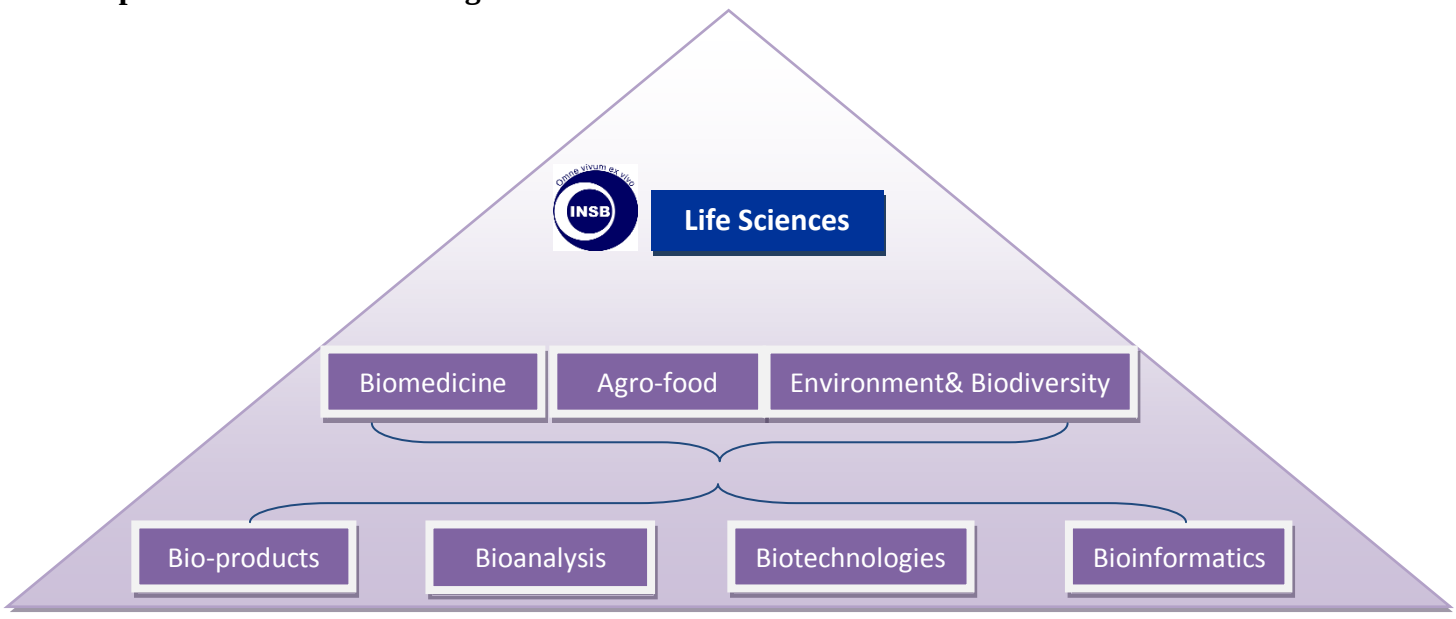
NATIONAL INSTITUTE of RESEARCH AND DEVELOPMENT FOR BIOLOGICAL SCIENCES, BUCHAREST

Institute Mission

National Institute of Research and Development for Biological Sciences, INSB, was created in 1996[1] as a National Research & Development Institute having as core activity **fundamental and applied scientific research, innovation and technological development in the life sciences field aiming to contribute to the knowledge of life based processes**. **INSB** is a Romanian legal entity coordinated by Ministry of National Education, the head-quarter being in Bucharest. The institute has 2 branches: Biological Research Institute, Cluj Napoca and Biological Research Institute Iaşi and 1 subsidiary: Biological Research Centre „Stejarul" Piatra Neamţ highly inter-connected by complementary activities in the core subject, namely life sciences.

Scientific objectives and research directions

INSB is performing its activity in the three main research directions on the base of existing experience, competencies and structured research teams: **biomedicine, environment and biodiversity and agro-food**. All these back-bone directions are sustained by a horizontally structure which supports and correlates with all three main directions and which consists of **bioanalysis, bioinformatics, bioproducts and biotechnologies**.

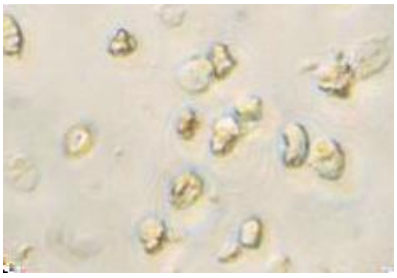


[1] INSB was established by G.D. 1317/ 11.12.1996, by reorganisation of Development Biology Institute, Bucharest and its merger with Biological Research Institute, Cluj Napoca, Biological research Institute Iasi and "Stejarul" Biological Research Centre , Piatra Neamt. In 2002, INSB absorbed the National research Institute for Biotehchnology (G.D. 1272/13 Nov. 2002). INSB last accreditation occured in 2008, by Decision 9688 / 30.06.2008

It has to be mentioned that the institutes R&D three main directions and the supporting four horizontal **ones are perfectly fitting into the Europe Horizon 2020 key priority 3**, Societal Challenges**.** The Societal Challenges priority **aims to bring together resources and knowledge across different fields, technologies and disciplines, covering the activities from research to market. Some focused challenges in this key priority 3 can be mentioned: *Health, demographic change and wellbeing* (INSB** is addressing by bio-medicine direction and supported by bioanalysis, biotechnologies, bioproducts and bioinformatics***); Climate action, resource efficiency and raw materials (*INSB** is addressing d by environment and biodiversity direction and supported by the same four ensuring the horizontal complementarity***); Food security, sustainable agriculture, marine and maritime research and the bio-economy (*INSB** is addressing by agro-food direction and again supported by the other four).

Based on the fact that success depends on building top research teams in the main research area able not only to undertake forefront science but also to apply advanced mechanisms and instruments and to identify innovative solutions in order to provide a better understanding of biological mechanisms in life science INSB is actively involved not only in developing knowledge but even in transferring the acquired knowledge, technologies and know-how toward a variety of stakeholders covering scientific, educational and socio-economic interests and ensuring the appropriate consultancy and training, equally involved in national and international networking.

In the **Biomedicine field** the institute is involved in fundamental researches based not only on cellular and molecular biology but on multi-disciplinary researches, leading to results applicable in the development of new products and new medical biotechnologies which are, at the project completion, transferred toward interested stakeholders.
An example of such complex project comprehending fundamental and applied research and human resources formation is the POS-CCE project, priority axis 2 – Research, Technological Development and Innovation for Competitiveness, BIOREGMED **Biotechnological center for cell-therapy and regenerative medicine based on stem cells and apoptosis modulators.** The project idea is related to an important area in the field of cell-based therapies and tissue engineering, namely the regeneration of functional hyaline cartilage, using expanded chondrocytes and biodegradable polymers cartilage as solution for cartilage reconstruction.
Project specific objectives envisaged the development of new solutions for biotechnologies and biomaterials for cartilage cell-therapy, which will be transferred and further implemented in the production field by a medical biotechnology laboratory (SME) and which are the subject of new patents; increasing the research capacity of INSB, modernising and developing the institute infrastructure by creating a formation centre for new specialists in cellular biotechnology; stimulating the technological transfer based on the cooperation between INCDSB and enterprises by generating results directly applicable in economy; attracting and specialization of young researchers for cell therapy and regenerative medicine and thus create new jobs for young graduates, PhD students and postdocs. It is aimed, equally the further use of this centre of excellence in solving other problems of regenerative medicine, stem cell-based and modular cell apoptosis.
Obtained results were oriented toward:



a. Innovation and knowledge transfer: the design and synthesis of tridimensional, implantable, mechanically stable, biocompatible and biodegradable structures, which will allow adhesion, proliferation, and preservation of the specific cell properties; the use of unconventional biotechnologies to obtain matrix components(type I and II collagen, GAG, hyaluronic acid) for synthesis of biomaterials with specific composition, structure and functionality characteristics; the developing of experimental models to realize a complex for cartilaginous transplantation based on collagen bio-products and *"in vitro"* cultivated chondrocytes; embedded biologically active substances in the newly obtained supports in order to facilitate cell- matrix interactions and ensure, when implanted, the filling of the empty space from the altered cartilage since the mesenchymal cells do not have the capacity of populating these empty spaces.

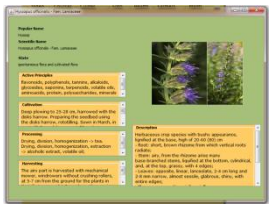
b. Scientific publications

In the **Agro-food field** the institute is involved not only in fundamental researches concerning plant physiology, composition and variability but even in applied researches dealing with plant cultivation technologies/biotechnologies, evaluating the active biological compounds and development of new, stable formulas of active compounds to be used as supplements. Development of new, modern, reliable analytical tools applicable in assessment of active compounds characteristics and efficacies and in bio-processes control is another research area in this field.

An example of an important project, based on multi- and interdisciplinary approach is **MedPlaNet, Medicinal plant network for enhancement of the comparative advantage of Calarasi-Silistra cross border area MedPlaNet**, a project implemented using ERDF funds, within the cross border cooperation program Romania-Bulgaria 2007-2013. MedPlaNet was implemented in partnership with two national institutes from Bucharest (INMA and ICCF) and with two entities from Bulgaria (ARCI-Silistra and New Century), having as implementing area the Calarasi-Silistra cross border region.

Project main objective was to create a support by providing the scientific basis for economic and social development of the area using the potential of medicinal, aromatic plants and natural products in developing new business. **Specific objectives of the project** dealt with realisation of an inventory of medicinal and aromatic plants, technologies and soil characteristics; phyto-chemical analysis of medicinal plants in the area; assessing the health status of the population in the area; comparative analysis of the technologies used to cultivate medicinal plants; support in developing a new marketing strategy.

Obtained results addressed:



a. Innovation and technology/know-how transfer: data-base with information about plants (composition screening; new extracts formulation technologies and applicability as supplements) and about potential farmers and processors in the region; two technologies regarding pilot cultures of medicinal and aromatic plants;

b. Public /socio-economic interest: Realization of two information centers in the Calarasi and Silistra cross-border area (providing information on cultivation technologies and medicinal plants processing); increasing of the awareness and involvement of local authorities on plant cultivation economical and sustainable development opportunities (through conferences, courses and meetings on including the cultivation and processing of medicinal plants in regional development strategies).

Another example proving that the multi-disciplinary approach of research issues is a definition of INSB R&D activity is **FP7 project**, KBBE-Research for SME benefit, **Sensbiosyn, Biosensors and Sensors for the industrial biosynthesis process of widely used commercial antioxidants: nutraceuticals as additives for food and aquaculture promoting public health and safety.** In this project INSB participated as RTD in a consortium formed by Biosensors SRL (Italy), Algatechnologies (Israel), Nanosens (Netherlands), National Council of Research (Italy), Ben-Gurion University (Israel).

Project main objective was to develop sensors and biosensors for on-line monitoring growth parameters of algal biomass and their bioactive compounds produced by large scale systems, with a particular focus on a group of relevant industrial processes - recently settled up - for the natural synthesis of antioxidant Xanthophylls. The specific targeted xanthophyll was astaxanthin, produced on large, industrial scale by Algatechnologies- SMEs partner in consortium, the main world provider of astaxanthin for fisheries and aquaculture. INSB specific objectives were the development of two electrochemical sensors to assess astaxanthin content and its efficiency as active compound, and ensuring support to validate all developed sensors/biosensors.

Obtained results addressed:

a. Innovation, development of competitive products and transfer toward SMEs.

Four single sensors were specifically developed and implemented in technological lines for the addressed Astaxanthin bioprocess in the tubular photobioreactor: 1) Optical sensor to measure the fluorescence emitted by chlorophyll inside the *Haematococcus pluvialis* cells in culture medium; 2) Optical sensor to measure the density of the *H. pluvialis* cells culture medium through a light transmission measurement which is linearly correlated to the Dry Weight (DW) used for the final determination of produced astaxanthin; 3) Electrochemical biosensor to measure the antioxidant potential of astaxanthin by measuring the decrease of the amperometric current generated by lipid peroxidation in the presence of astaxanthin, since astaxanthin is able to reduce oxidative stress. 4) Electrochemical biosensor to measure the astaxanthin concentration by measuring the output current of a NanowireFET (Field Effect Transistor) whose nanowire channel is deposited with PSII biomolecules. An integrated measuring device for simultaneous determination of astaxanthin amount and its efficacy was delivered.

b. Scientific publications

In **Environment & Biodiversity** field, the institute is involved in sustainable development and sustainable resource utilization; structure, functionality and productivity of ecosystems: taxonomy, ecology, eco-toxicology, molecular taxonomy and syn-taxonomy of species in the Romanian territory;

auto-ecology and natural ecosystem functionality, assessment of ecological risk factors affecting habitats.

Based on the experience in the Life Sciences field, ecosystem assessment and biodiversity INCDSB, within a Romanian consortium, is the responsible for this research area for the major project regarding the creation and development of **Danube International Centre of Advanced Studies for river-delta-sea systems**, project assumed by Ministry of Education and currently supported by an sectoral programme, to be implemented between 2013-2014. The Centre, which is included in regional development strategies- European Union Strategy for Danube Region, and in national research and development strategy, brings a new paradigm in order to provide inter- and multidisciplinary research solutions that encompass the entire river-mouth-sea macrosystem. The structure of the centre comprises three pillars - Life Sciences, Geonomic Sciences and Socio-Economic Sciences. All three pillars are thought to be permanently interlinked and to provide a multidisciplinary and integrative scientific environment. The Centre research activity will be based on a holistic approach, with a concern to identify and promote measures to ensure regional sustainability, balancing environmental protection and socioeconomic development in an optimal manner. The Centre will function as a Hub having nodes in all important research infrastructures, universities and centres from Europe and world-wide, the links between nodes being established on the basis of approached research issue.

The immediate result expected at the completion of sectoral programme will be the completed documentation to apply for International Centre as an ESFRI centre.

In the same field of environment, climate changes and assessment of its impact on biodiversity the study of the subalpine/alpine areas of the Carpathians vegetation has brought to INSB ICB Cluj Branch teams the recognition among European scientists and thus participation in few major projects with main focus on this topic, funded through Framework Programmes of the EU.

An example is the FP6 project, Ecochange, **Challenges in assessing and forecasting biodiversity and ecosystem changes in Europe.**

Main goal of the project was to provide data, scenarios and associated confidence limits so that policy makers and land managers can use them for anticipating societal problems and for designing sustainable conservation strategies by accounting the most likely global change effects on biodiversity and ecosystems.

Obtained results envisaged one of the first steps in understanding the dynamics of the subalpine/alpine vegetation focussing on Carpathians by gathering data on floristic diversity, as the raw material in creating vegetation maps. The outcome was the development of a consistent database for the Romanian Carpathians that includes data on species richness, distribution, different taxon-specific characteristics, genetic centres, etc.