

a Ghent University consortium

[home](#)

- [home](#)
- [objectives](#)
- [consortium members](#)
- [activities & events](#)
- [resources](#)
- [contact](#)

UGent Aquaculture R&D Consortium

Aquaculture is the world's fastest growing food producing sector with an annual growth exceeding 10% for the last 2 decades. Recently the share of cultured fish in the global seafood production has exceeded 50%. In view of the stagnating (or declining) fishery landings, the importance of aquaculture production is bound to further increase. The aquaculture industry faces tremendous commercial and socio-economic opportunities but also challenges for the sustainable development of this sector.

Aquaculture research at Ghent University dates back to early seventies with research on the brine shrimp *Artemia* and its crucial role as live food organism in the larval culture of the main cultured marine fish and shellfish. Since the *Artemia* Reference Center's establishment in 1978, this center has continuously sought to develop multidisciplinary research with various other departments on a wide range of topics such as microbiology, analytical chemistry, pathology, histology, nutritional studies, socio-economic aspects of development cooperation, ecology, food safety and food security.

At present 15 departments from 3 faculties are involved in aquaculture related research, education or development cooperation. This has yielded a long list of [joint A1 publications](#) and ongoing or finished PhD studies. This group of research units have grouped into this consortium in order to strengthen mutual objectives.

OBJECTIVES

The UGent Aquaculture R&D Consortium was established to:

- Coordinate and increase research cooperation between its members
- Increase the visibility and attractiveness for prospective postgraduate students and PhD students
- Support the valorisation of new developments with potential for commercial applications
- Strengthen the identity of the research group as a project partner

CONSORTIUM MEMBERS

The UGent Aquaculture R&D Consortium brings together 17 research groups from 3 different faculties.

- **Faculty of Bioscience Engineering**
 - Animal Production - Aquaculture (P. Sorgeloos and P. Bossier)
 - Biochemical and Microbial Technology (Willy Verstraete and Nico Boon)
 - Agriculture Economics (Jacques Viaene, Wim Verbeke and X. Gellynck)
 - Food Safety and Food Quality (Frank Devlieghere and John Van Camp)
 - Applied Ecology and Environmental Biology (Colin Janssen)
 - Crop Protection (Patrick De Clercq)
 - Organic Chemistry (Jo Dewulf)
 - Applied Analytical and Physical Chemistry (Paul Van Der Meeren)
- **Faculty of Veterinary Medicine**
 - Pathology, Bacteriology and Poultry Diseases (K. Hermans, A. Decostere and F. Pasman)
 - Virology, Parasitology and Immunology (Hans Nauwynck)
 - Morphology (Wim Van den Broeck)
- **Faculty of Sciences**
 - Biochemistry, Physiology and Microbiology (Geert Huys and P. De Vos)
 - Biology (Marine biology) (Magda Vincx)
 - Biology - Evolutionary Morphology of Vertebrates (Dominique Adriaens)
 - Biology - Vertebrate Morphology & Developmental Biology (Ann Huysseune)
 - Biology - Protistology & Aquatic Ecology (Wim Vyverman)
 - Molecular Genetics (Dirk Inzé)

UGent Aquaculture R&D Consortium

Faculty of Bioscience Engineering

- Animal Production - P. Sorgeloos and P. Bossier
- Biochemical and Microbial Technology - W. Verstraete and N. Boon
- Agriculture Economics - J. Viaene, W. Verbeke and X. Gellynck
- Food Safety and Food Quality - J. Debevere, F. Devlieghere and J. Van Camp
- Applied Ecology and Environmental Biology - N. De Pauw and C. Janssen
- Crop Protection - P. De Clercq
- Organic Chemistry - J. Dewulf
- Applied Analytical and Physical Chemistry - P. Van Der Meeren

Faculty of Veterinary Medicine

- Pathology, Bacteriology and Poultry Diseases - K. Hermans, A. Decostere and F. Pasmans
- Virology, Parasitology and Immunology - H. Nauwynck
- Morphology - W. Van den Broeck

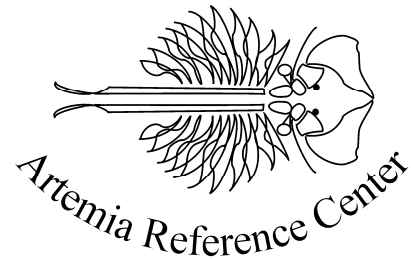
Faculty of Sciences

- Biochemistry, Physiology and Microbiology - P. Vandamme and P. De Vos
- Biology - Marine biology (M. Vincx)
- Biology - Evolutionary Morphology of Vertebrates (Dominique Adriaens)
- Biology - Vertebrate Morphology & Developmental Biology (Ann Huysseune)
- Biology - Protistology & Aquatic Ecology (Wim Vyverman)
- Molecular Genetics - D. Inzé

Laboratory of Aquaculture & Artemia Reference Center
Faculty of Bioscience Engineering
Department of Animal Production

Scientific personnel

- Patrick Sorgeloos
- Peter Bossier
- Gilbert Van Stappen
- Jean Dhont
- Kristof Dierckens
- Bart Van Delsen
- Marijke Van Speybroeck
- Mathieu Wille
- 10 to 20 PhD students (resident or sandwich type)



Activities

Since 1978 the Laboratory of Aquaculture & Artemia Reference Center (ARC) has been involved in research on larviculture of fish and shellfish species of aquaculture interest. Initially, the main research effort focussed on the universally used brine shrimp *Artemia* as vital food source for fish and shellfish larvae, namely: brine shrimp culturing biology, natural occurrence, production techniques, strain characterisation, nutritional value and enrichment. Gradually, research activities extended into the other live food organisms, micro algae and rotifers, *i.e.* their production and nutritional manipulation, with main emphasis on lipids and vitamins C and E. Meanwhile, the worldwide industrialisation of larviculture demanded more thorough research on the zootechnical, microbiological and immunological aspects of larviculture. Therefore, the ARC engaged in a multidisciplinary collaboration effort with specialists from different research institutes, local and abroad, in the framework of nationally and internationally funded R&D projects.

The ARC organises a 2-year postgraduate programme "Master of Science in Aquaculture". It was launched in 1991 in collaboration with different partners of the UGent Aquaculture R&D Center together with colleagues of the Belgian Universities of Leuven and Antwerp and Wageningen University (The Netherlands). So far, Ghent University delivered over 170 graduates from more than 30 countries in Europe, Africa, Asia and the Americas. Since 2004, this Belgian-Dutch postgraduate collaboration has been extended to the Universities of Algarve (Portugal), Bergen (Norway), Cork (Ireland), Trondheim (Norway) and Warmia & Mazury (Poland), offering students the possibility to study at least one semester at one of the six partner universities. Since 1985 over 40 PhD graduates/students from 14 countries in Europe, Africa, Asia and the Americas studied/study at ARC often under co-promotorship of colleagues from UGent or abroad.

The educational activities benefit from a European thematic network on higher education in aquaculture,

fisheries and aquatic resource management "AquaTNet" that is coordinated by the ARC.

The ASEM Aquaculture Platform, set up in 2003 to enhance dialogue and interaction between Asia and Europe, is also coordinated by the ARC.

The ARC has organised 2 Artemia symposia (Corpus Christi, 1979 and Antwerp, 1985) and 4 Fish & Shellfish Larviculture Conferences in Ghent (1991, 1995, 2001 and 2005).

It's spin-of company "Artemia Systems NV" (established in 1983) was taken over by INVE Aquaculture NV in 1991. The latter is now a leading aquaculture feed company with branches in many countries in Europe, Asia & the Americas.

The major topics of research performed in collaboration with partners of the UGent Aquaculture R&D Center are:

- Artemia culturing biology and strain characterisation
- husbandry and nutrition of fish and crustacean broodstock
- live food production and nutritional manipulation for fish and shellfish larvae
- analysis of microbial communities; quorum sensing (focusing on Vibrio); microbial bioflocs as feed in aquaculture
- gnotobiotic culture of Artemia, Brachionus and sea bass larvae
- gastrointestinal development in larvae
- development of alternative technique for disease prevention (probiotics, prebiotics, immunostimulants, environmental stress)
- pathology of WSSV in Penaeid shrimp
- morphological development of larvae
- transcriptome analysis in Artemia and fish larvae

Contact

Websites

<http://www.aquaculture.ugent.be>

<http://www.asemaquaculture.org>

<http://www.maqfish.com>

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Laboratory of Microbial Ecology and Technology
Faculty of Bioscience Engineering
Department of Biochemical and Microbial Technology

Scientific personnel

- Willy Verstraete
- Nico Boon
- Tom Van de Wiele
- Tom Defoirdt
- Sam Possemiers
- 25 PhD students



Activities

The LABORATORY OF MICROBIAL ECOLOGY AND TECHNOLOGY (LabMET) is a part of the Faculty of Bioscience Engineering, Ghent University. LabMET has focussed for almost 30 years on one central theme: the functioning of microbial communities. Efforts have concentrated on unravelling the microbial communities occurring in waste treatment technologies in soils and waters. LabMET has a staff of 2 Teaching Professors, 7 Post-doctoral collaborators, 25 PhD- and 20 masters students involved in research. LabMET has a well-established record of giving rise to industrial spin-offs. Some firms that are cooperating with LabMET are e.g. Avecom, Biotim, Epas, OWS and Proviron. Several other environmental actors have been inspired by developments at LabMET. The research group publishes 30-35 papers in double-refereed journals per year.

LabMET Vision: mixtures of micro-organisms can interact as communities. Each species in such a community represents a functional biological entity with numerous capabilities. The assemblage of these entities represents, when properly organized, a powerful resource. LabMET focuses on the optimal management of these microbial resources in various open non-contained systems such as soils, waters, gastro-intestinal systems

The vision of LabMET is that MICROBIAL RESOURCE MANAGEMENT - MRM - enables to:

- generate new products and processes
- improve human and environmental health
- assure environmental sustainability

In the domain of aquaculture LabMET investigates biological nitrification and denitrification processes by using specialised nitrifying inocula and dialysis reactors. Probiotic consortia and quorum sensing disruption strategies are used for the abatement of aquatic pathogens. Biologically produced nanosilver has been developed for water disinfection and has bactericidal and algaecidal properties. Mixed microbial communities in bioflocs are produced as aquaculture feed, containing high valued biomass, containing e.g.

fatty acids, PHA, proteins, vitamins, probiotics, ... A close scientific collaboration between LabMET and ARC exists more than 10 years by common research projects (FWO).

LabMET is fully equipped to operate different reactor types (SBR, biofilm-, dialysis-, membranereactors, etc.) and to perform standard microbial and chemical analysis (HPLC, GC, IC, ...). Moreover, LabMET has a microbial ecology group to investigate microbial community dynamics and composition by state-of-the-art molecular techniques (PCR-DGGE, real-time PCR, clone library construction, Fluorescent in situ Hybridisation and flow cytometry). These techniques have been frequently applied to monitor the microbial communities in aquaculture systems.

Contact

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Agro-food Marketing and Consumer Behaviour

Faculty of Bioscience Engineering

Department of Agricultural Economics

Scientific personnel

- Jacques Viaene (agricultural economics, extension and sociology)
- Guido Van Huylenbroeck (farm management, agricultural policy and environmental economics)
- Wim Verbeke (agro-food marketing and consumer behaviour)
- Luc D'Haese (agricultural economics of developing countries and rural development)
- Xavier Gellynck (agro-food marketing, business-to-business and chain management)
- 4 postdoctoral researchers
- 25 research assistants and PhD researchers

Activities

The research at the department of agricultural economics can be divided in three core disciplines relating to marketing of agricultural and food products, agricultural policy and rural development, and agricultural economics in developing countries. Within the discipline of marketing of agricultural and food products, major research disciplines are consumer behaviour, price-determination factors, international marketing, product development, direct marketing of farm products, quality and chain management and the efficiency of promotion campaigns for agricultural and food products. Specific attention is paid to: consumer acceptance of primary production methods and end products, issues relating to competitiveness at sectorial and private business level, cost-benefit analyses, and economic issues relating to innovation in food production and processing.

Within the research discipline of agricultural policy and rural development, issues of investigation pertain to sustainable production, organic production, organization of environmentally friendly food chains, food product labeling, multifunctionality, agriculture in urbanized areas and the effects of environmental policy measures. This research field focuses mainly on the relation and interactions between the farm and the political and rural environment and the consequences of these external interactions for the management of the farm. Research topics are amongst others the influence of the Common Agricultural Policy, the farm economy and structural impacts of environment and zoning policies, the possibilities for diversification in the agrarian sector, rural policy and rural development, with the focus on "sustainability".

With respect to LDC's, research is conducted about the efficiency of rural development projects, farming systems, co-operatives and international trade. Issues of particular interest pertain to the analysis of poverty reduction policies and water management and allocation issues in agricultural production in developing countries.

Although most of the aforementioned activities have historically concentrated on problems facing

agricultural production, including crop and terrestrial livestock production, the scope has gradually extended into problems facing fisheries and aquaculture production as well.

Most particularly, research has been performed recently with respect to management practices in aquaculture production, as well as to issues relating to consumer acceptance of seafood production and products have occupied a prominent position within the discipline of food consumer science. The department is actively involved in the EC Sixth Framework Programme Integrated Project SEAFOODplus and the Coordination Action CONSENSUS. Besides involvement in these international consortia focusing mainly on research, the department of agricultural economics is also involved in the EC Thematic Network AQUA-TNET.

The SEAFOODplus project is a joint research project including about 70 partners from 16 countries that aims at reducing health problems and increasing the well-being among European consumers by applying the benefits obtained from consumption of health promoting and safe seafood products of high eating quality. The department of agricultural economics is involved in the consumer issues pillar, and is responsible for the research project on seafood information and communication. This entails research activities related to consumer perception of seafood products (among others, farmed versus wild fish), consumer need for information about seafood, and consumer interest in seafood traceability.

The main aim of CONSENSUS is to ensure that sustainability becomes normal practice in the aquaculture industry in terms of the environment, social contribution and economic success into the future. Another major role of CONSENSUS is to demonstrate to consumers the health benefits of eating fish and shellfish grown in sustainable conditions. The latter is where the department of agricultural economics fits in. Our involvement mainly pertains to the consumer issues, more specifically developing and testing information messages designed to inform consumers about the true sustainability characteristics of aquaculture production in Europe.

Contact

Websites

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Food Chemistry and Human Nutrition
Faculty of Bioscience Engineering
Department of Food Safety and Food Quality

Scientific personnel

- John Van Camp
- Bruno De Meulenaer
- Patrick Kolsteren
- 15 to 20 PhD students (resident or sandwich type)

Activities

All activities in our unit are related to the nutritional value and the chemical safety of food products, and their relationship to human health. We have interest in analysing the content and bioactivity of new bioactive compounds and contaminants in food products. We have access to facilities to quantify bioactive components in foods (HPLC, GC, ELISA), as well as to appropriate techniques to measure *in vitro* bioactivity of these components (e.g. cell cultures). We also have a strong interest in food epidemiology and development of risk-benefit models in human nutrition. There is a close collaboration with the other laboratories within the department, as well as with more (bio)medical groups like the Child Health and Nutrition Unit in the Tropical Institute of Medicine, Antwerp, and the Department of Public health, Faculty of Medicine and Health Sciences, UGent.

Our unit participates in courses of food chemistry, human nutrition, functional foods, food and nutrition epidemiology, nutrition disorders, and nutrition planning, for Bachelor and Master students in Bio-Science Engineering, as well as for students in the international courses Rural Development and Nutrition, and Food Technology.

The following research topics are covered :

- 1) measuring the nutritional value and chemical safety of food products: e.g. vitamins, trace elements, phytochemicals, mycotoxins
- 2) evaluating the chemical safety of food products: mycotoxins, furan, acrylamide, PCB's, residues packaging materials
- 3) improving the bioavailability and the density of nutrients in foods: iron, zink, antinutritional factors (phytates, tannins)
- 4) evaluating new emerging bio-active components in foods: ACE-inhibitory peptides derived from food proteins, nutritional minor components derived from the milk fat globule membrane, antioxidative components (phenolic acids, polyphenols) in vegetable foods
- 5) evaluating food consumption and risk-benefit models in human nutrition (fish consumption, biological agriculture)

Contact

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Department of Pathology, Bacteriology and Poultry Diseases Faculty of Veterinary Medicine

Scientific personnel

- Freddy Haesebrouck
- Richard Ducatelle
- Koen Chiers
- Katleen Hermans
- An Martel
- Frank Pasmans
- 3 visiting professors: Annemie Decostere, Patrick Butaye, Peter De Herdt
- About 30 PhD students and postdoctoral researchers

Activities

The main research expertise of the Department of Pathology, Bacteriology and Poultry Diseases is focused on bacteria-host interactions, bacterial zoonoses and antimicrobial resistance in bacteria from domestic animals. The group has more than 10 years of expertise in the field of aquaculture, studying the pathogenesis of *Flavobacterium* and *Yersinia* infections in several fish species. Studies focus on the development of *in vitro* and *in vivo* models, which allow in-depth study of the mechanisms used by bacteria to cause clinical disease in fish. For this research, the following facilities are available: 1) L2 microbiology laboratory 2) extensive cell culture lab 3) molecular lab (PCR, sequencing) 4) proteomics unit 5) histopathology laboratory including microscopy and confocal scanning microscopy 6) veterinary facilities for exotic companion animals including piscine surgery and anesthesia and 7) A2 animalaria, equipped for working with freshwater fish (including trout) and complying with all biosafety guidelines.

The major topics of research performed in collaboration with partners of the UGent Aquaculture R&D Center are:

- *Yersinia* infections in fish
- *Flavobacterium* infections in fish
- *Edwardsiella* infections in fish

Contact

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Laboratory of Virology
Faculty of Veterinary Medicine
Department of Virology, Parasitology and Immunology

Scientific personnel

- Hans Nauwynck
- Kristien Van Reeth
- Herman Favoreel
- Maurice Pensaert (emeritus)
- Peter Delputte
- 20 PhD students

Activities

The Laboratory of Virology is managed by three persons: Prof. Hans Nauwynck (director), Prof. Kristien Van Reeth and Prof. Herman Favoreel. Together with a group of 40 enthusiastic coworkers they are performing research on different aspects of viral diseases in several animal species (pig, horse, cat, mouse, turkey and shrimp). Some viruses and animal species are used as a model for man. The most important research topics are:

- how do viruses cause disease in animals
- how do viruses escape from immunity
- synergistic effects between viruses and bacteria
- effects of viruses on the unborn animal (embryo and fetus)
- epidemiological studies
- development of new vaccines and antiviral drugs for the control of viral diseases in animals

For these studies, we use traditional methods (virus titration on cell cultures, detection of infected cells by immunological staining techniques, ...) as well as the most advanced cell biological and molecular techniques (genetic engineering, protein- and sugar analyses, live cell imaging, ...) .

Furthermore, the Laboratory of Virology is specialised in the diagnosis of viral diseases in domestic animals and in advising veterinarians on the control of viral problems.

Contact

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Department of Morphology
Faculty of Veterinary Medicine

Scientific personnel

- Paul Simoens
- Wim Van den Broeck
- 10 PhD students and scientific co-workers

Activities

The main research expertise of the Department of Morphology is focused on the functional morphology of the lymphoid and vascular systems in domestic animals. Very recently, the group started a collaboration with the UGent Aquaculture R&D Center, studying the development of *Artemia* and sea bass (*Dicentrarchus labrax*) larvae, reared in xenic and axenic conditions. This model allows in-depth study of the influence of probiotics on the development of *Artemia* and sea bass larvae. For this research, the following facilities are available: 1) light microscopy unit (histology laboratory for tissue processing, embedding and making paraffin sections; immunohistochemical analysis; different research microscopes), 2) transmission electron microscopy (TEM) unit (TEM laboratory for tissue processing, embedding and making ultra thin plastic sections), 3) scanning electron microscopy (SEM) unit (SEM laboratory for critical point drying and coating of tissues, SEM microscope), 4) software for image analysis and 3-D reconstruction.

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Laboratory of Microbiology
Faculty of Sciences
Department of Physiology, Biochemistry and Microbiology

Scientific personnel

- Paul De Vos
- Peter Vandamme
- Anne Wilems
- Danielle Janssens
- Geert Huys
- Dirk Gevers
- Rieka Reekmans
- Stefanie Van Trappen
- 10 to 15 PhD students (resident or affiliated)

Activities

Since the introduction of molecular techniques in bacterial taxonomy in the 1960s, the Laboratory of Microbiology of the Faculty of Sciences of UGent (LM-UGent) has steadily found its place among the expert labs in classification, identification, typing and detection of various bacterial groups. Through its wide expertise in bacterial systematics and microbial ecotaxonomy, research at LM-UGent involves a range of different bacterial groups:

- lactic acid bacteria involved in fermentation and spoilage of various foods or used as probiotics
- *Bacillus* and *Pseudomonas* as contaminants or pathogens in food (incl. crop) production
- human pathogens and opportunists (incl. *Campylobacter*, *Burkholderia* and *Helicobacter*)
- **pathogens and indicators of antibiotic resistance in aquaculture**
- human and animal intestinal flora with emphasis on *Bifidobacterium* and *Lactobacillus*
- nitrogen-fixing bacteria (incl. *Rhizobium* and related groups)

Research in the field of aquaculture was introduced in LM-UGent by Prof. em. Jean Swings in the early 1990s and initially concentrated on isolation and identification of pathogenic vibrios using conventional biochemical approaches. With the introduction of DNA fingerprinting techniques such as Amplified Fragment Length Polymorphism (AFLP) and 16S rRNA gene sequencing, this line of research gradually extended to other relevant groups such as *Aeromonas* and *Photobacterium*. Combined with DNA-DNA hybridizations as golden standard for species delineation, this research has resulted in the description of numerous new species mainly belonging to the genus *Vibrio*. Later, aquaculture research at LM-UGent also focussed on other aspects including molecular ecology of antibiotic resistance in aquaculture environments and the bacterial characterization of commercial nitrifying inocula and probiotic formulas used in aquaculture production.

LM-UGent has been actively involved as research partner in projects of several EU framework programmes including “Risk assessment of antimicrobial use in aquaculture” (1997-1999) and “Hazard analysis of antimicrobial resistance associated with Asian aquaculture environments” (2002-2005). These projects helped to establish fruitful collaborations with European and Southeast-Asian aquaculture expert groups at University of Galway (Ireland), University of Stirling and Heriot-Watt University (Scotland), Can Tho University (Vietnam), Aquatic Animal Health Research Institute (AAHRI, Thailand) and Universiti Putra Malaysia (Malaysia). With the support of the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, Brazil), a four-year scholarship was awarded to Dr. Fabiano Thompson and resulted in an internationally acknowledged PhD on the improved taxonomy of the family Vibrionaceae.

In 2005, LM-UGent organized the international two-day conference “Vibrio 2005” on the biology of vibrios in Ghent, bringing together over 120 researchers involved in studying the biodiversity, ecology, genomics, disease and epidemiology of this important aquaculture organism. Members of LM-UGent are actively involved in several expert committees including the Subcommittee on the Taxonomy of Vibrionaceae and *Aeromonas* Taxonomy Working Group Committee of the International Committee on Systematics of Prokaryotes and the Working Group on Aquaculture of the Clinical and Laboratory Standards Institute (CLSI), Wayne, PA, USA.

The BCCM/LMG Bacteria Collection is a service-directed unit within LM-UGent which currently holds up to 22.000 well-characterized type and reference strains including valuable subcollections of *Vibrio*, *Aeromonas* and *Photobacterium* (altogether approx. 1000 strains). This public collection thus forms a rich source of bacterial reference material for researchers and industries worldwide. An identification system based on AFLP fingerprints has been developed at BCCM/LMG specifically for Vibrionaceae and is available on a service basis.

Current research topics of LM-UGent of relevance to the field of aquaculture include:

- Study of microbial diversity through state-of-the art taxonomic tools including sequence analysis of ribosomal RNA and house keeping genes, a range of species- or strain-specific DNA fingerprinting methods (including AFLP), whole genome DNA-DNA hybridisations and chemotaxonomic methods
- High throughput bacterial identification through cellular fatty acid analyses, Raman spectroscopy and MALDI-TOF mass spectrometry
- Analysis of microbial populations through DGGE and real-time PCR
- Study of microbial evolution through multilocus sequence analysis of house keeping genes (special interest groups include *Vibrio*, *Aeromonas*, the *Bacillus subtilis* group and lactic acid bacteria)
- Computerized data handling and database construction, development of bioinformatics tools for storage, exploitation and analysis of biological data
- ISO 9001:2000 certified Biological Resource Center (BCCM/LMG) facilities for the preservation and distribution of bacterial cultures
- Analysis of antimicrobial resistance through classical tests, PCR detection, and detection and molecular dissection of the resistance genes and integrons

Contact

Websites

<http://www.lm.ugent.be/>

<http://bccm.belspo.be/about/lmg.php>

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Evolutionary Morphology of Vertebrates

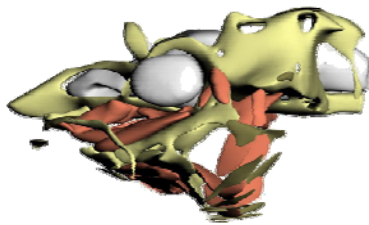
Faculty of Sciences
Department of Biology

Scientific personnel

- Dominique Adriaens
- Tom Geerinckx
- Natalie De Schepper
- 6 PhD students

Activities

The research focus has since the '70s been the ontogeny of the head, as well as postcranial system, in bony fishes with special attention to the feeding apparatus and the locomotory system. The ontogenetic



and evolutionary transformations of complex functional systems are the main field of interest of our research. Detailed anatomy of skeletal and soft tissue structures of all kinds of larval stages are studied relying on *in toto* clearing and staining, but also on serial histological sectioning, combined with complex graphical 3D-reconstructions. This methodology is used to look both at the morphology at the level of tissues (cf osteogenesis), as well as at

the level of complex systems at a micro-scale (*e.g.* musculoskeletal system of the feeding apparatus at the smallest larval stages - [figure on left shows 3D-reconstruction of cranial system in larval catfish](#)). All necessary infrastructures are currently present in the research group to generate histological series of large tissue blocks (such as complete fish). Studying the biology of shape changes is also one of the main research activities, where shape analyses are performed relying on landmark and outline based geometric morphometrics, both on the external morphology and the skeletal morphology.

Since recently, our research experience and methodology has also been applied in the field of applied ichthyology, as understanding the morphology and functioning of for example the feeding system in larval finfish is of great importance to improve larval quality in hatcheries. Also, shape analyses proved to be very useful for studying larval quality as well, as it enables a qualitative and quantitative screening of deformities occurring at early larval stages in cultivated fish. Current research has been focusing on larval development, growth and deformities in seabream (*Sparus aurata* - [figure on right shows deoperculated larval seabream](#)) and seabass (*Dicentrarchus labrax*), which is performed in close collaboration with the Artemia Reference Centre.



Our major topics of research performed in collaboration with partners of the UGent Aquaculture R&D Center are:

- morphological development of larvae
- histology of musculoskeletal systems in larval fish
- qualitative and quantitative analysis of deformations in cultivated larval fish

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Vertebrate Morphology and Developmental Biology
Faculty of Sciences
Biology Department

Scientific personnel

- Ann Huysseune
- Bart Bulckaen
- P. Eckhard Witten

Activities

For over 25 years, the research group has been involved in studies on the structure and development of the skeleton and the dentition in bony fish. Histological and morphological analyses of skeletal tissues are part of the daily routine. Recently expertise has also been acquired regarding the molecular control of skeletal development through studies of expression of relevant genes. To this end, the research group developed a unique technique for non-radioactive *in situ* hybridisation on cryosections of adult material.

Because of expertise in fish skeletal development, the research group has become increasingly solicited to participate in studies of skeletal deformities in farmed fish. We have conducted several studies together with the Nutreco (Skretting) Aquaculture Research Centre in Stavanger (Norway). Furthermore, the research group is official partner in the "Norwegian Deformity platform", an integration of Norwegian research projects about malformations in farmed Atlantic salmon, financed by the 'Research Council of Norway'. Studies within the "Deformity Platform" are conducted in collaboration with AKVAFORSK (Ås, collaborator Dr. P.E. Witten), the Institute for Marine Research (IFM, Matre, collaborator Dr. T. Hansen) and the National Institute of Nutrition and Seafood Research (NIFES Bergen, collaborators L. Gil-Martens and Dr. R. Ørnsrud). Other projects within Europe are carried out together with the Dr. L. Cancela and her research group (University of the Algarve, Portugal). These studies concern skeletal deformities in farmed Sea Bream.

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Mailing address:

Biology Department, K.L. Ledeganckstraat 35, B-9000 Gent, Belgium

Protistology and Aquatic Ecology
Faculty of Sciences
Department of Biology

Scientific personnel

- Wim Vyverman
- Koen Sabbe
- Elie Verleyen
- Katleen Van der Gucht
- Victor Chepurinov
- Pieter Vanormelingen
- 10-15 PhD students (resident)

Research activities

Since 1996 our group has been conducting research on the functioning of freshwater and marine ecosystems, with a strong focus on micro-algae, the base of aquatic food chains. A central research theme is to understand the dynamics of micro-algal populations and communities in both natural and artificial systems.

Building on a long-standing expertise in micro-algal biodiversity, the group integrates organismal and population-level studies with ecosystem-level approaches, focusing on ecologically and/or economically important key groups.

Topics of particular relevance within the context of Aquaculture include:

- Aquatic ecosystem health and water quality [effects of eutrophication, food web modifications, toxic bloom dynamics (e.g. *Pseudo-Nitzschia*, *Microcystis*)]
- Productivity and stability of micro-algal populations and communities
- Ecophysiology (e.g. mixotrophy, salinity tolerance)
- Cell and life cycle regulation.
- Experimental evolution and breeding

Contact

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VIB Plant Systems Biology
Faculty of Sciences
Department of Molecular Genetics

Scientific personnel in charge of aquaculture research

- Frank Van Breusegem
- Marnik Vuylsteke

Activities

The VIB is a top class centre of excellence consisting of 800 people in 60 research groups carrying out research in the frontline of life science. Besides the scientific excellence, the host institution VIB conducts a proactive technology transfer policy. Invention analysis, patent applications, licensing negotiations as well as building business plans for new companies are activities carried out by VIB's biotech specialized technology transfer team.

The VIB Department of Plant Systems Biology (VIB-PSB), headed by Prof. Dr. Inzé, is one of Europe's major centers in Plant Science. The ambition of the VIB-PSB is to further develop system biology approaches in the field of plant sciences with the clear goal to create improved crops important for sustainable development. Therefore, the VIB-PSB chose to study in particular the mechanisms controlling cell division and organ growth. The know-how generated in this research fields is key for the understanding and improvement of plant growth and biomass production.

The VIB-PSB and the VIB as a whole have a long standing tradition of converting basic science into successful industrial entities: Plant Genetic Systems (now Bayer CropScience), CropDesign, (now BASF Plant Sciences), Devgen and more recently Solucel. Today, these companies together with the VIB-PSB form the largest European Plant Biotechnology Campus.

Since 2003 the VIB-PSB and the ARC have joined forces to undertake large scale research in the field of larviculture of fish and shellfish species of aquaculture interest, with a main focus on the brine shrimp *Artemia*. Access to the latest DNA technologies at the VIB-PSB and to staff that are highly experienced in the rapid acquisition, analysis and interpretation of genomic data, allowed the ARC for the first time to implement advanced genomics, transcriptomics, gene mapping technology and bio-informatics, in its R&D program. The results of the research will add significantly to available knowledge and IP within the ARC and VIB-PSB with respect to the molecular controls on important aspects of the development of *Artemia* and other aquaculture species.

In 2004, Moana Technologies, a company active in *Penaeus Monodon* breeding, established a partnership with the VIB-PSB, and started a large scale, long term research with the VIB-PSB. This partnership will allow the company to take advantage of the VIB-PSB expertise in genomic technologies and bioinformatics to develop platform technologies crucial in its *Penaeus Monodon* breeding activities.

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