for the texture parameters, uncertainty, limit of detection (LOD) and limit of quantification (LOQ), repeatability, intermediate precision and reproducibility of the test method were calculated. Created database will be used as a basis for validation of a method that can be applied in everyday practice of quality control laboratories.

Keywords: texture profile analysis (TPA), uncertainty, limit of detection (LOD), limit of quantification (LOQ), repeatability, intermediate precision and reproducibility (Table 1 and figure 1).

Table 1 Parameters of the texture profile analysis (TPA)

| What properties can be studied by texture profile analysis (TPA)?	
Hardness	The force necessary to attain a given deformation
Cohesiveness	The strength of the internal bonds making up the body of the product
Viscosity	The rate of flow per unit time
Springiness	The rate at which a deformed material returns to its original condition after deforming force is removed
Adhesiveness	The work necessary to overcome the attractive forces between the surface of the food and the surface of other materials (tongue, teeth etc.)
Fracturability	The force at which material fractures
Gumminess	The energy required to disintegrate a semisolid food product to a state ready for swallowing
Chewiness	The energy required to masticate a solid food product to a state ready for swallowing.
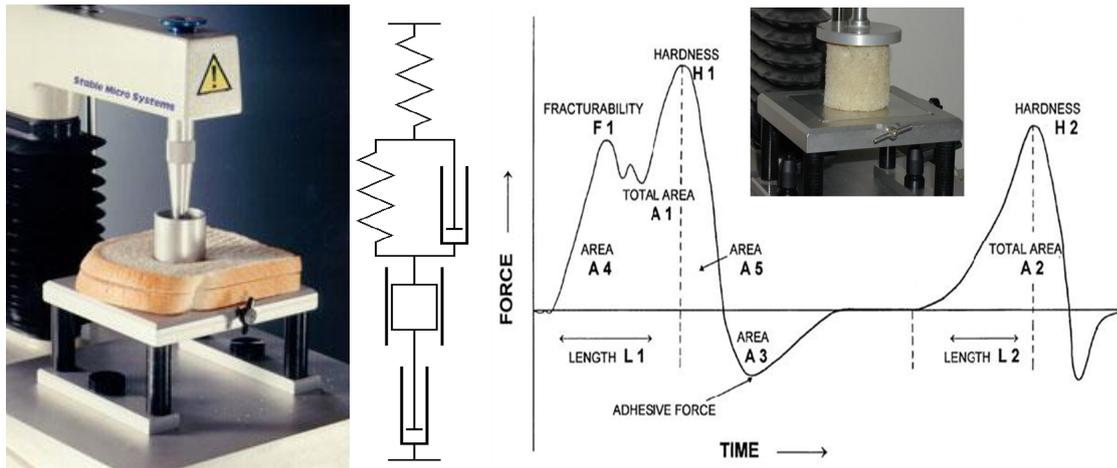
Figure 1 Texture analyzer (left), Rheological model of the breadcrumb (middle), Texture profile analysis method and calculated parameters (right)

1. Application of the electronic tongue in the food control (figure 2)

The electronic tongue, by providing objective and reproducible taste measurements, is a precious tool to help formulate or develop a new product that will appeal to consumers:

- Recipe optimization to **reach a specific taste**
- Conception of an innovative product with totally unique taste
- Re-development of product (retro-engineering) to change or **improve its savour and taste characteristics**
- **Benchmarking** of competitive products based on their sensory profile and their taste attributes
- Change of manufacturing process or ingredients substitution and **evaluation of the impact on product taste**
- Evaluation of a new product at different ageing steps to follow-up taste stability over time
- Comparison of different formulations to select the one that **best masks an unwanted taste**
- Quantitative taste analysis in correlation with a sensory panel.

Figure 2 Electronic tongue in the food control

2. Application of the hyperspectral vision system for non-destructive monitoring of the quality changes of food-staff during shelf-life (figure 3)

Non-destructive, non-contact and fast measurement methods are in great demand for on-line industrial quality control tasks. Optical method, like machine vision systems, allows real-time classification or discrimination of defected objects on the processing line. The hyperspectral imaging system allowed in two different configurations: one for imaging in the visible-very NIR range (400 – 1000 nm) and another for imaging in the NIR range (900 – 1700 nm). The system can measure moisture content, fat content and distribution, marbling degree of meat, freshness, microbial contaminations etc.
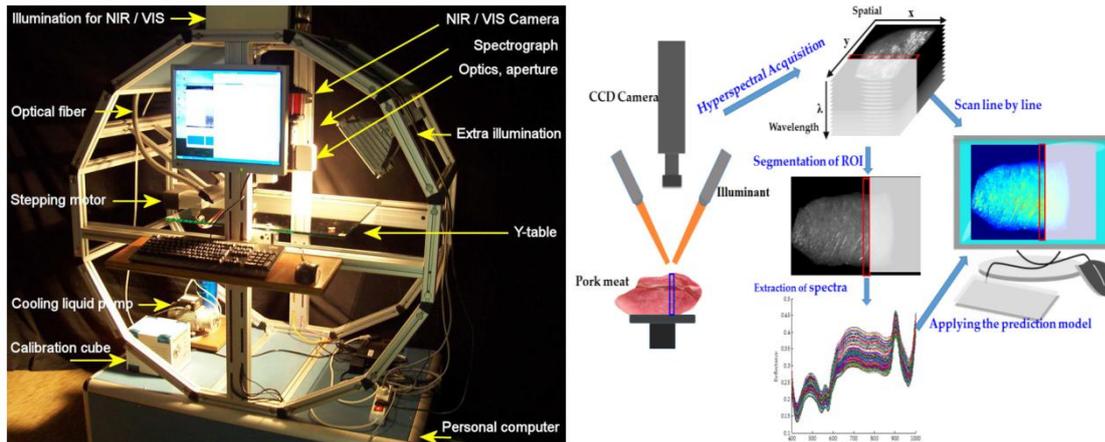

Figure 3. Hyperspectral vision system

INFORMATION
about participation at Erazmus+ lector and staff-mobility from Food research and
Development Institute – Plovdiv
ACADEMIC YEAR 2014/2015

I. Participants:

1. Milena Metodieva Ruskova, Assoc. Professor, 21 years scientific experience;

2. Todorka Valkova Petrova, Assoc. Professor, 22 years scientific experience.

II. Period of the training activity and receiving Institution:

1. Period of the training activity: from 30/03/2015 to 12/04/2015.

2. Receiving Institution: Department of Grain and Industrial Plant processing, Corvinus University of Budapest, Hungary.

At Corvinus University, more than 14,000 students are trained in educational programs in the field of agricultural science, business administration, economics and social sciences. The training is organized in six faculties - Faculty of Business Administration, Faculty of Economics, Faculty of Social Sciences, Faculty of Agricultural Sciences, Faculty of Food Sciences and Faculty of Landscape Architecture; In three degrees - Bachelor, Master and Doctor, taught in Hungarian, English, French or German.

The period of mobility of the scientists from FRDI - Plovdiv was in the Department of Cereals and Industrial Processing of Plant Raw Materials at the University of Corvinus. This department employs 7 people (1 administrator, 1 engineer, 1 assistant, 2 senior lecturers and 2 associate professors). Head of the Department is Assoc. Prof. Dr. Kerti Katalin. They teach students of 2 specialties: "Grain Technology" and "Confectionery Technology and Production of Food Oils".

III. New technologies, skills, knowledge, practices received by learners during mobility and subsequently introduced, disseminated and used in the scientific and educational activity of the structural unit.

Extrusion processing of pasta on a Bartscher Model MPF15N single screw extruder with a capacity of 1,5 kg was one of the problems that were mainly trained and worked the scientists from FRDI - Plovdiv. Cold extrusion is applied in the food industry primarily in the production of pasta. Aforetime made dough is forming at low temperatures and pressures. The dough feeds the extruder where a slowly rotating skrew takes it, moves forward and forces it to pass through the die openings, after which the product is dried. It is measured for thus obtained pasta: solid gain (by weight), total polyphenols (by Folin-Ciocalteu method), polyphenol oxidase activity (spectrophotometric at 420 nm), water absorption index and sensory evaluation.

So far, the scientists from FRDI - Plovdiv have been working with hot extrusion (high pressure and high temperature) for processing raw materials rich in starch. By participating in the Erasmus + program, they have enriched their knowledge of the heterogeneous nature of extrusion applications in the food industry, in particular the use of cold extrusion in pasta production.

Another new technology for researchers of IHRH-Plovdiv is the production of chocolate products (white, milk and black chocolate). The specific, associated with chocolate and chocolate products technology have been learned.

Opportunities for future joint activities with Assoc. Professor Kerti Katalin, PhD, head of the Department of Grain and Industrial Plant Processing at the University of Corvinus have been discussed.

The scientific community of the FRDI - Plovdiv was acquainted in detail with the acquired knowledge and skills from the accomplished training Under the Erasmus + program, at the University of Corvinus, Budapest, Hungary.

<p style="text-align:center">INFORMATION
about participation at Erazmus+ lector and staff-mobility from Food research and
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I. Participants:

1.Boriana Petrova Brashlianova - Associate Professor PhD. Eng., 17 years of scientific experience

2.Petya hristoforova Ivanova-Associate Professor PhD. Eng., 17 years of scientific experience

3. Maria Marianovna Momchilova - Assistant Eng., 4 years of scientific experience

II.Mobility period and host organization:

Period: 10.05.2015 - 24.05.2015

III. Host organization: "Dunarea de Jos" University of Galati, Romania.

The University of Galatz was founded in 1948. The training is carried out in 14 faculties: Faculty of Engineering, Faculty of Shipbuilding, Faculty of Automation, Computer Science, Electronics and Electrotechnics, Faculty of Engineering and Agronomy (Braila), Faculty of Food Science and Engineering, Faculty of Medicine and Pharmacy, Faculty of Science Faculty of Philosophy and Theology, Faculty of Arts, Faculty of Economics and Business Administration, Faculty of Social, Political and Legal Sciences, Faculty of Physical Education and Sport, Pedagogic Profile

The university trains 15,330 students in 68 bachelor programs and 47 master and 500 postgraduate students in 27 programs in 10 doctoral schools, under the guidance of 75 scientific leaders.

About 1275 researchers and specialists work in the university, whose main fields are related to the specialties of the aforementioned faculties.

IV. Contribution to deepening and expanding research at the Institute for Food Research and Development - Plovdiv.

• As a result of the visits, the contacts with Prof. Anka Nicolau, Deputy Rector and Prof. Petru Alexei were confirmed and options for future cooperation with the department "Food Science, Engineering and Applied Biotechnology" from Dunarea de Jos University in Galatz , Romania. It was discussed that joint work on different programs should continue (after a bilateral cooperation project and the Erasmus + project proposal, KD2).

• They were familiar the activities of the two research centers - Fruit and Vegetables and Aquaculture and the 4 pilot laboratories for applied research and technology transfer - for beer, dairy and meat products, supercritical liquid extraction

• During the training period, they were able to work with new analytical equipment (HPLC-MS, GC-MS, fluorescence spectrometer, ACTA PURE - chromatographic system for fast purification of proteins, peptides and nucleic acids, oxygen change bioreactor, Carbon dioxide and nitrogen, fiber counting apparatus, etc.);

• They were familiar with methods and participated in the determination of anthocyanins, common polyphenols, flavonoids and enzyme activity kinetics, which will be used directly in their research work with available equipment.

• They are acquainted with advanced equipment for measuring the physical, rheological and texture parameters of meat products and of various types of emulsions.

• Co-operation during mobility coincided with accreditation of a doctoral program. The Commission assessed positively their work with foreign researchers and discussed the opportunities for exchange of co-operation for the training of their students at EIRC under our accredited doctoral program "Technology of Fruit and Vegetable Cans

The participants was accepted in Department of Food Sciences, Engineering and Applied Biotechnology of the Faculty by Prof. Dr. Gabriela Rpeanu, Head of Integrated Center for Research and Training in Applied Biotechnology in Food Industry - BIOALIMENT with over 130 publications, a number of international And national projects on the priority areas of research, executive editor of the magazine for innovative food biotechnology in Romania.

Fig. 1, 2, 3, 4, 5, 6, 7 and 8 presented equipment in the laboratory undergoing the training: HPLC-MS, GC-MS; Fluorescence spectrometer; ACTA PURE - chromatographic system for fast purification of proteins, peptides and nucleic acids; Bioreactor with a change in the ratio of oxygen, carbon dioxide and nitrogen; a fiber counting apparatus.

Fig. 9. Viscometer for measuring texture parameters (density, elasticity, weighing ability, etc.) of different food groups.

Assoc.Prof. Boryana Brashlianova and Assoc. Prof. Petya Ivanova determined biologically active substances (content of total polyphenols, anthocyanins, flavonoids and antioxidant activity) in raw materials and products (prunes) of vegetable origin, traditionally grown in Romania. (Figures 10 and 11).

Assoc.Prof. Boryana Brashlianova and Assoc. Prof. Petya Ivanova took participated in a thermal test and a test for the influence of pH on anthocyanin content in grapes and prunes and content of β-carotene in shedding. (Figures 12 and 13).

Assis.prof. Petya Ivanova and ass.Maria Momchilova investigated the influence of aqueous and alcohol (ethanol) extraction of black rice on the content of total polyphenols, flavonoids and anthocyanins. (Figures 14 and 15).

Assoc.Prof. Boryana Brashlianova and Assoc. Prof. Petya Ivanova took participated in the determination of enzymatic activity of peroxidase and polyphenol oxidase in extract of prunes and skins from them and of purified polyphenol oxidase. The same enzymes are also used to inhibit polyphenol oxidase with a formic acid inhibitor (1%) (Figures 16, 17, 18 and 19).

In the microbiological laboratory Assoc. Prof. Petya Ivanova took participated in the study of aromatic oils of rosemary and pine needles for antimicrobial activity on microorganisms of the genus Bacillus and Aspergillus. (Fig. 20 and Fig. 21).

Fig.22. Annual student session, graduating students with presentations and posters of the results of their graduation papers.

Pilot Laboratory for Milk and Milk Products.

It carries out training of students and PhD students, prepares the basic raw materials and auxiliary materials for making traditional dairy products.

Pilot Laboratory for Meat Products.

Fig.25. Dryer for meat products

Ass. Maria Momchilova took part in practical exercises with students at the Department of Meat Products Technology, where two types of cooked pork sausages and fillets were made, traditional for Romania. (Fig. 24 and Fig.25).

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INFORMATION
about participation at Erazmus+ lector and staff-mobility from Food research and
Development Institute – Plovdiv

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ACADEMIC YEAR 2014/2015.

Participants:
1. Dida Iserliyska – Sen. assistant, PhD, having 16 years of experience with Food
   Research and Development Institute

2. Mobility period: 25 June – 08 July, 2015 with the Department of Pre harvest
   science and sensory analysis at Corvinus University of Budapest, Hungary.

3. Contribution to gaining knowledge and expanding the research in FoodRDI and
   Bulgaria:

Product development and product optimisation are important activities for all food companies. The aim of such activity is to deliver food products to the market place that are optimally aligned with consumer preferences. There are several common approaches to uncover consumer preferences and to define the possible directions of product development. Penalty analysis is a graphical technique to reveal the possible penalty paid by the product in terms of reduced overall liking by not being ''just about right'' on a characteristic, e.g. it provides the developers with a prioritized list of critical product characteristics that are most-penalizing product performance.

The aim of the mobility was to increase the knowledge about the application of rapid sensory evaluation methods. Experimental data were collected from a consumer sensory test for orange juice from six different manufacturers with 81 consumers. Data analysis of the XLStat statistical package was applied to the data processing. The results obtained were summarized in an article entitled "Application of penalty analysis to interpret JAR data – a case study on orange juices." The objective of this paper was to determine the acceptance of commercially available orange juice products (a case study) by Hungarian consumers via penalty analysis. This research was conducted to provide directional information for product developers on product reformulation or optimization of the various orange juice products.

Within the framework of the mobility, I had access to a number of peer review scientific journals in the area of sensory analysis, such as Journal of Sensory Studies, Food Quality and Preference, Journal of Food Science, Statistics for Sensory and Consumer Science, Novel Techniques for Sensory Characterization and Consumer Profiling, Sensory and Consumer Research in Food Product Design and development, etc..
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Abstract
Penalty analysis is a graphical technique to reveal the possible penalty paid by the product in terms of reduced overall liking by not being Just About Right (JAR) on a characteristic. Thus consumer affective tests were conducted to investigate the use of penalty analysis to model consumer acceptance of six well-known brands of orange juice using the proposed method to infer the drivers of liking from JAR data. Just-about-right (JAR) and hedonic ratings were used to measure each attribute evaluated. Consumers (n=81) were asked

to rate the overall acceptance using a 9-point hedonic scale. Just About Right (JAR) scales were used to evaluate the rest of the attributes as followed: color, sweet taste, sour taste, bitter taste and amount of pulp. Means and frequencies of each sensory attribute were obtained. Spearman's rank correlation coefficients gave the relationship between the sensory attributes and the overall liking.