Summary:

The technologies for obtaining functional products and highlighting their effects on the human and/or animal organism involve complex studies stretching on long periods of time. The methods for *in vitro* simulation are the modern way, which can be carried out in the lab and doesn't have any ethical implications.

Along with the eliminated ethical implications, *in vitro* technologies are reducing the necessary number of animal studies and they are the main form of primary analysis of the products from the bio-pharmaceutical industry. This translates through the ability to elaborate a primary screening useful in demonstrating the biological effects of a newly developed product. *In vitro* tests eliminate the need of a bio-basis and of specialized staff. These experiments are conducted in static or dynamic systems, depending on the scope and they have the ability to develop new applications used for the development of the bio-pharmaceutical industry.

Thus, after presenting the doctorate thesis, the research directions have targeted the following practical aspects:

1. Development of *in vitro* methods and systems for simulating a human gastro-intestinal tract (www.gissystems.ro). These researches leaded to three functional models of *in vitro* simulators and patenting two of them in 2016. The third simulator (GIS3) is aimed to simulate the gastro-intestinal tract of the pig and is used in the zoo-technical field.

   The first simulator, named GIS1, is a one-chamber system functioning in two stages but using the same technical solution. Stage 1 is dedicated to the transit through the stomach and the small intestine. Stage 2, which is independent, aims to simulate the human colon in a one-chamber system.

   The GIS2 system is exclusively dedicated to the human colon and is designed for final validation of a functional product. This is aimed to eliminate *in vivo* tests and to transfer validation tests on a lab level. It is based on continuous fermentation, which tries to replicate as much as possible the microbial imprint of the microbiota and the changes determined by the tested sample, under physiological conditions.

2. Cultivation of mushroom micellium in the lab, in the bioreactor, was another subject of interest. The cultivation of some species of *Pleurotus ostreatus* isolated from nature was targeted, but also of other edible and medicinal species. Obtaining micellium (in form of biomass) and also polysaccharide synthesis were aimed. The biological characterization was conducted through *in vitro* tests.

3. Cultivation of certain species of edible and/or medicinal mushrooms was another research direction mainly capitalized through graduation and dissertation papers. Worth noting were the elaboration of the technology and the execution of the functional model of a greenhouse, in the lab, for the cultivation of *Lentinula edodes*. Today there is a patent application submitted to OSIM and a series of prizes were obtained in invention fairs.

Other species cultivated in the labs of the faculty were *Pleurotus eryngii, Pleurotus djamor* and *Pleurotus citrinipileatus*. There elaboration of a cultivation technology for *Stropharia rugoso-annulata* is also studied because there is no such production adapted to available substrate and climate conditions.

A different research refers to implementing a new cultivation technology for *Pleurotus ostreatus* in the garden, in open spaces. The method has passed the first validation and is aiming implementation within a minimum of three years, without major intervention on the substrate, with minimum maintenance and quantity refreshment.

All these research directions have materialized after the elaboration of the doctorate paper, by publishing two specialty books with international publishing houses, a teaching manual and two practical work guides. Over 20 articles were published as single author or main author in ISI magazines and at least 16 articles BDI indexed. Two ISI works published as single author have received an award from UEFISCDI. Two patents obtained and other three patent applications were submitted to OSIM. Three research projects were also obtained (two TE projects and one PCCA project).

Another way of invention capitalization was the participation to the International Exhibition of Inventions in Geneva and the four medals obtained there (Gold Medal 2013, Silver Medal 2016, Bronze Medal 2014 and Gold Medal 2017), the two medals and two special prizes obtained in the Eureka Invention Fair – Innova Brussels (Gold Medal and Special Prize Poland

2015 and 2016). And other prizes and medals from invention fairs from Romania are also added here.

The third part of the thesis is presenting the development plan from the point of view of the scientific research, but also in relation to quality increase of the teaching activity. The directions of scientific research development will aim to improve the analysis of the samples resulting from *in vitro* simulation of the human gastro-intestinal tract by increasing the number of articles published in impact journals, but also by establishing collaborations with new research partners. The researches regarding the cultivation capacity for *Pleurotus ostreatus* will also continue, with a view to capitalization of indigenous vegetal resources resulting in the agricultural and food industry. Cultivation technologies will be elaborated and the cooperation with IMM (small and medium-size companies) from the field of mushroom procurement will continue. This means an involvement of the students, empowering during the practical stage of the graduation and dissertation papers. The correlation of the research activities presented before will occur within the doctorate works, since they require advanced knowledge from many fields. The PhD candidates will be supported for the increase of result capitalization not only by fulfilling the minimum conditions for presenting the doctorate thesis, but also through patenting and participation to invention fairs. Another important aspect will be the elaboration of and participation in research projects.