

## ABSTRACT OF HABILITATION THESIS

### Natural compounds - from chemistry to biological properties

#### Domain: Biotechnologies

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This habilitation thesis presents the academic and scientific achievement after receiving the PhD degree in 2001 until now. The main field of my research is related to the chemistry and biochemistry of carotenoids and of other bioactive compounds, with a special interest on their antioxidant and antiproliferative properties. The competences in analytical chemistry, biochemistry and cell culture techniques acquired during fellowships and training courses were exploited in the development of my research directions.

A consistent part of my work was dedicated to the characterization of carotenoids, fatty acids and lipids or phenolics composition in several plants of medicinal or nutritional interest. As an exemple, fatty acids distribution in polar lipids and the polar lipids content of a carotenolipoprotein complex extracted from sea buckthorn was reported for the first time. In the field of carotenoids we concentrated on original aspects regarding the carotenol ester fraction reporting for the first time the presence of certain compounds belonging to this class in *Hippophae rhamnoides* and *Physalis alkekengi* and contributing to the characterization of the subspecies *Carpatica*. The analytical work on the lipophilic compounds was extended to animal derived products (milk, cheese, eggs) reporting for the first time the fatty acids profile in lipid fractions and carotenoids in Araucana hen eggs.

One original contribution was the study regarding the incorporation of carotenol esters in liposomes, as a part of researches performed in collaboration with University of Bremen. Liposomes containing free and esterified carotenoids were characterized using advanced spectroscopic techniques. We demonstrated that carotenol esters get incorporated at a lower yield than their corresponding free carotenoids, they increase significantly the liposomes sizes but also the membrane rigidity.

The antioxidant effect of natural compounds (carotenoids, polyphenols) was investigated in an experimental design that simulated the three general mechanisms by which oxidative stress is induced in Retinal Pigment Epithelial cells. Lutein, zeaxanthin and resveratrol were found to protect retinal cells against induced oxidative stress through either direct inactivation of ROS or by increasing the activity of antioxidant enzymes. These results obtained by *in vitro* tests create prerequisites for testing these compounds *in vivo* in order to achieve specified dietary supplements to prevent age-related ocular diseases (AMD, cataract) and to improve antioxidant status in the retina of diabetic patients. Recently we extended our work on the characterization of rich sources of phenolic compounds (*Vaccinium myrtillus* and *corymbosum*, *Aronia melanocarpa*, *Sambucus sp.*, *Viscum album*) and on the testing of their antioxidant, antidiabetic and antitumour properties.

Original contributions on the involvement of carotenoids in the antioxidant defence and immune system (birds, horses) resulted from collaboration with colleagues from the Faculty of Biology Babes-Bolyai University and from the Faculty of Veterinary Medicine.

The works performed in the frame of PN-II-ID-PCE-2011-3-0721 project demonstrated the higher thermal stability of esterified forms of xanthophylls compared to unesterified form, in model systems (pure compounds obtained by semi-synthesis) and food samples (fresh and processed fruits).

Starting with 2001 I was director of 6 research projects, partner project manager of 3 projects, member in 3 international research projects and more than 15 national research grants. By the projects ruled as director/partner manager I attracted about 600.000 euro which were used mainly for improving the infrastructure of our laboratories (food analysis and cell culture). The research activities have resulted in the publication of 35 papers in ISI journals with impact factor (13 as first author), 46 in ISI proceedings or journals without impact factor, 75 in journals indexed in other databases, and participation to numerous conferences and symposiums in Romania and abroad (EuroFedLipids, Pigments in Food, International Symposium on carotenoids, International Symposium in Separation Sciences). I contributed with 3 chapters (53 pages) to “*Food Colorants: Chemical and Functional Properties*”, Socaciu C. (editor), CRC Press 2008, one chapter in “*Handbook of Nutrition, Diet and the Eye* (Academic Press, Elsevier, 2014), two chapters (80 pages) in “*Fiziologia și patologia glandei mamare la vacă*”, Editura Academic Press, 2010, three chapter in “*Stresul Oxidativ și Antioxidanți Naturali*”, Editura Academic Pres, 2014 (Prize “Ion Adameșteanu” of ASAS). I was invited to review papers for prestigious journals: *Journal of Food Composition and Analysis*; *Food Chemistry*; *Journal of Agricultural and Food Chemistry*, *Journal of Functional Food*, *Food research International*, *International Journal of Molecular Sciences*, *Journal of Cellular Biochemistry*, *Molecules etc.* and I was nominated as evaluator in national competitions for research grants.

Our future plans include the continuation of analytical work on plant/animal food products but also the studies on the protective/apoptotic/antiangiogenic effect of natural compounds by using *in vitro* models of various cell culture lines. A special interest will be the evaluation of bioaccessibility of lipophilic natural compounds and their cellular uptake (intestinal, retinal cells), with a high impact on the understanding of factors affecting their bioavailability and on the improvement of nutritional status.

One major interest is to obtain funding for sustaining the research activities, to create position for employment and funding of PhD students as well as to sustain the attendance of specialized training courses and international scientific events. The main outcome of this plan is to develop scientific and managerial skills and to encourage the young researchers (PhD and postdoctoral students) to participate in research grants competition and to become successful independent researchers.

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