

NATIONAL RESEARCH-DEVELOPMENT INSTITUTE
FOR ANIMAL BIOLOGY AND NUTRITION
(IBNA)

SELF-ASSESSMENT REPORT 2007-2011

1. ADMINISTRATIVE STRUCTURE DIAGRAM OF THE INSTITUTION

Full administrative structure of **The National Research & Development Institute for Biology and Animal Nutrition**, known under the brand “**IBNA**”, is presented in the diagram on the next page. The structure of management is imposed by the current legislation while the structure of the departments / teams is the decision of the institute, with the approval of AAFS – Academy of Agricultural and Forestry Sciences (the coordinating organism). Thus, the institute mainly consists of **a research department** (four research laboratories and a non-scientific team for research-related logistics), **a development department** (a feed mill, a multispecies animal farm with its own arable land and support teams) and the regular **administrative services**.

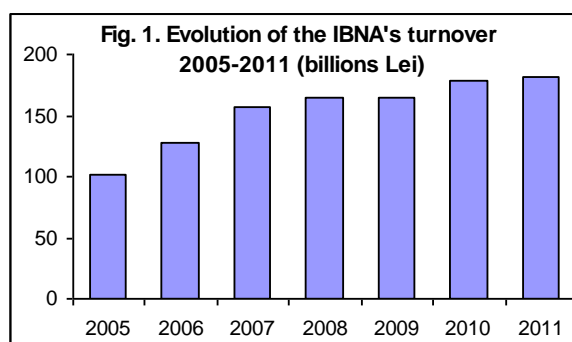
IBNA’s research department operates **mainly through** public- and private-funded **research projects**, which covers the research activity and part of the IBNA’s technological transfer (according to the requirements of the financing bodies and its own strategy to increase the impact of the research results). **IBNA’s development department** is self-financed (doesn’t use public funds) and **offers services to the research department** (providing the experimental feeds according to the specifications of the researchers, hosting the experiments on animals) and is **involved in the technological transfer** of the research results that are obtained and validated within research projects, mainly toward the small and medium farmers that are not able to directly absorb the research results. According to the current legislation, the institute is **allowed to valorise the research results** obtained through the research projects.

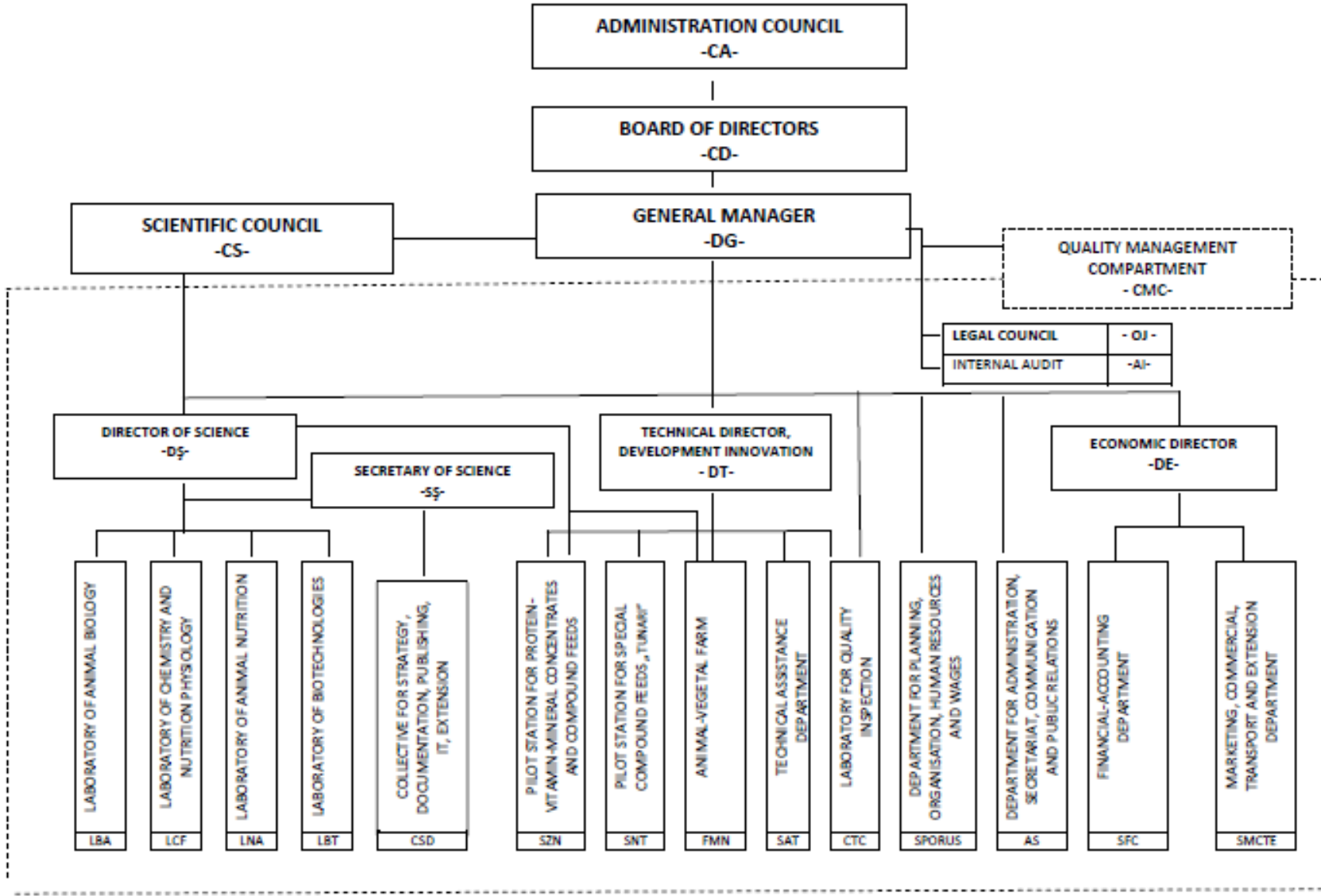
The structure of these departments and the way it is implemented **ensure the adaptability of the institute** to various situations (in terms of scientific directions, financing, etc.) and **proved to be successful over years**. Actually, while many other research units disappeared, IBNA got consolidated and became the **most important research facility in the Romanian animal science** sector and one of the most important in South-Eastern Europe.

2. GENERAL ACTIVITY REPORT OF THE INSTITUTION

2.1. General description of the state of the institution

Despite the financial crisis and the too slow general reform of Romania, **the status of IBNA** in the past four years (2007-2011) **has been good** - sound financial evolution (constant increase of the incomes of the institute (Figure 1), a noticeable scientific growth and a determined evolution toward the European model of a research institute. At the previous institutional evaluation (2002-2007), **IBNA ranked first** and currently has the **biggest turnover within AAFS network** of research units. Overall, IBNA is the most important Romanian research facility for animal science, well integrated into the European Research Area (ERA), having enough critical mass in order to play an important role especially in the field of feed & food quality and safety, physiology of nutrition, genetic improvement, animal health, etc.





2.2. Activity and evolution in the previous 4 years, from a scientific point of view

The main objective of the institute in the past four years was to **intensify its institutional reform** in order to **increase its capacity to perform at international scientific standards** and to **integrate into the ERA**, while continuing to provide intense scientific **support to the animal production sector** in Romania. This was done through **project-oriented activity**, the projects being won within calls for proposals.

The decision of national financing bodies to adopt the European FP7 model for national research projects (topics, partnerships, projects design) and leaving the choice of the subjects of the project proposals, allowed IBNA to fully valorise its orientation toward modern research priorities and its international experience (participation in FP projects, staff trained abroad, intense international collaborations, capacity to perform good quality research) and to diversify its research areas.

This led to a **high capacity to submit project proposals** and to a **high success rate** (comparing to the average). Even within 2011 calls for proposals, when new and higher eligibility criteria for project directors were implemented, IBNA was able to submit 11 proposals as coordinators, of which 2 were already financed and 6 are still under evaluation. Also, IBNA is partner in a good number of national and international project proposals that were submitted in 2011.

On this basis, IBNA ran **85 projects and contracts between 2007-2011** (without nucleus program), of which **51 coordinated by IBNA** and **12 international projects** (FP6, FeedSEG, FP7 Feed to Food, FP7 SOLID, FP7 FoodSEG, COST-FA082, Eureka E! 5008 EGSE, etc.), with a **total turnover of 4,223,531 euro**. This **intense research activity** allowed a **good scientific output** (if judged in the context of Romanian agricultural research): **25 articles in ISI quoted journals, 38 articles in journals indexed in international databases** using evaluation process, **more than 100 communications** within international conferences/symposia but also to a **high impact in the Romanian animal science sector**, via a boosted technological transfer in the last years (42 lectures, 28 interviews, 25 dissemination articles, etc.).

2.3. Major achievements in 2007-2011

2.3.a) Maintaining an intense research activity

Although Romanian expenditures for RD (% of GDP) were still low in 2007-2011 and despite the budget reduction of the on-going projects and scarceness of project competitions, **IBNA succeeded in raising enough funds to maintain its research activity at an appropriate level**, thus ensuring the basis for a good scientific output.

Thus, the **number of public-funded projects** running simultaneously in a year has **never decreased below 35**. Also, the funds from public-funded projects **have never decreased below 0.7 million euro/year**. To these, an important number of research and service contracts with third parties were concluded, leading to significant supplementary funds and contributing to the impact on the agriculture sector. Few more facts are to be highlighted:

- IBNA had one of the highest load / researcher in terms of number and volume of projects within the whole agricultural research system. These projects were carried out by the 31 researches, many of them being early career scientists. (whose potential as project managers will be valorised in the next years);
- 60% of the projects (beside the nucleus program) were coordinated by IBNA, thus ensuring better control of project development, research directions and scientific output. These projects focused on broad aspects related to animal nutrition and biology, of which many were similar with FP topics: nutrition-immunity, feed safety, nitrogen metabolism efficiency in ruminants, rumen acidosis, alternative feed additives (from microorganisms or plants), better quality of animal products for better public health (PUFA, functional food), etc.
- Half of the international projects have been FP6 and FP7 projects (including STREP and Collaborative types): FP7 SOLID, FP7 FoodSEG, FP6 FeedSEG, FP7 Feed to Food, FP6

Feed for Pig Health, etc. **In fact, IBNA ensures a large part of the Romanian participation to FP7 in the field of agriculture and, in some of the FP projects, IBNA was the only partner from Eastern Europe (FP6 Feed for Pig Health, FP7 SOLID).** At this moment, IBNA is involved in 3 FP7 projects, one COST, one Eureka, one bilateral project with Greece, and several project proposals are under evaluation.

2.3.b) Progress in volume and quality of the scientific output

As shown at the previous point, **IBNA has put a lot of efforts to maintain an intense research activity and to keep fitted for research activities its scientific staff.** As a result, an **improvement** in the number and quality of both published articles and scientific communications was noticed (table 1).

Table 1. Evolution of the scientific output (number)

	average 2002-2006	2007	2008	2009	2010	2011	average 2007-2011
ISI articles / of which non zero influence score	2.5 / 1.2	2 / 2	4 / 1	4 / 4	7 / 7	8 / 5	5 / 3.8
IDB indexed articles	9.5	7	23	5	15	10	12
international communications	14.0	11	22	16	23	26	19.6

In the considered period (2007-2011) **the number of ISI articles doubled** comparing to the previous period: 25 articles were published in ISI journals (of which 19 in journals with non-zero influence score), leading to an average of 5 articles / year. A good number of these articles are jointly written with researchers from France, Belgium, etc. as a **result of IBNA's international collaborations.** This evolution is an improvement, comparing to the previous period and **one of the first results of the IBNA's institutional reform.** It is to be mentioned that the trend is more pronounced in the last years of the period. **This evolution is likely to continue** as more and more scientists will reach the potential to produce ISI articles and newly obtained results will be valorized. Many of the ISI articles were published in well-known international journals such as: Brith J. Nutr, Anim Sci J, Animal, Toxicol in vitro, J. Agric. Food Chem, Mol. Nutr. Food Res, Meat Sci, Toxicol, J Trace Elem Med Bio. etc.

38 articles were published in journals indexed in international databases with selection process (CABI – full text products, PROQUEST, EBSCO, IVIS, ULRICH, SPRINGERLINK), leading to an average of 12 articles / year. **While the overall production increased by 25%** comparing to the previous period, it has to be noticed that the **proportion of articles published in foreign journals also increased**, as well as those published in journals with more severe reviewing process (e.g. Archiva Zootechnica, Romanian Biotechnology Letters).

Also, IBNA's scientific staff produced **more than 100 scientific communications** within international congresses / conferences / symposia. While none of these are listed on ARC database (used for this evaluation process), some of them are of high quality, very important for the field and really selective – organized by IUPAC, Nutrition Society, WPSA, etc. Other events where IBNA participated with communications were EAAP meeting, Animal Biology and Nutrition symposium, Serbian Animal Husbandry Congress, etc.

IBNA also produced a large number of communications within national events, **25 articles** in technical journals, **28 professional interviews**, has organised dissemination **24 events**, **45 on-farm demonstrations** etc., all these in order to ensure an **intense flow of technological transfer** toward the Romanian animal science sector. IBNA also produced several patents and patent applications, especially in the last two years and is constantly putting on the feed market a lot of products which resulted from the research activity. Also, **30 new or improved products** (compound feeds, feeding additives, ensiling additives) were issued in the evaluated period.

2.3.c) Increased visibility and recognition

The fact that IBNA was ranked first within AAFS network at the previous institutional evaluation is not singular. Its **visibility and recognition increased in 2007-2011**, both at international and national level. This is supported by the following:

- IBNA is **constantly invited to participate in international projects** (12 FP7 project proposals in 2007-2011), following the **recommendations of former partners and coordinators** of previous international projects (which means the institute has met their expectations);
- of the international communications, about **20 % were given as invited lecturers** (mainly in South-Eastern Europe);
- participations of IBNA's researchers in: • **scientific committees of international events** (ABN Int. Symp. – Bucharest (2007-2011), Int. Symp. on Feed Technology - Novi Sad (2007-2011); Int. Symp. on Anim Sci - Belgrad (2011)); • **as reviewers or members of editorial boards** (Immunopharm & Immunotoxicol; Anim Feed Sci and Technol; Liv Sci; World J Mycotoxin, Perspectives in Agriculture, Vet Sci, Nutr and Natural Resources, J Vet. Med. Anim Health, J Anim Physiol and Anim Nutr, J Anim Sci.); • **as projects evaluators**: I. Taranu (FP7 KBBE 2007-1 call and FP7 KBBE 2008-2B call), RD Criste, C. Dragomir D. Marin, RC Duca (Romanian national projects IDEAS, PARTNERSHIPS, CAPACITIES, CALIST etc.), RD Criste and C. Dragomir (Serbian National Projects, Bulgarian National Projects), • **as members in national and international committees**: D. Marin (Scientific Commission of the National Council for the confirmation of Titles, Diplomas and Academic Certificates), C Dragomir (SCAR) • **as members in PhD committees**: H. Grosu (coordinator of five PhD thesis), I. Taranu, (in PhD thesis committee of C. Tabuc - 2008, Toulouse, France; R. Duca - 2009, Paris, France; C. Braicu - 2009, Cluj, Romania), R. Criste (in PhD thesis committee of C. N. Durdun – 2010, Bucharest, Romania), etc.;
- IBNA was many times **invited** by actors related to RD activity **to join many initiatives** (projects, Info Days, promotion of success stories, promotion of noticeable results, etc.);
- **following the boosting of IBNA's technological transfer** activities (see following chapters), beyond recognition and visibility, **its impact** on the Romanian animal science sector **has considerably increased** in the last years
- IBNA was **repeatedly identified** by the national authorities and foreign evaluation missions (e.g. within MAKIS project) **as the Romanian research facility for animal science**.

2.3.d) Pioneering

Traditionally, IBNA is **one of the most dynamic research units** in Romanian and SE Europe agriculture. The institute gives **special focus to modernization and reaching the international standards**, being **among the firsts performing the necessary steps**. Some examples:

- Among the first units that **adapted its research directions**, according to the European priorities but also according to the needs of the Romanian animal science sector (this led to huge advantages in terms of won projects, quality of research, international collaborations, etc.);
- Among the first units that **organize a yearly symposium at international standards** (15-20 countries, reviewing process, high international visibility, good presence of researchers from Western Europe, etc.);
- Among the first units that **publish an international journal** (Archiva Zootechnica) **using international standards** (severe reviewing process, wide databases indexing, large coverage, etc.) leading to the achievement of the potential to be submitted for ISI quotation;
- Among the first units **implementing ISO 9001, ISO 170025 and self-imposing high standards** (in quality of research, recruiting and training staff, language skills, intensity of collaborations, intense staff training).

2.4 Portfolio of investments and methods

The institute put considerable efforts in the last years and **managed to significantly modernize its research infrastructure** (equipment amounting to 1.4 million euro purchased in 2007-2011, of which 0.8 on MAKIS project and 0.6 on own sources – e.g. research projects). Unlike many investments in Romanian, **the degree of using our infrastructure is very high**: 30-45 projects running every year (therefore high number of experiments), a **rich portfolio of research methods**, many of them validated by the Romanian Accreditation Association - RENAR or issued from national and international collaborations, a rich scientific output. It is important to emphasize that **updating** of the research equipment **allowed improvement of the research capacity** leading to **results that were valorised through articles in well-known journals**. Funds were directed toward the acquisition of research equipment (which directly brings projects and scientific results), while rehabilitation of experimental spaces was solved through MAKIS projects (on-going).

2.5. Recruiting & Human resources

IBNA currently has 155 employees (152 full time equivalent), of which 50 in the research department, 57 in the development department and 48 in administration. Of the 50 employees in the research department, 31 are researchers, of which 19 are PhD. The average age of the researchers is 45, which means a good potential for both the present and the future.

IBNA has a **prudent yet very determined recruiting policy**. In Romania, good quality human resources suitable for agricultural research are scarce. In this context, the institute has developed in the last years a **very effective system to secure its human resources for scientific research**. This comprises identification and recruiting of promising staff (high entry-level standards, attractive environment), their intense training for research activity (based on 12 supervisors with international experience, 30-45 projects/year, active infrastructure and research methods, high number of specialization stages abroad), stimulating framework for scientific career (good working environment, fast evolution, possibility to become project manager), flexible wages (system of bonuses, variation of base salary upon performance), encouragement for long-term specialization stages, etc. **As a result, the institute managed to build a core of high-level scientific staff** allowing high capacity to attract funds for research (mentioned above), good capacity to publish in ISI journals (in the context of Romanian agriculture) and high capacity to support Romanian animal production field. Few facts about human resources:

5-10% of the researchers were constantly abroad in medium & long specialization stages (PhD, post-docs),

40% of the scientific staff have medium & long-term **specialisation stages in developed countries** and maintained the collaboration with foreign teams

91 missions abroad for symposia, congresses, joint research stages, meetings for preparing project proposals (one of the highest rate in agricultural research)

In 2007-2011 the institute recorded 20 entries and 15 exits of the research staff (of which 30% retirements or similar). As a result, **the institute managed to maintain a good average age** (also of the researchers – 45 years), while significantly **improving and diversifying the scientific background** of the research staff.

2.6. Actions and events

Many of the IBNA's interactions with its environment have been achieved through actions / events initiated by the institute. These **took into account the heterogeneity of the audience** hence the IBNA's **initiatives were very diverse**. Of these, few highlights:

- **yearly Biology and Animal Nutrition International Symposium** (Xth edition in 2011) organized at international standards;

- **four national workshops / year** (separated on animal species), targeted toward farmers (2nd/3rd editions in 2011);
- editing and publishing **two journals**, one in English - **Archiva Zootechnica**, ISSN 1016-4855 (4 volumes / year, international journal) and one in Romanian – **Analele IBNA**, ISSN 1016-474X (one volume / year national journal, for dissemination);
- **French-Romanian workshop** “Impact of farm animal nutrition on animals and human health” Bucharest, September 23, 2010;
- two international projects **consortia meetings** organized by IBNA (FP6 FeedSEG, FP7 Feed to Food);
- a **high number** of actions / events have been **specific to the part of the technological transfer** that directed toward private sector (described in the next chapter);
- **five training courses**, or which 3 international (focusing on breeding value prediction, marker-assisted selection in animal breeding, farming systems and animal welfare).

2.7. Technology transfer activities

While traditionally IBNA has a very good position and image within animal science sector anyway, after the national-level chaos of late 90s and early 2000s, **IBNA has boosted in the last four years its national wide collaborations**, e.g. with the national authorities relevant to animal production, professional associations (9 agreements, 12 joint initiatives), academia (about 30 students in practice stages, 15 PhD thesis performed in the institute in 2007-2011), private sector (about 25 direct collaborations and 20 partners in projects), etc. **IBNA has identified the technological transfer as an important piece of the knowledge chain and has developed a system to ensure an efficient technological transfer:**

- a **dedicated team** for the technologic transfer of the research results, using an adapted methodology (Dr. Voicu I, Dr. Soare A, Dr. Hebean V, Dr. Ciurescu C);
- **wide network of relationships** with authorities, associations (**practically all associations** relevant to animal production sector), **well-known farmers - good practice examples for other farmers** (Mr. Petcu, Ms. Solomonescu, Mr. Lungu, etc.)
- an **intense, national-wide, action plan** that led in the considered period to:
 - 17 workshops throughout the country (in Alba, Brasov, Sibiu, Mures, Harghita, Giurgiu, Teleorman, Arges, etc. counties)
 - about 45 demonstrations in farms from Ilfov, Giurgiu, Călărași, Teleorman counties, in order to disseminate the research outputs
 - about 30 articles for mass dissemination
 - about 25 lectures within national events, 20 radio & TV professional interviews
 - about 50 participations to fairs, exhibitions

Overall, the institute reached a very high capacity for technological transfer (constant source of results, logistics, experience, large network of relationships) **which ensures the increase of its impact and visibility in the next years.**

2.8. Publication and communication

This output was **described in Chapter 2.3.b.** The most important is that the **production of ISI articles has been improved, especially in the last two years.** This is a result of the **choice** of the targeted journals as well as the general **increase of the quality** of the articles.

Also, a **selection of scientific events** targeted for communication of the results **was initiated**, upon their relevance for the field. Unfortunately, the events that are specific to the IBNA’s field of activity are **not listed in the ARC database; however, many of them are of a high quality** (organized by IUPAC, WPSA, Nutrition Society, etc.). This shows a **good potential to valorize** the

research results, which will be developed in the next years, as part of the IBNA's scientific strategy.

2.9. Other aspects

In the considered period, **the institute underwent institutional reform**, under a project (**MAKIS** – Modernizing Agricultural Knowledge and Information Systems) initiated by the Ministry of Agriculture and AAFS with the assistance of the World Bank. This project was a **result of a negotiation with the institute's points of view** (e.g. which insisted on the objectives deriving from the integration into EU) and **comprised institutional reform in several aspects**: human resources, infrastructure (~ 4 million euro), self-monitoring systems (for outputs), research directions (orientation and flexibility), capacity to attract funds for research, etc. **All chapters of this project were concluded, except the rehabilitation of buildings (on-going) and part of equipment acquisitions (on-going).**

3. ACTIVITY REPORT BY TEAM

The research staff can be clustered in **5 research teams**; however, the **degree of interaction among the teams is high**, as the projects staff lists are often composed of persons from several teams.

E1 team. Feed safety and immuno-nutrition (within Animal Biology laboratory) Team leader: Dr. Ionelia TARANU

In the past four years the research activity of this team has been focused mainly on **feed quality and safety area** but also on the effect of **nutrition on immune response**. The implication in such important area and results obtained by our team lead to the increase of team visibility at national and European level.

1. Major results

A. Scientific production:

Peer review articles. In the last four years 2007-2011 our team published a total number of **22 articles** as principal authors or in collaboration, **12 papers ISI** (*10 in journals with a good impact factor*), **8 articles in CABI data basis life science** and **2 articles** of dissemination. These articles include the research work carried out by the team members in IBNA-Laboratory of Animal Biology or issued from international collaboration; they focused on four pillars:

- i. Modulation of the innate and acquired immune response of pig under the action of low concentrations of mycotoxins with special attention to Fusarium toxins as the most frequently mycotoxins in Eastern Europe.*

Pigs are generally considered to be the most sensitive animal species to *Fusarium* toxins and its metabolites (EFSA, 2004). Our *in vitro* studies showed that these toxins are able to alter the cellular (decrease in proliferation and cytokines synthesis, increase of O₂⁻ synthesis) and humoral (decrease of the IgG, IgA or IgM level) immune response in porcine blood cells (mono- and polymorphonuclear); examples:

- *Marin DE, Taranu I, Burlacu R, Manda G, Motiu M, Neagoe I, Dragomir C, Stancu M, Calin L. 2011. Effect of zearalenone and its derivatives on porcine immune response. Toxicol. In Vitro. 25:1981-8.*
- *Marin D.E., Taranu I., Burlacu R., Tudor D.S. 2010. Effects of zearalenone and its derivatives on the innate immune response of swine. Toxicon, 56:956-963.*
- *Marin Daniela Eliza, Gouze Marie-Estelle, Taranu Ionelia and Oswald Isabelle. 2007. Fumonisin B1 alters cell cycle progression and interleukin-2 synthesis in swine peripheral blood mononuclear cells. Mol. Nutr. Food Res, 51: 1406 – 1412.*

Pig can be regarded as a good model of extrapolation to humans because of the similarities of their gastrointestinal tract. In this regard in collaboration with **INRA-Toulouse, France** we compared the immunomodulatory effects of several common mycotoxins in pig and human *in vitro*. Based on the results of this study, high mathematical correlations coefficients were found between human and pig especially for DON and NIV which suggest that investigations in pig may contribute to human risk assessment of DON and NIV effects:

- **Taranu I., D. Marin, R. Burlacu, P. Pinton, V. Damian and I Oswald. 2010.** *Comparative aspects of in vitro proliferation of human and porcine lymphocytes exposed to mycotoxins.* **Arch. Anim. Nutrition**, 64: 383-393.

ii. *Effect of mycotoxins on the barrier function of intestine*

The intestinal tract represents the first barrier to ingested chemicals or food contaminants and is also the first line of defence against intestinal infection. In collaboration with **INRA-Toulouse, France** and using human and porcine intestinal epithelial cell lines, we demonstrated that DON decreases the barrier function of the intestine. The underlying mechanism involves a MAPKinase dependant removal of claudin isoform from the tight junction; examples:

- **Philippe Pinton, Cornelia Braicu, Jean-Philippe Nougayrede, Joe, Ile Laffitte, Ionelia Taranu and Isabelle P. Oswald. 2010.** *Deoxynivalenol impairs porcine intestinal barrier function and decreases the protein expression of claudin-4 through a mitogen-activated protein kinase-dependent mechanism.* **J. Nutr.**, 140:1956-1962.
- **Pinton P., Nougayrede J.P., Del Rio J.C, Moreno C., Marin D.E, Ferrier L., Bracarense A.P., Kolf-Clauw M., Oswald I.P. 2009.** *The food contaminant deoxynivalenol, decreases intestinal barrier permeability and reduces claudin expression.* **Toxicology and Applied Pharmacology**. 237, 41-48.

iii. *Approaches to reduce the adverse effects of Fusarium mycotoxins*

The work related to some of the most recent approaches (biological mitigating agents) to reduce the adverse effects of *Fusarium* mycotoxins. Specifically, the ability of a nutritional complex compound (a protein concentrate additive, enriched in calcium fructoborate) and probiotic (*Lactobacillus sp*) product in counteracting the toxic effect of dietary naturally contaminated with low levels of *Fusarium* toxins was evaluated in starter pigs. A decrease in performance and several immune parameters was observed in mycotoxin contaminated animals, which was ameliorated by the dietary calcium fructoborate and probiotic supplementation.

- **Taranu I., D. Marin, G. Manda, M. Motiu, I. Neagoe, C. Tabuc, M. Stancu, M. Olteanu. 2011.** *Assessment of the potential of a boron-fructose additive in counteracting the toxic effect of fusarium mycotoxins.* **British J. Nutr.**, 106:398-407.
- **Marin D.E., Taranu I., Motiu M., Manda G. 2010.** *Effect of Lactobacillus feed supplement in deoxynivalenol intoxicated piglets.* **Archiva Zootehnica**, 13, 1: 12-22.

iv. *Mycotoxin survey*

Romania has not been included in the surveys like SCOOP (Scientific Cooperation on Questions relating to Foods) which monitor human exposure to mycotoxins in Europe and only few data are available concerning mycotoxin contamination of cereals produced in this new EU member state. Therefore, one of our attentions is to survey fungal mycoflora and mycotoxin contamination of cereals produced in the South East part of Romania:

- **Tabuc C, Marin D, Guerre P, Sesan T, Bailly JD. 2009.** *Moulds and mycotoxin content of cereals in south-eastern Romania.* **J Food Prot.**, 7:662-5.

Papers issue from partnerships projects carried out by the present team (coordinator I. Taranu):

- **C. Cristescu, A. Andronie, S. M. Iordache, A. Cucu, S. Stamatina, G. Nan, I. Taranu, L. M. Constantinescu, I. Stamatina. 2010.** *Detection of the neurotoxin, deoxynivalenol, with PANi modified screen-printed electrode.* **J Optoelectronics Advanced Materials**, 12: 941 – 943.
- **Ittu M., Cană L., Tabuc C. Tăranu I. 2008.** *Preliminary evaluation of some factors involved in DON contamination of bread wheat under natural and artificial inoculation.* **Romanian Agricultural Research**, 25: 37-4.

Books and book chapters. The experience accumulated in the field of mycotoxins in IBNA and in collaboration with dr. Oswald from INRA-Toulouse was assembly in two books; examples:

- ***I.Taranu, D.E. Marin, C.Tabuc. 2009. Fungi and Mycotoxins. Effects of mycotoxins on pig.*** ARS Docendi Bucharest Univ. publisher, ISBN: 978-973-558-436-8.
- ***Oswald I.P., I.Taranu. 2007. Mycotoxins in farm animals.*** Transworld Research Network publisher, ISBN: 978-81-7895-312-0, Trivandrum-695 023, KERALA (co-editor and co-author).

B. Projects obtained by competitions:

National projects. Drawing funds for the research activity is a strong concern of the present team. Within 2007 & 2008 national calls for proposals, our team submitted **11 research projects** (under three modules: *Partnership / Complex ideas / Ideas*, **6 proposals** as project coordinator and **5** as partner in other consortia. The team obtained 4 projects, **3 as project coordinator** and **1** as partner in other consortia:

1. PNCDI 2-Partnerships-„ERGOMET”/Contract 51-078/2008-2011- project director: **Cristina TABUC**;
2. PNCDI 2- Partnerships -„NUTRIMICODIM”/Contract 55-122/2008-2010- project director: **Ionelia TARANU**;
3. PNCDI 2-Ideas/contract 1080/2008-2011– project director: **Daniela MARIN**;
4. PNCDI 2- Partnerships „ZISOPROD”/Contract 62-068/2008-2011/-project executive: **Ionelia TARANU**.

At the most recent competition, in 2011, when new eligibility criteria were implemented, the team filed **10 project proposals** with scores which exceeded the minimal of 2: **3 proposals** under the *Ideas section*, obtaining 1 project, and **7 proposals** under the *Partnerships priority areas section*, **4 proposal** as coordinator in type-1 projects and **3 proposals** as partners in other consortia (type-2 projects). The results of this competition are expected by April 2012.

International projects. The team has strong links with foreign partners (10 years of collaboration with INRA-Toulouse, France) being involved as partner in 12 international project proposals (European projects, network and bilateral collaborations) and in 8 projects on-going in 2007-2011:

1. 2011-2014: FP7-Feedseg (local director-**I.Taranu**);
2. 2011-2014: bilateral cooperation: Romania-Greece (local director-**D. Marin**);
3. 2008-2012: COST-FA 0802/Feed for health (local director-**I.Taranu**);
4. 2008-2012: FP7-[REGPOPT]/FEED-TO-FOOD (team members-**D. Marin, I. Taranu**)
5. 2006-2009: Network -Reseau formation recherche (local director-**I. Taranu**, team members-D. Marin, C. Tabuc);
6. 2006-2008: bilateral cooperation, Romania-France “BRANCUSI” (local director-**I.Taranu**, team members-D. Marin, C. Tabuc);
7. 2006-2008: ECO-NET network (France – INRA; Romania-IBNA; Polonia –Univ. Warmia, fac. MV; Slovenia – IAPSAS), (local director-**I.Taranu**, team members-D. Marin, C. Tabuc);
8. 2004-2008: FP6-Food for pig health (local director- **I.Taranu**).

All these collaborations resulted in common papers (in journals with a good impact factor) mentioned above and scientific symposiums.

Other collaborations. The team has established partnership arrangements with the private sector (forage producers, processors, feed additive manufacturers, etc.) such as S.C. AGROMAR S.R.L., S.C. NOACK S.R.L., S.C. SOUFFLET MALT ROMANIA S.A., .C. LABOREX 2000 S.R.L., Research-Development station for Bovine, Targu Mures.

2. Dynamic of research directions:

Beside the two major area of research in these four past years: **(i) improvement of the feed quality evaluation** and **(ii) assessment of the effect of mycotoxins on performance, health status and systemic immune response**, the scientific activity of the team has been broad with new *in vitro* and *in vivo* approaches focus on:

(iii) Evaluation of the effect of mycotoxins on the intestine as the first barrier to ingested chemicals or food contaminants (local immune response); we developed and optimized *in vitro* tools for the investigation with two epithelial intestinal cell lines. Approach developed by the projects *Ideas/1080* and – *Nutrimicodim/52-122*;

- (iv) *Development of a porcine microarray to in-depth investigations of the effect of zearalenone*, approach which will be developed by the projects-**Ideas/101**;
- (v) *Nutritional strategies to mitigate the adverse effect of Fusarium mycotoxins*. The ability of several pre- and probiotic and symbiotic agents have been investigated in *in vitro* and *in vivo* experiments. Approach developed by the project-**Nutrimicodim/52-122**;
- (vi) *Evaluation of the efficacy of natural feed additives in swine nutrition*, approach developed by the projects-**PN07-43 04-02** and **P09-0202-Nucleu**;
- (vii) *Immunological characterisation of new sources of feed*, approach developed by the projects **PN07-43 04-03** and **P09-0204-Nucleu**.

3. Dynamic of human resources:

Employing. In 2007, our team counted 3 PhD researchers (I.Taranu, D. Marin, C. Tabuc) and 2 technicians (L.Calin, M. Stancu) with permanent positions; in order to develop new research directions and consolidate the existing ones in the past four years 3 young researchers joined our team in permanent positions: **2008**-Monica BURGHELE, research assistant – immuno-nutrition; **2009**- Veronica CHEDEA, research assistant, PhD - identification and characterization of new sources of feed; **2010**- Gina PISTOL, PhD researcher IIIth degree – molecular biology. The team has in present a good complementarity between members with very good collaboration and *an average age of 40.5 years*.

Trainings. The teams promote all the time professional interest especially for young. Examples: Daniela MARIN: training FP6 SSA project/“Young Train”/2007-2009; Monica BURGHELEA: master 2 years/2008-2010, biology, Bucharest University; Veronica CHEDEA: postdoctoral training (Japan Society for the Promotion of Science) /2010-2012, life science and biotechnology, Shimane University, MATSUE, Shimane, Japan. Several mobilities were carried out within bilateral projects (Romania-France).

Interdisciplinary initiatives. The team succeeded to persuade the nutritionists from IBNA to take into consideration the impact of feed on immunological status in their feeding trials. Within this context the team was involved in almost all the feeding trials carried out in the last two years in IBNA by analysing the effect of different feed ingredients on immune response in pig and poultry:

- *Habeanu M., Hebean V., Taranu I., Ropota M., Lefter N., Marin D.E. 2011.* Dietary ecologic Camelina oil – a beneficial source of n-3 PUFA in muscle tissue and health status in finishing pigs. **Romanian Biotechnological Letters**. 16, 5: 5564-5571.

4. Other aspects significant for the scientific development of the team:

-Scientific events. The team has contributed with paper presentations to **16 international conferences** and has also contributed to the organization of the last **6 international** IBNA symposiums and 1 workshop with France Embassy.

-Reviews for international peer reviews. Members of the team (**I. Taranu and D. Marin**) are involved in reviewing activities (*15 scientific journals*-e.g. Toxicon, Animal Feed Science and Technology, Journal of Agricultural Science and Technology Immunopharmacology and Immunotoxicology, etc; *1 editorial board* -Archiva Zootechnica). **I. Taranu** is evaluator expert (ID: EX2002B070822) of the **European Commission** for the project proposals evaluation submitted under *the seven and the sixth European Framework Programme* and along with **D. Marin** serve as evaluator for joint applied research projects **PCCA 2011-Romania**. **D. Marin** is a member of the *Scientific Commission of the National Council for the confirmation of Titles, Diplomas and Academic Certificates* and I.Taranu was member in PhD commission for 3 PhD students.

Perspective: the team will intensify the research on in depth investigation at molecular and cellular level and on the intestine as the first barrier to ingested chemicals or food contaminants (local immune response).

E2 team. Animal Genetic Resources Management (within Animal Biology laboratory) Team leader: Prof Dr Horia GROSU

Animal genetic resources for food and agriculture (AnGR) provide crucial options for the sustainable development of livestock production. The erosion of these resources globally, and particularly in many developing countries, has accelerated in recent years as a consequence of the rapid changes affecting livestock production systems (intensification and industrialization) as they respond to surging global demand for animal products. As distinct field, animal genetic resources management was included among the research topics of the institute after 1995. As concept, AnGR refers to four major aspects: taxonomy of animal populations; genetic improvement; conservation and utilisation of animal genetic resources.

Dynamics of the research topics.

Given the four action directions of AnGR, the main objectives of the team refer to:

1. Identification, characterization and classification of the farm animals populations;
2. Scientific substantiation of the programs aiming to preserve and conserve the vulnerable and endangered animal populations;
3. Genetic and economic optimization of the breeding programs for the animal populations with normal status;
4. Fundamentation of biometric procedures used to evaluate the genetic potential of the populations of animals of economic interest;
5. Fundamentation of biometric procedures used to evaluate the genetic parameters of the farm animals populations;
6. Research regarding the effect of using genetic markers in the breeding programs for the main farm animals species

Significant achievements of the animal genetic resources management team

During this period the team run 7 projects, 4 projects coordinated by INCDBNA and 3 projects in partnership with other institutes. All projects were won by competition and were financed from different programs: Partnerships; Human Resources; Sectoral; Structural Funds; Nucleus.

Important results were obtained in Partnerships program project "Economic and genetic optimization of the sheep breeding programs within the context of European harmonization - OPECGEN". The general objective of the project was to conduct complex interdisciplinary research by interconnecting animal science (breeding), economy (technique of updating) and biochemistry (molecular biology) fields with the purpose to optimise the breeding programs for sheep, for the milk and meat productions.

Another research objective was included in two projects which aimed to improve the meat production in the local sheep breeds. The studies investigated the potential of the local breeds for meat production and the improvement of their performance using the cross with breeds specialised in meat production: Suffolk and the black head German meat breed. The results showed that the hybrid lambs had a body conformation similar to that of the meat breeds, with a better dressing in the high quality regions: leg, loin and flank; a higher slaughter yield, a better meat to bone ratio and a higher growth rate than the local lambs. The results were transferred to the **Association of Sheep and Goats Breeders, Teleorman**, through a **Contract of technological transfer**. Another project involved research to determine the polymorphism of goat milk proteins; the milk samples were collected from Carpathian and F1 Carpathian x Saanen hybrids. There were no differences in milk protein polymorphism between the Carpathian and the hybrid goats: the team identified 2 genotypes at the locus of β casein, homozygous BB and heterozygous AB, but no AA genotype. Genotype frequency analysis showed predominance of allele B (70%) over allele A.

The team also run a project within the Sectoral Operational program “Increase of the economic competitiveness”, Priority Axis 2 – Competitiveness through Research, Technological Development and Innovation. The project was cofinanced by the **European Union** through the **European Fund for Regional Development**. The goal of the project was to develop a strategic plan of development, promoting and marketing for all the products (outcomes of previous research projects) and services provided by INCDBNA, in order to penetrate the domestic market; this will enhance the economic competitiveness and the technical-economic profitability of the institute. The research outcomes were: a **marketing study**, plan of measures to capitalise on the research outputs, **strategy to improve the access to INCDBNA sources of funds**, **strategy regarding the image and institutional promotion of INCDBNA and of the products and services it markets**, personalized advertising materials, a film presenting the institute, 7 workshops in central Romania counties, publication of **4 brochures with feeding recommendations for ruminants, poultry and pigs**. Three researchers from the other research teams also participated in this project.

The research topics approached during the past 4 years produced several significant results such as:

- Genetically and economically optimised breeding program to increase the milk and meat productions of the sheep;
- Design for the commercial cross for the improvement of sheep meat production;
- Protocol for the homologation of the local sheep breed Teleorman Black Head;
- Updating and implementation of the methodology for milk control in the local sheep breeds;
- Design for rotational cross for the production of superfine wool.

Interdisciplinary initiatives

Given the complexity of AnGR problems, we also involved in research specialists from other fields of science so as to accomplish the goals. Thus, OPECGEN project developed a network of research-development institutions: INCDBNA-IBNA Balotesti (the National Research-Development Institute for Animal Biology and Nutrition); The Academy of economic Sciences; Bucharest University, Faculty of Biology and University of Agricultural Sciences and Veterinary Medicine, Bucharest – faculty of Animal science, with complementary objectives and activities; they all contributed, by their high level of expertise, to the creation of a research, development and innovation “mass” supporting the development and application of the advanced knowledge, services and technologies in the target field of the project, thus coping with the European and international competition. The whole team had a high and very high level of competency. The team members worked previously in different national or European projects. The human resources used in the project were complementary, consisting of specialists in genetic breeding, economy of investments, molecular biology.

Human resources dynamics

AnGR team consists of 5 researchers (one senior researcher I / Professor, one senior researcher II and three scientific researchers): they are all animal husbandry engineers, 4 are PhD in animal husbandry and one is PhD student in the final stage of preparing the doctoral thesis. Four member teams joined the institute in 2006, 2007 and 2008, while another member joined the institute even earlier. The young researchers (aged 35-36) participated in training courses.

The three young researchers submitted two proposals for research projects in the 2010 competition of the Human Resources program, one project being accepted and currently running. The main goal of the project is to establish an **interdisciplinary and inter-institutional team of young researchers** from IBNA and USAMV Bucharest specialised in animal rearing, nutrition and statistics, which to analyse genetically the production and reproduction traits of a local sheep population from Romania.

The team members published during this period 18 articles in journals indexed in international databases, presented 8 communications in international conferences and published other papers in national journals of dissemination, plus a chapter in a book.

The team members participated (2007-2011) in multiple training courses:

- Training in genetics and molecular biology at the Scottish Roslin Institute, the Agriculture College Edinburgh (Department of genetics and molecular biology) 26-29.11.2007, C. Lazar;
- Training in genetics and molecular biology at the University of Veterinary Medicine Glasgow, Scotland, December 2007, Rodica Pelmus;
- Applied training and documentation for electrophoresis, PCR, molecular biology, at the Research Centre Toulouse-Laboratoire de Pharmacologie Toxicologie, INRA, France, 6 months in 2008;
- Globaldiv Summer School is organized within the GLOBALDIV project (www.globaldiv.eu) financed by the European Commission within the AGRI GEN RES Programme and will be held in Piacenza, Italy, from 7th to 10th September 2009, Cristina Lazar;
- International training course hosted by INCDBNA- Breeding value prediction and introduction into variance component estimation, lecturer Prof. Dr. Mrode Raphael , Scottish Agricultural College, Edinburgh, Scotland, United Kingdom, 19 – 23 October 2009, Cristina Lazar, Rodica Pelmus, Mihai Gras;
- International training course hosted by INCDBNA - Marker assisted selection in Animal Breeding, lecturer, Assoc. Prof. Raluca Mateescu, Oklahoma State University USA, 9-13 May 2011 , Cristina Lazar, Rodica Pelmus, Mihai Gras;
- International training course hosted by INCDBNA - Farming systems and welfare farm animals, lecturer, Prof. Pascal A. Oltenacu, Oklahoma State University USA, 9-13 May 2011, Cristina Lazar, Rodica Pelmus;
- Postdoctoral School through POSDRU project 81/3.2S/55362 “Program for the specialisation of the human resources working in the biomedical and biotechnological fields” hosted by the Bucharest University, Faculty of Biology, 2011-2013, Cristina Lazar, Rodica Pelmus, Mihai Gras;
- Finishing the PhD thesis and presentation in January 2012, Mihai Gras.

The three international training courses hosted by the institute were run at the initiative of the team coordinator.

The human resources policy for the future period is to enlarge the team by bringing in higher education graduates of animal husbandry, biochemistry, biology, mathematics, statistics etc.

Other significant aspects contributing to the national and international visibility of the team

The team coordinator also has other assignments:

1. Founding member of the Romanian Society of Animal Husbandry (SRZ);
2. President of the department of “Genetics and breeding” of the Romanian Society of Animal Husbandry (SRZ);
3. Member of EAAP (European Association for Animal Production) commission developing the “EAAP strategy 2012-2016”;
4. Vice-president of the Romanian Association for Animal Genetic Resources Management;
5. Member of the “Commission for the elaboration of the Strategy for the medium and long-term development of animal science” within the Romanian Academy;
6. National FAO coordinator for Animal Genetic Resources Management;
7. Titular member of the Academy of Agricultural and Forestry Sciences „Gh. Ionescu-Șișești”;
8. University professor, titular of disciplines: “Genetic breeding of farm animals”; “Breeding programs”; “Experimental technique and research in animal husbandry” within the Faculty of Animal Husbandry, Bucharest.

The team collaborates closely with the General Association of the Cattle Breeders from Romania (AGCTR), whose headquarters is on the premises of the institute. The team contracted from the Association services for the prediction of the breeding value of cattle with the purpose to identify the best parents for the next generation.

E3 team. Physiology of monogastrics' nutrition (within Laboratory of Chemistry and Physiology of Nutrition)

Team leader: Dr. Rodica Diana CRISTE

In the current form of organisation, the Laboratory of Chemistry and Nutrition Physiology was established as of January 1st, 2004. The laboratory consists of two research teams: the team of physiology of monogastrics' nutrition and the team of physiology of ruminants' nutrition.

The dynamic of the research subjects and directions

The team of research on physiology of monogastrics nutrition has expertise on a complex range of research subjects **starting from studies strictly directed towards increasing the efficiency** of nutrient utilisation. During the analysed period, the team approaches **reference interdisciplinary research topics** such as:

- **Improve the efficiency of nutrient utilisation.** Projects regarding nutrient bioavailability and dietary nutrient (vitamins, mineral etc.) absorption in monogastric animals;
- **Development of new physical and chemical methods to evaluate feed and food quality and safety** Projects regarding the development of methods for the fast assessment of the quality and safety of the feeds for farm animals; set of chemical methods for the fast evaluation of soybean meal protein digestibility
- **Development of foods fitting the principles of sustainable development and food safety.** Projects regarding: optimisation of the diet formulations with the purpose to obtain functional food having beneficial effects on consumer health such as: the production of ω :3 polyunsaturated fatty acids-enriched consumer eggs; improved broiler carcass quality; food quality evaluation through clinical studies on human volunteers.
- **Decrease the environmental impact of animal production.** Projects regarding: reduction of P excreta by poultry, reduction of Cu and Zn excretion in faces pigs; natural alternatives to the chemical sources of minerals; characterisation of molecular sensors produced from derivatives of CICLOBIS (PARAQUAT-P-FENILEN) used for the detection and identification of the local crisis-generating factors (hazardous and very hazardous substances, etc.;
- **Use of experimental animal models to study the nutritional diseases in humans.** Projects regarding: experimental model for the study of nutritional factors (Ca, B, phytosterols) bioavailability and their influence on bone mineralization in pigs, scientific support for osteoporosis study; research on the incidence and diagnosis of the celiac disease; production of fortified flour foods – medicine for the long-life dietetic treatment.

During the considered period (2007-2001), the collective runs **20 research projects and contracts** of which 1 **international project (EUREKA, E!5008 EGSE, financed from 2011)** and 19 projects from national funds. Of the 20 projects, 11 were/are run by the team members as project directors, while in 9 projects the researchers were project executives on behalf of IBNA Balotesti. A number of 12 projects (amounting to 3 790 850 lei) were gained by competition within the **national research programs: CEEEX: MODULE I-Complex projects of research-development and MODULE IV-Projects for the development of the infrastructure and for the certification of conformity; PN II: Area 5 - Agriculture, food safety and security and Area 8 – Space and security.** Private national funds are/were used to run 7 research contracts (amounting to 145 002.63 lei) contracted directly with economic agents. The researchers from this collective have also been involved directly, but with no management responsibility, in other several IBNA's projects from which two are **international projects: one FP6 project, FeedSEG (043077/2006), one FP7 project, FEED TO FOOD (207043/2007)**

Key-partners in the research contracts and the contact persons:

Universities: **USAMV Bucharest:** Faculty of animal husbandry (Prof Dr. Stoica I); Faculty of veterinary medicine (Prof Dr. Papuc C.); Faculty of Biotechnologies (prof. Dr. Mona Popa). **USAMVB Timisoara,** Faculty of animal husbandry (Prof Dr. Drinceanu D. Conf. Dr. Stef L.). **Bucharest University:** Faculty of Chemistry (Prof Dr. Badea I.); Faculty of physics (prof. Dr. Stamatin I). **UMF Bucharest,** Faculty of Pharmacy (Conf. Dr. Gird C.); **Craiova University,** Faculty of Horticulture (Lect. Dr. Radutoiu D).

Research institutes: National Institute for Food Bioresources, Bucharest (Dr. Belc N; Dr. Denisa D; Dr. Mihociu); National Institute of Endocrinology C.I. Parhon (Dr. Manda D); National Institute for Soil Science, Agro-chemistry and Environmental Protection Bucharest (Dr. Lacatusu A.); Pasteur Institute (Dr. Cismileanu A);

Private organisations: Emona Nutrition Research & Development Department, Ljubljana, Slovenia (Dr. Cervek Matjaz; matjaz.cervek@e-rcp.si); Centiv GmbH, Germania –IMM (Malte Bethke; ar@centiv.de); SC Natural Research Craiova –IMM (Dr. Scorei R.); SC Hofigal SA - Bucuresti (Dr. Tamas. V.); SC Avicola Bucuresti SA (Dr. Pricop F.; Ing Zarug T.); SC Transapicola SA –IMM (Dr. Dan Iosif); S.C. SIAT S.A. (Dr. Surdu I.); SC ANGST RO-SA (Drd. Stefan G).

The areas of activity and the organisation of the partners from the research projects show the **interdisciplinarity degree of the research** activities and the complex nature of the research, both **fundamental and applied**.

The most important achievements obtained from the activity in these projects are listed below:

Papers published by the members of the collective in 2007-2011, in ISI rated journals:

First author/ collective first author	Journal	Year
Untea A.E et al.	<i>J Trace Elem Med Bio</i>	Vol. 25 , S35-S40, 2011
Duca R.C et al.	<i>Environmental Toxicology</i>	DOI10.1002/tox.20617, 2011
Papuc C, Mircea E. et al.	<i>Rev Chim</i>	in print, 73/16.11. 2011
Duca R.C et al.	<i>Analytical Letters</i>	Vol. 43, 1287- 1300, 2010
Papuc C; Criste R.D., et al.	<i>Rev Chim</i>	Vol. 61, 920-925, 2010
Duca R.C et al.	<i>J. Agric. Food Chem</i>	Vol. 57, 10497–10504, 2009
Duca R.C. et al.	<i>Int. J. Mol. Sci.</i>	Vol. 10, 1824-1837, 2009
Duca R.C. et al.	<i>J.Label.Compnd.Radiopharm</i>	Vol. 50, 537-538, 2007
TOTAL score of influence: 9.29		

! **8 citations** (period 2007-2011) in journals with impact factors, among which: Biological Trace Element Research (IF 0.29122); The Journal of Poultry Science (JPS; IF 0,833); Xenobiotica (IF 2.364); Journal of Chromatography A (IF 4.069)

! **2 books:** one published by LAP Lambert Academic Publishing, Luxemburg, 2011, 978-3-8465-2482-4 and one by Eurobit Press, Timisoara, Romania, 2011, ISBN 978-973-620-870-6; **9 scientific articles** published in B+ category journals (6 papers published in Romania and 3 abroad); participations in national and international conferences with 22 papers presented of which 13 (59 %) had young researchers as the main author (below 35).

! **4 Patents:** one registered with OSIM (3/30/2011) regarding the phosphate composition with boron for animal feeding within project SUPLIBOR (CEEX 110/2006).; 3 patent applications filed with OSIM: a feed concentrate (11.02.2010/ A 00116) project FITOMIN (CEEX 51 025/2007); a compound feed for layers (06.12.2011/ A01315) project AVIMORUS (52 112/ 2007); a pastoral system with mulberry (06.12.2011/ A01316) project AVIMORUS.

! **Procedure** for the production of ω 3 polyunsaturated fatty acid **linolenic acid-enriched eggs** (minutes for technological transfer nr. 3559/27.06.2008 and 1398/27.06.2008 between IBNA Bucuresti and SC AVICOLA SA Bucuresti, co-financing partner); eggs EUROU marketed by SC Avicola SA and **Technical documentation for the license of a CPVM** Beneficiary: SC Avicola București SA - (minutes for technological transfer: 5912/21.11.2007) – results of project OMEGANUTRIOSAN (CEEX 22/2005);

! **General procedures for chemical analysis (number 21)** – result of the project Research on the documentation/implementation/accreditation of the Chemistry Laboratory according to SR EN ISO / CEI 17025:2001.

Evolution of the human resources

The physiology of monogastrics nutrition team is interdisciplinary, in agreement with the research topics. It consists of **8 researchers (5 PhD and 3 PhD students)** with different professional backgrounds: **3 chemists** (1 PhD in animal science), **2 animal husbandry engineers**, **1 chemist engineer** (PhD in animal science), **1 veterinarian**, **1 biochemist**. The team has 1 senior researcher Ist degree, 2 senior researchers IInd degree, 3 senior researchers IIIth degree, 1 scientific researcher and 1 research assistant. The **average age of the team is 41**. The team includes 7 women (87.5%). In 2007-2011 the team participated in 5 project competitions. Of the projects submitted as coordinator, 3 projects have been gained, 5 were rejected and two are under evaluation. **The success rate in the project competitions is 37.50%**.

Four researchers did/do their **PhD thesis** in collaboration with **Romanian and foreign universities** within the team research projects. Two of them (1 in 2009; 1 presentation in 2012) at the University of Agricultural Sciences and Veterinary Medicine – Bucharest; one (in 2009) at University Paris XI South (France) & University of Bucuresti - Faculty of Chemistry; one (presentation in 2012) University of Bucuresti- Faculty of Chemistry

The team members had continuous training by **specialisation in different fields**: mathematical statistics applied to the evaluation of the analytical results; chromatographic methods for forage and animal product control quality; experimental techniques (in Germany), implications of the contaminants in the environmental chemistry (in France) ; post-doc studies (France and Luxemburg).

Other aspects considered significant for the scientific development of the research team.

Infrastructure: Modernization of the experimental basis which supported the research activities was accomplished exclusively within the projects gained by competition. The following equipment was acquired: digestibility cages for poultry and pigs; equipment for the determination of the physical characters of eggs; gas chromatograph, liquid chromatograph; atomic absorption spectrometer, UV-Vis spectrometer, analytical assembly for WEENDE; centrifuge, homogenizer, fume chamber, stoves, analytical scales, microwave oven, rotvapor, IT equipment.

The chemistry compartments are accredited by RENAR (certificate nr. LI 674/ 2008) during the project EURONUTRICAL (CEEX 64 / 2005) and approved by ANSVSA (5622/10.05.2011). This allowed running during 2007-2011 period several service contracts with different private companies and farmers (28 contracts for the delivery of services amounting to 145.002.63 lei); participation in 3 performance tests, of which 1 international (IMEP 29 - Total As, Cd, Pb, Hg, Sn and extractable Cd and Pb in feed of plant origin – organised by the European Commission; Joint Research Centre, running until 2010)

Perspectives

New areas of activity: Development and validation of a quick in vitro methodology to evaluate the bioavailability of some essential nutrients from pig, poultry feed sources; Development of analytical approaches to species – specific (speciation) analysis for trace and ultra-trace metals in feed and animal products. The acquisition of the equipments needed for new areas.

Increase team visibility by a larger number of articles published in publications indexed in international databases such as Thomson Reuters (ISI) minimal 2/year

Access to EU funds: Project FP 7 – SME-2012 - Development of sheep's wool blocks to be used for greenhouse cultivation currently under evaluation.

E4 team. Physiology of ruminants' nutrition (within Laboratory of Chemistry and Physiology of Nutrition)

Team leader: Dr. Catalin DRAGOMIR

Human resources dynamic

The team is composed of two senior researchers (Dr. Catalin Dragomir - also the scientific director of the institute and Dr. Ilie Voicu) and three junior researchers. Laboratory work is done using several technicians and animal workers that are shared with the monogastrics team (within the same laboratory). In the considered period, one researcher retired and a part time researcher left, both being replaced with young researchers (one transferred and one hired) which led to a slight increase of the team size (4.5 fte) and a significant decrease of the average age (40 years). The newcomers are now trained for research activity and well-integrated in the team (e.g. both published articles as first authors). Besides local training, ensured by the senior scientists, the junior researchers benefited of several specialization stages abroad, in Belgium (2007, 2008), Spain (2009), Serbia (2011).

As a whole, the team is well trained for research in ruminant nutrition – the team leader has a rich international experience (2 post-docs in Belgium / France, is partner responsible in several FP projects, has rich international collaborations, etc.), Dr. Voicu has several specializations (France, Switzerland) and worked for many years in the field of ruminant nutrition, while the junior researchers already accumulated about 15 person-months trainings abroad.

In the considered period, the team members also underwent several joint research stages in Serbia, Slovakia, Belgium (base for common projects ideas, common articles, exchanging research methods, etc.) and participated to a large number of international events (project proposals preparation meetings, FP consortia meetings, pan-European workgroups meeting – e.g. within SCAR, etc.). The team concentrates the Romanian knowledge on physiology of ruminants nutrition (e.g. IBNA is the only Romanian unit performing research on fistulated animals).

Infrastructure

The infrastructure and methodology used by this team is unique in Romania: digestibility stands/cages for large/small ruminants, fistulated animals (cows/sheep), good analytical equipment: GC, HPLC (shared with the sister team), Dumas nitrogen analyzer, equipment for in vitro incubations, pH-meters, etc. Many of the research methods were acquired following interactions with international environment (projects, specialization stages, informal collaborations, etc).

Research subjects

The team is well connected both to the European Research Area and the Romanian animal production sector and is trying to compromise between European priorities (more advanced) and national priorities (more applied, deriving from the gap between Romania and EU15 in the field of agriculture). Based on the specific tool to collect research priorities, the team identified and worked within four main subjects:

a) **Rumen metabolism**. Within this subject, the team focused on producing new knowledge on the **nitrogen metabolism** (mechanisms, influence factors, ways to manipulate microbial protein synthesis, extent and **dynamics of rumen degradability**, quality of the **rumen by-pass**, nitrogen efficiency, etc.) and on **energy metabolism** (side effects of intensive feeding of ruminants such as

subacute rumen acidosis - better knowledge and ways of prevention; influencing fermentation pattern, efficiency of energy utilization, etc.)

b) Feed to food chain and quality of animal products. Animal nutrition is an effective tool to manipulate the quality of animal products. The team focused on one hand on improving the PUFA content of milk by including oils or oilseeds in cows' diets. In a recent collaboration with E1 team, influence of certain feeds on animal's immunity started to be investigated (collaboration within FP7 SOLID project and on a common article) and will be consolidated in the future, as the relationship nutrition-immunity is less studied in ruminants than in monogastric animals.

c) Refining feeding system for ruminants

The team is trying, within all research projects on ruminants, to keep updated the tables of nutritive values (with parameters such as efficiency of microbial protein synthesis allowed by nitrogen / energy, parameters describing the dynamic of degradability in rumen, etc.) and to refine the equations that compose the Romanian feeding system for ruminants. This is important, as the foreign feeding systems and tables of nutritive values do not automatically apply to Romania, in the case of ruminant (which massively use local feeds – in general badly characterized from nutritional point of view).

d) Novel feed resources within global changes. The global changes (climate change, trend toward use of renewable energy, globalization, socio-economic evolution, emergence of biotechnologies) strongly influence the feeding strategies for ruminants (nowadays and in the future). In this context, novel feeds are emerging on the Romanian and international feed market, new varieties of feeds are cultivated, etc; all these representing research opportunities that are matching research needs (identified via feed-back from farmers). This subject was addressed within several project during the evaluated period and will continue to be addressed (e.g. within WP3 of one of the new FP7 project (SOLID), where IBNA is project partner).

Projects

The team members ran 13 projects between 2007-2011 (beside the nucleus program), of which 5 were coordinated but the team members and 4 were international – mainly FP7 projects (as partner responsible). The most important of these projects were:

- **AZORUM** (national collaborative project, 2007-2010) - **Enhance nitrogen retention in ruminants by optimizing annual microbial protein synthesis**

The project focused on finding methods to manipulate microbial synthesis, with two targets: increasing the efficiency of the use of dietary nitrogen and, consequently, reducing the nitrogen wastes toward the environment. Microbial synthesis was assessed by dosing purine derivatives in urine, using a HPLC method. Three levers were assessed using specific trials and methods: i) ensuring appropriate substrate, micro-nutrients and rumen environment, ii) synchronizing the supplies and dynamics of dietary energy and nitrogen available in rumen, iii) a mixture of the previous. The later issued a new and marketable product - a compound feed receipt (PROTEOSTIM) allowing stimulation of rumen protein synthesis without significant increase of the costs.

- **PUFARUM** (national collaborative project, 2007-2008) - **Increase milk content of polyunsaturated fatty acids by feeding oleaginous feeds grown in Romania in dairy cows diets**

The project focused on the influence of four oilseeds (as whole seeds or as extracted oils), included in the diets of dairy cows, on the profile of polyunsaturated fatty acids in the milk and derived dairy products. It is important to underline that inclusion of oilseeds is a more appropriate method, for Romanian conditions, to manipulate milk PUFA. Significant increase of healthy PUFA profile was obtained, especially for linseed and rapeseed.

- **two nucleus projects** running consecutively (2007-2008, 2009-2011) **on sub-acute rumen acidosis (SARA)**

These projects focused on better understanding of mechanisms that modulates influence of various dietary factors on the postprandial dynamics of rumen pH. Research approach and methods included analysis of pH dynamics (using threshold related parameters) and were acquired during a previous post-doc stage of the team leader in France. These projects led to a better quantification of the effects of various factors (nature and dynamics of rumen availability of the energy source, effects of acidogenic or buffering factors, etc.) but also to development of new compound feeds receipts (marketable) and feeding recommendations (e.g. use of certain by-products to prevent SARA but maintain animals' performances.)

- FP7 SOLID project (2011-2016) - Sustainable Organic and Low-input Dairying, in which IBNA is the only partner from outside EU15

The leader of the E1 team is also the partner responsible in SOLID (E1 and E3 teams are also involved) and significant contribution is provided in WP1 (participatory research – including research stakeholders), WP2 (nutrition and welfare) and WP3 (novel feeds).

Other significant projects done mostly in this team are FP6 FeedSEG (2007-2009, support action project focusing on the dissemination of the results from EU-funded projects on feeds), FP7 Fed to Food (2008-2012, coordination action project), CEEEX 46 (2006-2007, a national support project dedicated to integration into ERA), a national project on traceability and quality of the milk production (via markers occurring in feeds), another project on sheep nutrition, etc.

Results

Researched activity performed through mentioned projects led to the publication of **one ISI article** (in Animal journal), publication of 14 articles in journals indexed in international databases (of which 10 as first authors) and to the participation in 15 national and international communications (mostly oral presentations). Besides, five new/improved products (compound feeds with specific action) were developed and disseminated toward field specialists from animal production sector.

Beside these, a constant and intense flux of technical information toward farmers, feed processor and processors of animal products was ensured via methods that are specific to direct technological transfer (lectures, on-farm demonstrations, mass-media interviews, articles in technical journals, etc.)

Perspectives

The team will develop the research on rumen metabolism, by addressing subjects such as the role of rumen within nutrition – animal immunity relationship (recent collaboration with E1 team), gut barrier physiology, etc. Also, research on novel feed resources will continue (within on-going but also in future projects) by addressing dynamics of rumen processes, use of feeds particularities (e.g. presence of plant secondary metabolites) within targeted feeding strategies, etc.

New equipment will be purchased, some are already planned (e.g. a new GC for analyzing fermentation gases, 12 digestibility cages for sheep) or set as target (a multipurpose HPLC - e.g. for analyzing purine derivatives or plant secondary metabolites). Also, team will continue to expand its portfolio of research methods, valorizing its intense international collaborations.

The team will continue to improve quality of its scientific output, by increasing the ratio between ISI articles and those published in IDB-indexed journals.

E5 team. Animal Nutrition and Biotechnologies (consisting of the Animal Nutrition and Biotechnology laboratory)

Team leader: Dr. Mihaela Habeanu

The team resulted from the natural merging of the staff of two laboratories Animal Nutrition and Biotechnology, in order to reach the critical mass. While Biotechnology laboratory kept administrative boundaries because of the legal and organizational aspects deriving from the recent

rehabilitation and functioning of the pilot station for biotechnological products (very successful among farmers) the activity of the two teams is closely related as the biotechnical products are to be assessed on all farm animal categories and species. Furthermore, the PhD thesis of the team leader, Dr. M. Habeanu, also approached use of biotechnological products in pig nutrition. The team leader recently returned from a specialisation stage in France and was deputy of the retired head of Animal Nutrition laboratory – this is a good opportunity for a fresh start.

The recent scientific research of the Animal Nutrition and Biotechnologies team is directed by the current challenges related to the synergies between feeding, biotechnologies and welfare. The team has a predominantly applied activity and runs extension activities strengthening the link between research and animal production (farmers agro-processors) focusing on the immediate on-farm implementation of the research outcomes.

Evolution of the research topics

The research topics of our team is complex and interdisciplinary; it exceeds the boundaries of a single field of knowledge by conduction studies on the plant-animal-product-human flow and makes connections between converging fields: biotechnologies-nutrition-animal welfare-animal and human health. The team aims to develop sustainable concepts which to maintain the efficiency while not making any compromises regarding animal health and welfare, product quality, food safety or the environment.

The main research directions of the team are:

- Develop feeding technologies for farm animals relying on the efficient conversion of domestic raw materials (ecological and conventional) into functional animal products;
- Isolation, purification, identification and selection of strains of lactic acid bacteria, not modified genetically
- Development of inoculum products as mono- and polyculture of selected strains of lactic acid bacteria
- Production and testing of biotechnological products (probiotics from selected strains of lactic acid bacteria) as alternatives to antibiotics and coccidiostatics, as growth promoters improving the immune system and alleviating the adverse environmental impact;
- Development of natural biological conservatives for ensiling with positive effects on forage quality and on milk production;
- Identification and characterization of new drought-resistant feed sources and their proper utilization;
- Efficientize animal production and improve animal welfare using innovative feeding technologies relying on the fundamentation of the minimal requirements and provision of higher animal welfare standards;
- Studies on the impact of feeding on animal health and welfare.

Over the past four years, the team run 8 national projects (4 as coordinating team and 4 as partner), 5 projects within the Nucleus Program and 4 contracts for product testing. The research project which the team won by competition brought a plus of knowledge by:

- Showing the qualitative interactions due to the transformation of the lipid nutrients along the forage-animal-human consumer flow and determining indicators of impact on human health; the studies aimed to identify new feeding solutions (Camelina oil) which improve meat composition due to their content of fatty acids. We certified the product NC FS OMEGA 3 and the studies were extended on 40 human patients with/without diabetes (25 women and 14 men) who were monitored clinically and biochemically for 30 days, while they consumed normal lipids meat (the experimental group), the effects on human health being beneficial;

- Feeding solutions to improve the lipid structure of the meat using Camelina meal resulting from the production of biofuel for planes, for the finishing animals;
- Improve the quality of silages made from plants which are difficult to ensile and their influence in milk production;
- Production of poultry products using new feeding formulations using ecological raw materials
- Scientific and technical support addressed to ensure high standards of animal welfare, based on Article 40 of Regulation (EC) no. 1698/2005 / (early stage);
- New natural alternatives with positive impact on poultry house environment: growth promoters made of polycultures with selected strains of lactic acid bacteria used for poultry feeding;
- Improve the feeding quality of the pig and poultry meat by using ecological feed ingredients with beneficial effects on consumer health;
- Improved use of sorghum grains for fattening steers as alternative to corn and barley in the non-irrigated fields from the droughty regions;

The research topics approached in 2007-2011 produced good results, such as:

- A **patent application** for the compound feed formulation using the ecological flax oil as source of n-3 fatty acids for finishing pigs;
- A **homologated product**: „NC FS OMEGA 3”;
- **Publications with impact**: 2 ISI articles, 6 books in our field; 21 papers with B rating + of which 13 in international databases, plus other articles, many of them within international collectives;
- **Natural biotechnological products (probiotics, biological preservatives)** used with beneficial effects by the animal producers;
- **4 contracts of technological transfer of the research outputs to animal producers**;
- **Alternative dietary energy and protein sources** (by-products such as corn gluten and distiller’s corn, Camelina meal and rapeseed meal, sorghum and some drought-resistant corn hybrids);
- **New dietary calcium sources** - dolomite.

Interdisciplinary initiatives

- Establishment of an interdisciplinary “Pole of excellence” on the feeding chain feed-animal-mean-human;
- Joint feeding-biotechnology actions: biotechnological products such as the growth promoters incorporated into compound feed formulations optimised by nutritionists and validated by animal trials, with beneficial effects on animal health and performance
- Synergy feeding-welfare-animal and human health (project started in November 2011);
- Feeding contributions, next to the genetic methods, to the preservation of Mangalitza pig breed in Romania. We studied two equally-important aspects: plant and animal: diet composition (improved quality) as feeding instrument improving the quality of lipids for Mangalitza pigs, as scientific support for the conservation of this endangered pig breed. Using the new **bio** technologies we consider essentially that this breed adapted to the conditions from our country and to the extensive rearing systems, is fed ecologically, with a diet balanced in nutrients allowing the expression of the genetic potential in terms of performance and furthermore, higher meat quality. These are arguments for the preservation of the valuable genetic potential of this breed, responding to the higher quality requirements of the consumer.

Evolution of the human resources

The team consists of a biotechnologist, 6 nutritionists and 3 technicians. Given the current challenges to provide answers to major issues such as sustainable development, food safety and security we developed a strategy for continuous betterment of the team members, for the professional promotion in acknowledgement of the individual contribution and for the inclusion of new members according to the financial possibilities. Thus, during the past 4 years, the human resources of the Animal Nutrition and Biotechnologies team was in a continuous evolution:

Trainings / staff specialisation:

Mihaela Habeanu

- Stage of 2 years (2007-2009) of post-doc training in France INRA / Theix on issues of lipid metabolism– fatty acids;
- Post-doc school for zootechnical diversity and food biotechnologies on the basis of bioeconomy necessary for ecosanogenesis;
- One month training at INRA / Theix – improve the ability to separate plasma lipid constituents by ultracentrifugation.

Georgeta Ciurescu – finishing PhD thesis: presentation in December 2011;

Anca Gheorghe – PhD student

Nicoleta Lefter – master student; enlist for PhD studies (2011); accepted for 6 months training stage with INRA (2012)

Recruiting / staff evolution: Mihaela Habeanu – CSII in 2010 / Voicu Dorica – CSII in 2010
Nicoleta Lefter – CS in 2011; one young graduate employed in 2011 (Uta Razvan)

4. REPRESENTATIVE PROJECT

The specificity of the Romanian financing system for agricultural research activity is that research is done through rather small, medium-term projects, won within erratic project competitions. Therefore, major research issues cannot be solved within a single projects and have to be addressed through several smaller projects (which can run simultaneously or consequently).

In this context, a representative project is the scientific part of the MAKIS project (described in Chapter 2.3.9); beside other objectives, it implied research activity within scientific directions agreed with Ministry of Agriculture and Rural Development, Academy of Agricultural and Forestry Sciences and World Bank experts, as part of the IBNA's contribution to MAKIS projects. From the financial point of view, while MAKIS project provided funds for equipment and buildings rehabilitation, the institute had to provide operational funds from scientific projects won within competitions.

Among others, MAKIS project included the orientation of the IBNA's research directions in order to better adapt to the European priorities, to increase the degree of integration into European Research Area and, what is relevant for this chapter, to adopt the model of FP projects in IBNA (consortia, appropriate identification of research needs/opportunity, merging basic and applied research, strong dissemination plan).

These scientific (agreed in 2006 and to be followed up to the end of the MAKIS project, in 2012) directions were grouped in three themes, of several objectives each:

Theme A: Enhance animal production competitiveness

Objective A1: Enhance farm productivity by improving the efficiency of animal feeding

Objective A2: Identification and characterization of new feed sources for animals

Objective A3: Improvement and harmonization of the feeding systems with the international database of knowledge

Objective A4: Fast assessment of the nutritive value of the feeds for animals

Theme B: Quality and safety of animal feeds and products

Objective B1: Decrease the incidence and impact of animal feeds contamination

Objective B2: Improve the biochemical characteristics and the quality of animal products

Objective B3: Improve the harvesting, conservation and processing of the forages and compound feeds in Romania

Objective B4: Evaluation of the alternative feeding solutions for animal production

Theme C: Development and promotion of sustainable farm animal production systems, observing EU requirements for environmental and animal protection

Theme C1: Development of natural replacers of the chemical additives

Theme C2: Development of biotechnologies for conservation and preservation which reduce the loss of nutrients and protect the quality of surface water bodies

Theme C3: Feeding solutions minimizing the impact of animal rearing activities

Theme C4: Development of sustainable management systems for animal production, protecting the genetic resources and promoting animal welfare

Of this, representative for IBNA's approach in performing research activity is **Theme B – Feed and food quality and safety**. This implied correlated actions in order to fulfil the objectives of the theme, which comprised:

- acquisition of appropriate equipment (e.g. dedicated GC, HPLC, semiautomatic system for proximal analysis, Dumas nitrogen analyser, safety microbiological cabinet, etc.) in order to complete the existing ones,
- improving / acquiring **new specific methods and standardize** the existing ones (ISO17025 accreditation in 2008),
- ensuring staff training, local and abroad (15 stages in France, Germany, Belgium, etc)
- a large number **international collaborations** on the subject, of which many led to formal partnerships, through projects: INRA Toulouse - France, EMONA - Slovenia, CENTIV GmbH - Germany, RTD - Austria, Aberystwyth University - UK, FINS – Serbia, universities from Greece, Turkey, etc.
- ensuring **continuous feed-back** from the potential beneficiaries of the research results (up to the inclusion on SMEs in the research projects)
- ensuring **operational costs** (personnel, consumables, overheads, etc.) from IBNA resources, through preparing a rich project proposals portfolio, participation with a high success rate within all kind of calls for proposals (national/international) and undergo a high number of financed projects

Thus, in 2007-2011, **32 projects** addressed the “**Feed and food quality and safety research**” theme. Focus was put on continuity, in order to ensure a constant flux of research activity and results within this theme. This included also the projects coordinated by IBNA (which means higher financial turnover, more activities), e.g. “**Omeganutriosan**” project (Contract no. 22/2005) and “**Nutrimocodim**” project (Contract no 52-122/2008). The first one ran between 2006-2008 and the second one between 2008-2011. Both included project partners performing within the ideas and work plans proposed by IBNA, used project-specific monitoring tools (S.M.A.R.T. objectives, deliverables, milestones, dissemination plan) and were well integrated into the national and European priorities. These successive projects are shortly described below:

Omeganutriosan, 2005-2008

Full title: Optimization of the nutritional factors for the production of ω : 3 polyunsaturated fatty acids-enriched egg, as new functional food for the Romanian market

Through the development of activities that were especially, of applied research, *The Consortium* assured, through a 32 months project, the scientific, logistical and informational support for the production, under quality and safety conditions, of eggs enrich in polyunsaturated ω -3 fatty acids, from hens reared in conventional systems. The project was related to the thematic of FP6 Priority 5 – FQS – thematic area 7: Feed impact on human health, and to the FP7 Thematic area 2: Food, agriculture and biotechnology the second direction *Farm to Fork – thematic: Society demands safer and healthier food*

The partners of the project were: 4 research institutes; 2 university research centres; 2 SMEs, and 2 trading companies well known on the market of eggs

Main Results:

- Procedure for the production of ω 3 polyunsaturated fatty acid linolenic acid-enriched eggs (minutes for technological transfer nr. 3559/27.06.2008 and 1398/27.06.2008 between IBNA Balotesti and SC AVICOLA SA Bucharest); eggs EUROU marketed by SC Avicola SA, co-financer of the project

- Technical documentation for the license of a CPVM Beneficiary: SC Avicola București SA - (minutes for technological transfer: 5912/21.11.2007)

- Modernization of the experimental basis

- Dissemination of results obtained was performed: (i) lectures at the university level given to students, (ii) seven articles in the country and abroad were published at the scientific community level (an abstract in World's Poultry Science Journal, 2008, vol. 64 , Supplement 1, pp. 109-110), (iii) at business level (Exhibition IndAgra of 12th, Bucharest, 7-11 November 2007; Exhibition EXPOAGROUTIL, in Mamaia 13-15 June 2008; questionnaires, leaflets)

Research of this project continued through a collaboration with a private partner from Slovenia, in the frame of Eureka collaborative projects, the tasks of the Romanian part are financed within **E! 5008 EGSE project: Eggshells processing and production of eggs with functional food properties. Activities within this project will focus on two areas: Technological Area (7.1.2 / Animal Selection/Production / Husbandry technology) and Market Area (7.3.4 / Food supplements/vitamins)**. Project consortium consists of three partners: Department of Research and Development of EMON Ljubljana, Slovenia (ERDC), SC Avicola Bucharest SA and National Research and Development Institute for Biology and Animal Nutrition, Balotesti. The three partners have established to undertake a research and development project (E! 5008 EGSE) in order to develop a technology for feeding laying hens, based on novel nutritional solutions to obtain eggs enriched in omega -3 vitamins (E, a, K, D, B complex) and minerals (Se, I, Zn). It is followed that the enrichment with vitamin E and selenium to prevent oxidation of omega-3 eggs during storage and also improve the body's antioxidant status of the consumer.

Nutrimicodim, 2008-2011

Full Title: “Ensure the security and quality of feed and animal products by new nutritional solutions to decrease the negative effect of *Fusarium* mycotoxins, natural contaminants of feed and food chain”.

The concept of “**Nutrimicodim**” project was to develop a comprehensive approach to reach a better **understanding of the effect** of some *Fusarium* mycotoxins, natural contaminants of the feed and food chain in EU and proposed **nutritional mitigating solutions** by investigating the decontaminating potential of some *symbionts* (including as probiotic *Rhodotorula rubra*- yeasts

strain with a complex structure- and **inulin** as prebiotic) in reducing the toxic effect of these mycotoxins. The project focused especially on zearalenone (ZEA) for which **no European limits of tolerance** are yet set for the feeds and few data on its effect on pig are reported. Therefore the project focused on pig, one of the great consumer of cereals and one of the species frequently exposed to intoxications with mycotoxins. It is also one of the most important animal farm species due to its production across and beyond Europe.

Two **complementary approaches** were used to evaluate the effect of ZEA and the mitigating capacity of the symbiotic additives: (i) an ***in vitro, cellular approach***, using two types of cells implicated in the systemic (blood lymphocytes) and local (**human-Caco-2** and **pig-IPEC-1** epithelial cells) host response. The new modern techniques for epithelial cells (transwell insert technique) allowed the simulation of the gut epithelium and ***in vitro exploration of the barrier functions***; (ii) an ***in vivo, integrated approach***, using trial on pig after weaning answering more practical questions.

The **strategic objective** of the project was **to strengthen the multidisciplinary and partnership** research at **Romanian national level** similar to the research work carried out within the **EU framework programs**; in the consortium of this project was involved three national research institutes: IBNA, INCD-Chemical and Pharmaceuticals and INCD V. Babes, an animal science university (USAMV Timisoara) an ONG (Biothenol Center) and a commercial society (SIAT).

The ***in vitro results*** showed that this toxin are able to alter the cellular (decrease in proliferation and cytokines synthesis, increase of O_2^- synthesis) and humoral (decrease of the IgG, IgA or IgM level) immune response in porcine blood cells (mono-and polymorphonuclear):

- **Marin DE, Taranu I, Burlacu R, Manda G, Motiu M, Neagoe I, Dragomir C, Stancu M, Calin L. 2011. Effect of zearalenone and its derivatives on porcine immune response. *Toxicol. In Vitro.* 25:1981-8;**
- **Marin D.E., Taranu I., Burlacu R., Tudor D.S. 2010. Effects of zearalenone and its derivatives on the innate immune response of swine. *Toxicon*, 56:956-963.**

The ***in vivo results*** (some of them undergoing) showed that ZEA at concentration indicated as tolerance limit in the **576/ 2006 EU recommendation** was able to alter some important biochemical and immunological parameters of pig and that symbiotic combination had the capacity to counteract some of the toxic effect of ZEA. Others analyses are undergoing. These results will be useful in the establishment of a tolerance limit for ZEA in feed for weaned pig.

The researches which have been displayed in this project will be continued within recently won/financed project – „**Ideas 101**” / **2011-2014** (Studying the toxicity of zearalenone, natural contaminant of food using tools of nanotechnology) which will focus on **in-depth investigation** at the cellular level.