

# APPLIED RESEARCH THAT MEETS THE NEEDS OF THE AQUACULTURE INDUSTRY



## Fraunhofer-Gesellschaft

The Fraunhofer-Gesellschaft is the leading organization for applied research in Europe. Its research activities are conducted by 66 institutes and research units at locations throughout Germany.

The Fraunhofer-Gesellschaft employs over 24,000 scientists and engineers, who work with an annual research budget totaling more than 2 billion euros. Of this sum, around 1.7 billion euros is generated through contract research.

## Fraunhofer Chile Research

The Fraunhofer Chile Research Foundation (FCR) aims to improve industrial competitiveness of local businesses through applied research in Chile and Latin America.

We develop new products and services for different industries, including Food and Food Ingredients, Aquaculture, Medicine, and Energy. Additionally, we offer consultancy services in technology transfer, intellectual property, technology commercialization, and innovation management.





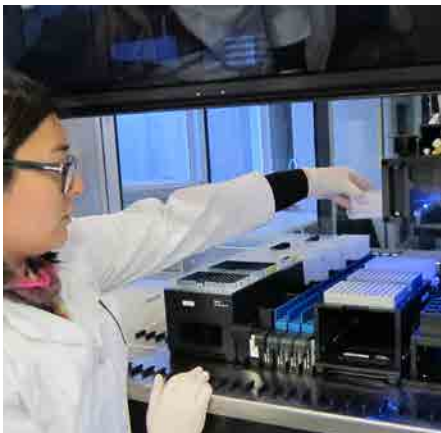
## Fraunhofer Chile Research - Center for Systems Biotechnology (FCR-CSB)

FCR-CSB was the first research center established by the Fraunhofer Chile Research Foundation with the support of the Program for the Attraction of International Excellence Centers in R&D of CORFO.

Its aim is to offer innovative solutions for various industries using biotechnological platforms.

As of October 2015, FCR-CSB has:

- Over 125 researchers working in 8 Divisions, including Biomedicine, Biocomputing and Applied Genetics, Nanomedicine, Nanobiotechnology, Renewable Resources, Therapeutic Peptides, Aquaculture and Sustainable Aquaculture, and Agriculture.
- Generated over 49 new research projects from competitive public sources and over 74 industry contracts.
- 13 patent applications and 3 granted patents from work done in Chile.
- More than 60 articles in peer-reviewed journals.
- Has established collaborations with 22 local Universities, three of them as strategic collaborators.
- Its strategic collaborators are Universidad de Talca, Universidad Católica de Valparaíso, Universidad Andrés Bello and Fundación Chile.



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## Aquaculture Industry

The Chilean aquaculture is a major contributor to Chile's food exports. The country has the second largest salmon farming industry in the world. In order to maintain and increase its international competitiveness, aquaculture needs to address health and sustainability issues.

Due to the intense production systems, diseases such as IPNV and ISA viruses, bacteria such as SRS and parasites such as sea lice, have caused major losses to the industry. In addition, extensive use of antibiotics, waste management issues and other general practices are of concern.

### Research focus:

#### Aquaculture Health

- Implementation of novel cultivation techniques for salmon pathogens.
- Developing pathogen detection tests and kits.
- Production of new types of oral vaccines for salmon.
- Development of novel treatments for salmon disease.
- Development of molecular biomarkers for studying the immune response to oral salmon vaccines.
- Design and implementation of in vivo assays to find new treatments for caligidosis in salmon.
- Development of a broad range of tests and analysis to determine the efficacy of new foods, drugs, immunostimulants, as well as genetic testing.

#### Aquaculture Sustainability

- Design of health and environment risk reduction strategies.
- Prevention of anaerobic conditions in marine and lake sites.



- Bioenergy production using freshwater and marine sludge. Design and implementation of strategies to reduce pathogens and contaminating compounds affecting sediment, water column and atmosphere.
- Preparation and recommendations for the Aquaculture Stewardship Certification (ASC) approval.
- Biochemical analysis to determine methanogenic potential of organic sludges.

### **Biocomputing and Applied Genetics**

- Sequencing of salmon pathogen DNA, in order to detect the interaction of the fish with its pathogens.

### **Nanobiotechnology**

- Development of nanochips to determine levels of concentration of metals present in the water or soil.
- Development of biomarkers to detect diseases in fish such as the ISA virus.

### **Nanomedicine**

- Design, synthesis and testing of dendrimers for the controlled release of drugs and/or molecules of biomedical use.
- Development of new delivery systems which are biocompatible for application in clinical trials.

### **Renewable Resources**

- Development of systems for the optimization of biomass production for microalgae.
- Extraction of biomolecules from microalgae with the aim of producing biofuel.



## Services:

### Aquaculture Health

- Health checkups for fish.
- Virus and aquatic bacteria detection.
- Experimental studies to test diets or drugs.
- Bioassay studies (in association with Fundación Chile).
- Gene expression assays by RT-PCR from mRNA obtained under different conditions. Absolute and relative quantification in relation to reference genes.
- Cell culture (pathogens identification, pathogen inoculum preparation for Bioassay).
- Diagnostic techniques, detection by microscopy using of immunofluorescence antibody test (IFAT) and ELISA.
- ELISA tests for cytokine detection in salmon or in fish in general, quantifying the presence of antibodies.
- Test of minimum inhibitory concentration to assess if bacterial strains are sensitive to an antibiotic.
- Concentration of virus samples.

### Aquaculture Sustainability

- Submission of this waste to an anaerobic digestion process to decompose and generate biogas, with which electricity or heat energy can be generated to supply farms or adjacent sites.
- Use mathematical modeling to recommend production limits of each fish farm.
- Advise on obtaining sustainability certification under the ASC standard of the Wildlife World Fund (WWF).
- Design of special cages to facilitate the collection of waste.
- Analysis of water and sludge: Soluble oxygen chemical demand, total chemical oxygen demand, volatile fatty acids, ammoniacal nitrogen detection, total solids, volatile solids, total suspended solids, volatile suspended solids, pH, total alkalinity and conductivity, methanogenic activity, methanogenic potential, redox potential.
- Biogas pilot plant for escalation analysis.

### Biocomputing and Applied Genetics

- Development of new varieties for aquaculture.

### Nanobiotechnology

- Development of membranes and filters to selectively capture unwanted compounds.
- Development of biomarkers using chemical approaches.
- High-throughput analytical services.
- Toxicology studies and determination of toxic compounds.
- Mass spectrometry services to measure chemicals in certain environments, food or living things.

### Nanomedicine

- Drug design.
- Drug synthesis.

### Renewable Resources

- Production of biogas from various sources.
- Development of experimental technology platforms with microalgae.
- Development of technology platforms for the extraction of bioactive compounds from microalgae.



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