



# ANNUAL REPORT 2009



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## Matís' ability to answer future questions is better than ever

### Friðrik Friðriksson, Chairman of the Board

Matís Ltd. is, in a number of ways, an important asset to the people of Iceland. The organization is a key player in the field of food science and safety, a role strengthened by its most important asset: the knowledge and expertise of its employees, specialists and scientists in a variety of fields. These professionals not only connect Matís to numerous businesses within the Icelandic economy, but link the organization to projects around the globe. Furthermore, in collaboration with Icelandic universities, Matís is actively involved in the education of young scientists, thus promoting the sustainable development of scientific data.

Since its formation in 2007, Matís Ltd. has shown significant success. Matís has celebrated many accomplishments: the annual turnover has doubled in three years, the facilities have been substantially improved and the company is effectively and strongly managed, to name but a few. However, the most important change is the significant increase in the company's 'knowledge index' - an indicator for the internal improvement of professionalism amongst its staff. The index is based on the level of education, number of staff and branches, project results and other factors. Matís' knowledge index has, just as its turnover, doubled in the last three years, a statistic just as valuable as other conventional economic indicators. Matís' staff are consistently and continually developing and improving through knowledge.

With a larger knowledge base the company is better prepared to respond to diverse customer requirements, as well as the owners'. Innovation is a key concept in the industry in this country today and in this field Matís can truly submit their talents. I feel I can say that the ability Matís has to answer future questions is better than ever.



# Year of growth and expansion

Sjöfn Sigurgísladóttir, CEO

2009 marks a year of growth for Matís. Towards the end of 2008, the divisions were reconstructed and increased from three to six. Their development was based on Matís' primary goal to build up and support the Icelandic economy and contribute to an increase in GDP. The new divisions saw the arrival of an increased number of highly-skilled specialists and a clearer strategy for each group. These factors have contributed to a greater diversity in projects both domestically and internationally and an increase in new customers. Matís has already exceeded its expectations first outlined at its formation in the beginning of 2007.

## Matís – an important link in the reconstruction of Iceland's economy

In 2009, Matís decided to take advantage of opportunities created by the economic crisis. With an increase in projects and income from international sources as well as an increased diversity in projects domestically, Matís has shown the significant importance that food has on growth and innovation in the current economic climate.

Matís is an important link in the reconstruction of Iceland; the newly formed divisions have been working to their full potential and have demonstrated their abilities as individual cells within the economy, providing services wherever Matís' specialized knowledge is needed.

Matís bridges the gap between the corporate world and academia. The cooperation between Matís, the corporate world and academia leads to the creation of new products, new methodology, optimized utilization and more. All these

factors contribute to and help increase GDP in Iceland. An improved relationship with the corporate sector builds up a knowledge base and demonstrates what Matís means to the corporate environment and innovative creativity and how diverse Matís' involvement can be.

A number of Ph.D. students conduct research at Matís, a collaboration which greatly benefits both parties. The number of Ph.D. held amongst employees has also increased and currently stands at around twenty. The high level of education is not only useful for research purposes, but also as a marketing tool for overseas investors and potential collaborators.

## Well timed reorganization?

Since the economic crisis, the public view of domestic food production has changed significantly. This shift in attitude has greatly benefitted Matís. Fishing and farming form the core of Matís' operation and are key elements to innovative project development. One example to illustrate this point is the development of food tourism.

Food tourism is the perfect example of how many small things can make a whole. In order to assist small businesses and entrepreneurs to realize their full potential, Matís has established a food center in Höfn, where they can receive specialized help in developing and producing their product in a fully equipped, accredited establishment. Matís understands the interest and need for innovative product development using Icelandic raw material such as solva, algae or sea cucumber and the creation of enzymes

from extremeophiles and to monetize upon that knowledge. The interest in more traditional food is expanding along with health consciousness, which is where our biotechnology and biomolecules department plays a significant role. I believe that recent changes within the organization came at the correct time to meet the demands of the economy after its collapse.

## New workplace in Reykjavík

One of the biggest steps towards change was taken in 2009 with the introduction of new residence at Vínlandsleið 12, Reykjavík. Previously Matís operated from three offices in the capital area, but since the completion of the interior in December, all Matís employees from the greater Reykjavík area now work under one roof.

Thanks to the new building, new opportunities have arisen. Firstly; there has been an increase in cooperation between specialists, which has enabled us to deal with more diverse projects. Second of all; the work environment has improved significantly and finally; our customers will receive better services. Employees soon realized the opportunities created by the new building, a development that is going to create significant improvements on Matís' future.

## Creation of knowledge is our gain

In 2007, Matís' revenues/income was estimated to reach 850 million ISK by 2009. However, last year's revenues were significantly more - 1200 million ISK. 200 million ISK was acquired internationally from investors who funded both large and small projects and from contracts with Nestlé and other companies in Europe. Significant growth is due to international revenue as well as domestic.

Matís' operations are rooted in sustainable growth rather than a maximized revenue stream. Its real profits are the creation of knowledge amongst its specialized staff, as well as its projects and the way in which they help Icelandic companies to maximize their results, improve health and quality standards of produce, improve information flow and ensure food security for the Icelandic nation. The management concluded that these goals were achieved in 2009.

## Matís Ltd.

Matís Ltd. is a governmentally owned company, established January 1, 2007. The company's primary aim is to conduct research into food and promote innovative job opportunities within the food industry. Matís has played a significant role in promoting healthy living and food safety in Iceland.

Matís' operations are diverse. The company is divided into six divisions that work alongside a support division, which supplies them with financial, management and information services. Matís' divisions are:

- Genetics and Aquaculture
- Biotechnology and Biomolecules
- Innovation and Consumers
- Analysis and Consulting
- Value Chain and Processing
- Food Safety and Environment

The high level of education of the staff and the company's professional facilities, combine to make Matís a leading force in the field of research in Iceland. Matís is involved in numerous research projects each year, both domestically and internationally, many of which are led by Matís. This is highly beneficial to both Matís and its cooperative partners thanks to the company's strength in the field of research. Furthermore, Matís fulfills its duty to improve and promote scientific research, by working closely alongside Icelandic universities.

Another important factor in Matís' operations is the direct service provided to institutions, companies and individuals both domestically and globally. In addition to research, this would be consultation, a range of measurement and development.

Matís' goal is to increase profitability in Icelandic food production and to improve the competitiveness of Icelandic produce internationally. By doing so the company will increase income for Icelandic food production, create jobs and promote innovation.

The headquarters of Matís are situated in Reykjavík. The company also operates in the Westmann Islands, Höfn

in Hornafjörður, Neskaupstaður, Egilsstaðir, Akureyri, Sauðárkrúkur and Ísafjörður.

## Human Resources

"Our employees saw significant changes in the company's work environment after Matís' operations were moved to the new facilities. To have over 80 employees under one roof is like starting work at a new company. From day one, we acknowledged significant change in the management of our staff as well as a heightened sense of corporate culture, such as an improved information flow and communication between employees. We have seen significant improvements and work opportunities amongst our employees that were difficult to produce before." says Jón Haukur Arnason, head of Human Resources at Matís.

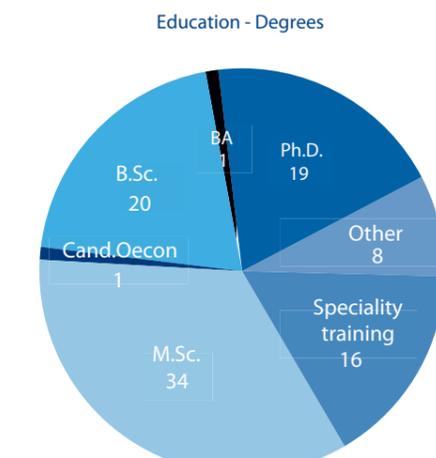
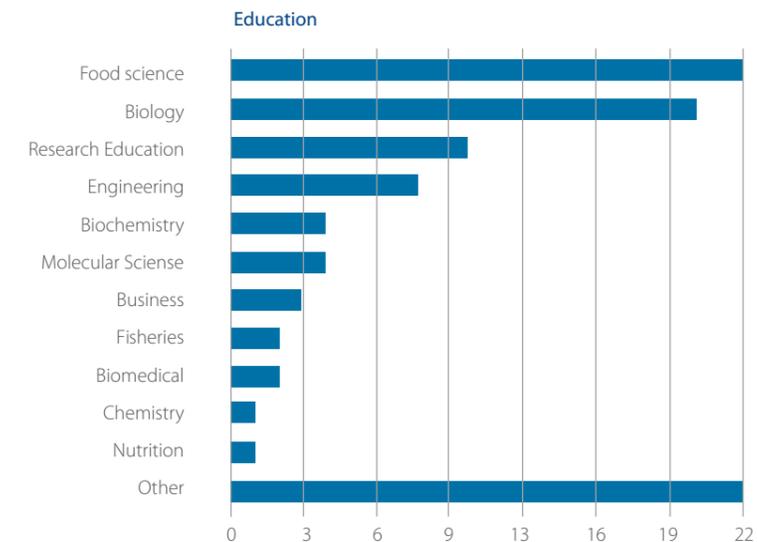
Matís had ninety-nine employees at the end of 2009, an increase of four from previous year. In Reykjavík there are eighty-two employees and seventeen in the seven different divisions around Iceland.

The Matís' employee association coordinates certain aspects of entertainment for the staff, whereas the company organizes all courses and presentations. Matís offers all of its employee's fitness support, which can be used to buy gym memberships. All of the staff has access to personal trainers, which a number of employees use regularly. Matís' employees were successful in the "Cycle to Work" effort and came first in the number of kilometers cycled, an average of 62 kilometers per employee. Healthy eating is also of great importance to Matís. All employees have access to free fruit and with the new building they saw the arrival of a kitchen where an expert chef cooks up delicious and healthy food every day.

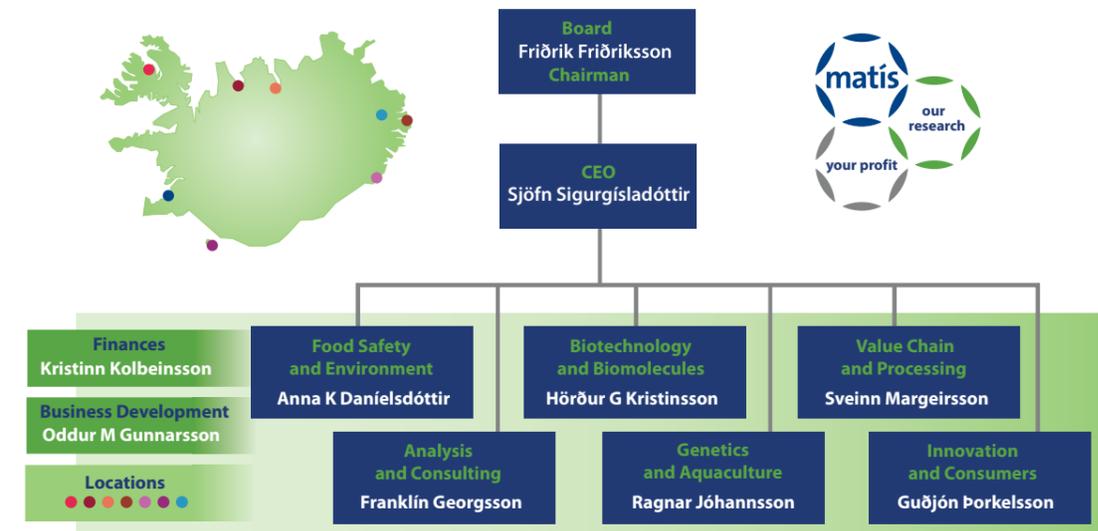
General Info	
Number of employees	99
Number of positions	94
Average age of employees	44
Average number of years at Matís	8

"We emphasize flexibility for our staff and being a family friendly company. We consider ourselves successful in achieving this goal. We conducted a job satisfaction survey in collaboration with HRM consulting, using the 'European job satisfaction index' to evaluate job satisfaction amongst our employees. The results were then compared to other surveys conducted at other Icelandic and Scandinavian companies, and Matís scored very positively in all categories" says Jón Haukur.

Matís supports the further education of its staff and in 2009, nineteen employees conducted their PhD research and fourteen their Masters research with the company. Amongst Matís' staff, seventy-five have university degrees, of which thirty four have Masters degrees and nineteen have doctoral degrees.



## Organizational Chart



## Values, Role and Vision

### Matís' Values

- Initiative
- Creativity
- Ambition
- Integrity

### Matís' Role

- ...enhance the competitiveness of Icelandic products and industry
- ...ensure food security and sustainable management of the environment through research, innovation and service
- ...improve public health

### Matís' Vision

- To continue to be a dynamic knowledge-based food and biotech R&D institute, offering research carried out by highly competent, enthusiastic and competitive scientists working at first class facilities in an interesting workplace.



## Locations

### Reykjavík – Finally under one roof

#### Matis' new facilities at Vínlandsleið 12 opened their doors in December 2009

A big step was taken in Matis' history in December 2009 when the company's operations in Reykjavík and surrounding areas moved to Vínlandsleið 12 in Reykjavík. The company had previously operated from three different locations in the capital area.

In early 2009, Matis began advertising for a new headquarters that would satisfy all the company's needs and accepted an offer from the construction company Mótás Ltd. The building, located at Vínlandsleið 12, is 3800 square meters, spread over three floors and a basement. The building was modeled to Matis' specific needs and the company moved in towards the end of 2009.

The new building is divided into: office space, research facilities, reception, processing space, storage and other specialized spaces. Along with the more traditional research spaces, there are also a number of specialized research spaces that fulfill a number of specific services, such as microbiological and chemical research, biotechnology, chemical testing, culturing, sensory science, microscopic viewing, radiological studies and more.

The new building contains the Reykjavík food center, a perfect test kitchen where entrepreneurs and small companies can rent the facilities, along with expert knowledge to test, develop and initiate small-scale production of their product. This service allows them to save money that would otherwise be spent on expensive technology needed

at the beginning of the production process. This unique opportunity gives producers the chance to develop their product further and investigate the market place. The building also contains a facility accredited by the health administration in Reykjavík for product development and production. The facility is the optimal place for companies or entrepreneurs who need assistance with the development and production of their product.

#### The building is a revolution that creates new opportunities

The new building is not only a revolution with regards to the work environment for the employees, but has also presents an opportunity for Matis to become a leading force in innovative creativity in the production of food in Iceland.

The new building has not only revolutionized the work environment for the employees, but has also given Matis the opportunity to be a leading force in innovative creativity in Icelandic food production.

"There is no doubt in my mind that there is visible improvement of our involvement with both academia and the economy. This is supported through innovation in the fishing industry and the agricultural industry but also through recent development connected to food tourism, to name but a few. The economy is consistently realizing the potentials of research and I welcome and celebrate the opportunity we have been granted with the new headquarters to strengthen our company especially when it is so crucial for the economy to enforce innovative thinking and creation" says Sjöfn Sigurgísladóttir CEO, about the new headquarters.

### Akureyri

#### At Borgir

Matis' operations in Akureyri are located in the research house at Borgir. The employees conduct research in collaboration with the University of Akureyri and other institutions and companies located in the north of the country. Matis has four employees in Akureyri, and two students from the University of Akureyri who are conducting research towards their Masters degrees.

In 2009, staff conducted research into a number of undesirable substances found in imported and domestic goods. Emphasis was placed on research and innovation in aquaculture, as well as experiments on the collection and breeding of Icelandic zooplankton.

A close relationship is maintained with the University of Akureyri. Matis' employees have taught at the university's science department and many students have worked on their B.Sc. thesis in collaboration with the company.



### Egilsstaðir/ Food Center of Eastern Iceland

#### Kaupvangi 39

The Food Center of Eastern Iceland, in which Matis is involved in, began operation in the fall of 2009. The center falls under the 'Innovation and Consumer' division and its purpose is to implement small-scale production in the area. The center offers assistance to entrepreneurs with the development and production of their product. The emphasis is primarily on the production of dairy products, but there is also considerable interest in meat production. The projects are therefore based on what produce is being emphasized in the area.

### Höfn – Höfn Food Center

#### Nýheimar

Matis' center of operation in Höfn is located in the knowledge center Nýheimar, a platform for creative collaboration in the area. Two specialists, belonging to the Innovation and Consumer division, were based there in 2009. The center emphasizes the strengthening of small-scale food production, tourism related projects, exporting shellfish and crab, and research into the lobster, *Nephiops norvegicus*. Matis' first food center was set up in 2008, in Hornafjörður, which

became the center of operations in 2009. The center emphasizes on small-scale production as well as conducting a few small projects in product development with an aim to fully develop a product ready to be marketed.

## Ísafjörður

### At the West Fjords R&D Center

Matís' center of operation in Ísafjörður is located in the West Fjords R&D Center. Projects conducted there are based on the demand and emphasis of the surrounding area. There are three employees, two of which work under the 'Value Chain & Processing' division and the third under the 'Genetics & Aquaculture division'. In 2009 the center worked on a project ("Vinnsluferill línuveiðiskípa") involving the processing procedure of line-fishing ships. This project has been going on for the last three years and is due to finish in the fall of 2010. A new project, ("Sókn á ný mið"), was started this year and the focus is to develop new equipment and improve processes for thawing of gutted groundfish before processing.

Projects conducted in the field of aquaculture are, amongst others, research into the use of light in aquaculture and its effect on delaying or cessation of maturation of cod, project to gather all available environmental and weather information that have to be taken into consideration to develop fish farming equipment to be used in Icelandic waters and a project aimed to define natural biodiversity of Ísafjardardjúp, pollution limits, and potential impact of eutrophication.

## Neskaupstaður

### Mýrargata 10

The east of Iceland is the center of the fishmeal industry and subsequently the main project conducted by Matís in Neskaupstaður branch is connected to the monitoring of this industry.

There has been an increase in services for the east of Iceland's Health Department in monitoring food and potable water. The branch has also seen an increase in demand for servicing reefer vessels, for example, measuring microorganisms and levels of fats in fish, such as blue whiting, herring, capelin and mackerel. There has also been a significant increase in the measuring and analysis of samples from various Matís projects from all over Iceland. Also, the branch has seen an increase in services for other economic activity in the area, like the aluminum smelter in Reyðarfjörður.

There are three Matís' employees in Neskaupstaður, who all work within the 'Analysis and Consulting' division.

## Sauðárkrókur

### Háeyri 1

Matís' main objective in Sauðárkrókur is the operation of a biotechnology center, which opened at the end of 2008. The center works closely with food companies in Skagafjörður to enable them to fully utilize their resources and optimize their profits. Cooperation with Hólaskóli is related to education and research in aquaculture.

The biotechnology center conducted a variety of diverse projects in 2009: health products from fish, FisHmark, improved stability in fish proteins and peptides, Nice protein, Biotechnological research in Sauðárkrókur, Skagafjörður Value chain, bioactive flavoring from Icelandic marine products, utilizing cheese whey for health products, natural enzymes and antioxidants from by-products.

There are four employees in Sauðárkrókur who work within the 'Biotechnology and Biomolecule' and 'Value Chain and Processing' divisions. One Ph.D. student and engineering students did their thesis work at Matís' biotechnology center in Sauðárkrókur last year.

## Vestmannaeyjar

### At the the Vestmannaeyjar knowledge center

Matís' operations in Vestmannaeyjar involve cooperation with fishing companies on the island in order to assist them in utilizing their resources and optimizing their profits. An emphasis has been put on utilizing new resources, namely a project involving the catching and processing of mackerel. A Matís employee has been working with food production companies in Vestmannaeyjar to develop new products.

One new project started in 2009 was "Receiving station for live marine animals". The aim of the project is to open a receiving station (nursery, storage and distributional station) for live seafood in Vestmannaeyjar, do pre-experiments on storage and transport and create guidelines and protocols to prolong shelf life in restaurants and retails.

One employee is currently working for Matís in Vestmannaeyjar under the 'Value chain and processing' division.



## Board members

Back row from left: Laufey Haraldsdóttir, Arnar Sigurmundsson, Ágústa Guðmundsdóttir, Halldóra Lóa Þorvaldsdóttir og Jón Eðvald Friðriksson.

Front row from left: Einar Matthíasson, Vice Chairman, Friðrik Friðriksson Chairman og Sjófn Sigurgísladóttir, CEO.

Board changes at the annual general meeting, September 28, 2009: Laufey Haraldsdóttir og Halldóra Lóa Þorvaldsdóttir replaced Guðrún Elsa Gunnarsdóttir og Ýr Gunnlaugsdóttir.

# Genetics create new opportunities in aquaculture and breeding of animals

Ragnar Jóhannsson, director of Genetics and Aquaculture



The creation of new opportunities in aquaculture and breeding through genetics/ Genetics: creating new opportunities in aquaculture and breeding

With regards to the breeding of fast-growing white fish, Iceland is the land of opportunities, which is estimated to become highly visible in the near future. Aquaculturing of arctic char has advanced significantly in Iceland and Icelanders have every opportunity to replicate this with other fish species. Our role is to strengthen the field through research projects that increase quality and efficiency. The genetic research we conduct is utilized to achieve goals in a variety of ways, from marine species identification to parental analysis in dogs. Our clients range from large research funds to dog breeders.

## Genetics utilized in new ways

The division has accumulated a strong base of knowledge in genetic analysis and the ways in which to utilize it in fish research. Parental analysis plays a big part in the service provided by the division and is frequently sought after by dog- and horse breeders who need confirmation of their animal's paternity. Over 2500 horse samples were analyzed to trace their paternity last year, both domestically and internationally.

A method to identify the origins of all Icelandic marine species has been developed by the division as well as a method to analyze pathogens in herring around Iceland, which has caused significant losses in its stock and, subsequently, adversely affected fishing. The division is developing new methods and analysis of scrapie gens in sheep and is now selling tools, under the MateMeRight® label, that assist the user to process genetic data and use for e.g. aquaculture. Genetics are now being used in the research of the Icelandic cow stock, in an attempt to answer demands from cow farmers regarding the use of genetics to maximize the breeding of their cows.

## New information on marine species

Genetics will be a valuable tool to us in the future. We will be able to prevent inbreeding before aquaculture takes place. We also have the opportunity to build up a knowledge base of marine species around Iceland and how the use of genetics could answer questions on the development of different species, whether they are localized, what characterizes the genotypes of a specific species, and so on.

The division has just completed a research project that, through the use of genome sequencing, was able to conclude about the history of salmon stocks in the North

Atlantic. Similar research in the future on other species, such as cod, could lead us to valuable information on how we can best manage and utilize the stock. Genetics has the potential to answer many questions in the future regarding the environment and its resources that we are unable to answer today.

## The future is aquaculture

The divisions' employees work industriously on projects related to Icelandic aquaculture. This includes projects aimed at improving progress and quality in the production of fry, with an emphasis on cod and halibut. The division also conducted an extensive project involving the use of light to speed up the maturity of cod, affecting the speed at which the fish grows and the time in which it take to grow. This maximizes the output of cultured fish.

Another project involves utilizing Icelandic rapeseed in feed for cultured arctic charr. This could create significant profits. The project aims to create protein rich feed for aquaculture out of rapeseed, which is now first being planted in Iceland. Experiments have been conducted in feed for cod and arctic charr with positive results. In other words, it seems as though we have found good feed, local and environmentally friendly production and, above all, a cheaper feed for aquaculture than is currently in use. The largest gain is the effect aquaculture has on the economy, maximizing its profits and increasing its competitiveness in the market.

## Kinship analysis of cultured turbot in South-China

"We have been seeking Matis' specialized services in finding relatedness between individuals in the spawning stock of our turbot. The see the benefit of that within the next couple of years," says Jóhannes Hermannsson, who manages a company in South-China that specializes in cultured turbot. The company has been in operation for three years and is owned by investors in Hong Kong, as well as by Icelanders based there. The aquaculture site is based in China, just north of Hong Kong.

"We breed the fish in closed circulation systems indoors and have the capacity to produce about 300 tons of turbot a year. The environmental factors here are far from the turbot's natural surroundings, but it lives in waters measuring from 12 to 16 degrees Celsius. The sea temperature here in China can go down to 16 degrees Celsius in the winter but well over 30 degrees Celsius in the summer. We are breeding the fish far from its natural habitats. Culturing turbot in tanks on land is known, e.g. in Spain, France, South America and other places and turbot is known delicacy," says Jóhannes but





his company sells all his fish alive to restaurants, hotels and retailers. "It is important to us that the fish is alive, looks good and is fresh."

Matís specializes in technology that analyses kinship in aquaculture and this knowledge is sought out by Jóhannes. "This knowledge could have been provided by another company, but we chose Matís because it is a company neither too big or too complicated. In this case, both parties gain greatly from being Icelandic. We both know where we are heading and what we expect to gain. It matters to us that we have extensive knowledge, which is plentiful at Matís." says Jóhannes Hermannsson who expects that samples will be regularly sent from his company in South-China to Matís for analysis in the future.

## Research on sex maturation and its effects on growth in cultured cod

"The goal of the research was to examine if it were possible to stop or delay sex maturation in cultured cod through specialized lighting equipment. The purpose is to speed up growth in the fish because once the fish reaches sexual maturity, its energy accumulated through feed goes in to that factor, as opposed to growth and building of muscle." says Rannveig Björnsdóttir, research group leader for Matís in Akureyri, on two projects related to cultured cod that she managed on Matís' behalf.

On one hand there was the Codlight Tech project, which was funded by the European Union. The project was undertaken in collaboration with aquaculture companies HG and Álfsfell hf. in the West Fjords, as well as Vaki hf., aquaculture producer NoCatch Ltd., Stirling University in Scotland, the Swedish Agricultural University, cultured cod producer Fjord Marin Cod AS, the Norwegian Marine Research Institute and Intravision AS in Norway who designed and produced the lighting equipment used in the project. These specialized lights are designed to produce one wavelength, which better distributes the light through the water in comparison to halogen lighting, which is traditionally used in aquaculture. This new lighting technology has proved successful in preliminary research on cod.

Alongside the research Matís started another project, with local partners, assessing the possibility for using the same lighting methods to control cod from the fry stage. This project also included an in-depth research conducted by the Natural History Institute of Westfjords on the effects of sea aquaculture on the diversity of benthic animals below the culture site. Both projects were finished in the year 2009 after a three-year research period.

"The aim with Codlight Tech was to research new types of lighting and its effects on fish after their release into the culture site at sea, whether it would prevent sexual maturation entirely or at least delay it for a year. Cod seem to sense the wavelength of the light better than the white light traditionally used in aquaculture. In short, the results of this project were that it is possible to delay puberty for one year but a state of constant light control does not prevent it because of daylight and temperature's effect on the natural surroundings" says Rannveig.

The Icelandic project, which was funded by the AVS research fund, utilized the same type of light systems where the fish were kept under constant light control from birth. This was done to examine the effects of constant light control on puberty in cultured fish. This project also aimed to develop and standardize various techniques in measuring the strength of growth hormones in cod as well as researching the possibility of measuring the speed of growth by analyzing various

growth factors in the fry. The project concluded that constant light control did not affect the growth of fry but there was evidence of a lower frequency in growth defects. Light control of fry seemed to have a negative effect on the growth of fish after its transportation to the culture site. There were also many unexplained deaths amongst the fish in that particular group.

Matís' collaborative partners on this project were the Westfjord Nature Agency, the University of Akureyri, the Icelandic Marine Research Institute and the University of Gothenburg.

## The history of the Atlantic salmon

In 2009, an extensive DNA sequencing project was carried out looking at 576 salmon samples from all over the North-Atlantic area. The samples were extracted across the Cola Peninsula to the United States and Canada, France and Spain in the south.

Certain parts of DNA in the salmon's mitochondrion were analyzed. This was achieved using new genome sequencer with much more sequencing capacity than previously possible. The equipment reads information from a 100 million base pairs and through computer analysis Matís' specialists are able to read out the DNA variations that are passed down from generation to generation. From this data, the specialists were able to answer questions on the origins of the Atlantic salmon and how the Atlantic salmon populated the North Atlantic Ocean after last ice age.

This project is the beginning of similar research that DNA specialists will work on in coming years. It will provide answers to large theoretical questions on life and convert that knowledge into information, which can be utilized in the development of our future. This research on DNA could provide answers to other theoretical questions, which can then be utilized in future developments.





## A few other selected projects in Genetics and Aquaculture

### Current projects

#### Improved fertilization of halibut eggs

The main goal of this project is to define controllable parameters that influence the quality of halibut eggs which often is defined by their fertilization rate.

#### BASECOD - Stable and safe production of cod larvae and juveniles

The project objective is to define the approach for a stable production of high quality larvae and juveniles, by combining the knowledge and experience in juvenile production of cod in Norway.

#### Experimental production of natural zooplankton

The main goal of this project is to design and develop methods for production of zooplankton species.

#### Pigmentation of Arctic charr

Iceland is the leading producer of farmed Arctic charr with estimated annual production of about 3500 MT in 2008. The industry estimates an annual growth of 10% per year over the next years if prices are acceptable. An aim is to rise the product price by pigmentation of Arctic charr.

#### The effects of reduced salinities on growth rate, feed conversion and biology of Atlantic cod

The objectives of this project are to elucidate salinity effects on growth, osmoregulation, endocrine control and immune parameters, at three growth stages of cod. Optimal salinity for growth and food conversion efficiency will be defined.

#### Shortening the growing time of blue mussels on long-lines

Shortening the growing time of blue mussels on long-lines and to harvest mussels at least one year earlier compared to normal methods for growing mussels.

#### Herring: genetics and processing properties

A pilot study on the multidisciplinary approach for the genetic stock identification of herring in the Northeast Atlantic: Biodiversity, functional and chemical properties.

#### Effect on replacing fish meal in Arctic charr diet on growth, and feed utilization

To produce economical feed for Arctic charr to decrease production cost and increase profitability in Arctic charr farming.

#### Real-Time PCR assays for *Flavobacterium psychrophilum* in 16S region

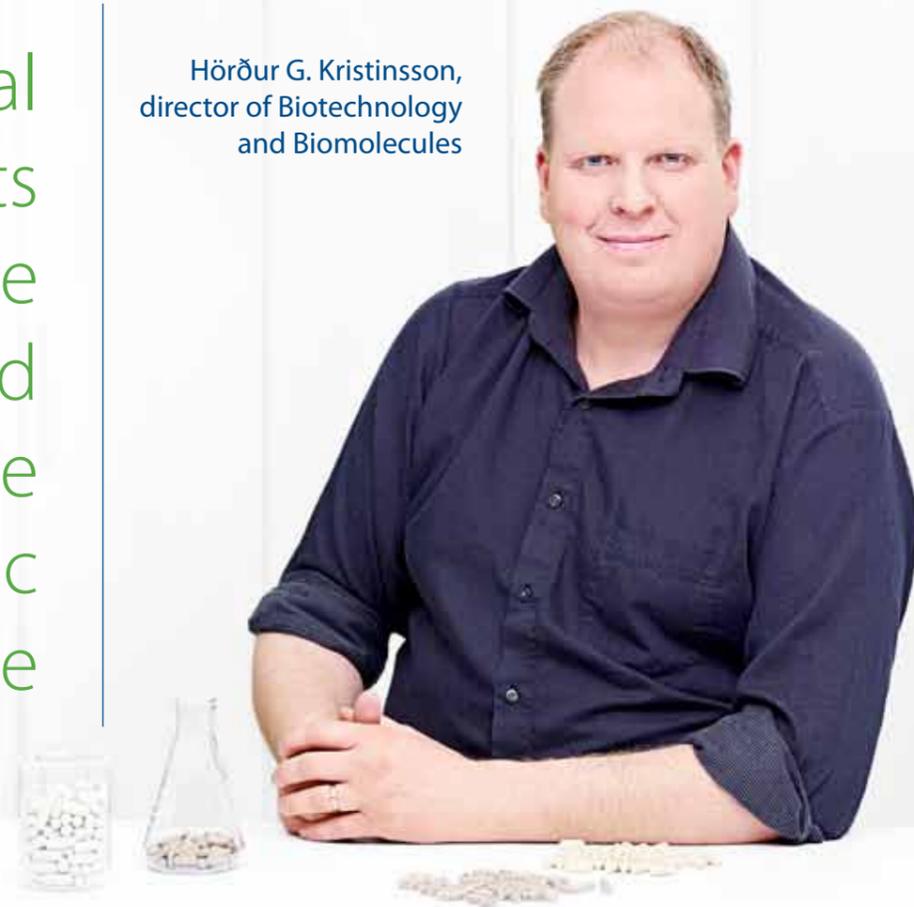
Correction or development of Real-Time PCR assays directed for detection of *Flavobacterium psychrophilum* in 16S region or other parts of the genome.

#### Protein requirements of Arctic charr

The protein requirements (protein from high-quality fishmeal) of five age groups of charr will be determined by feeding the fish isoenergetic feed formulations, ranging from 28-52% in protein content while measuring growth, feed consumption & efficiency.

# Natural ingredients from the hardy and unique Icelandic nature

Hörður G. Kristinsson,  
director of Biotechnology  
and Biomolecules



One of Matís' primary goals is to become a visible and leading company on a global scale in the field of biomolecular research and biotechnology development. This can be achieved through research and development of biomolecules, bioactive chemicals, enzymes from Icelandic nature and subsequently the marketing of products incorporating these factors. We are getting closer to the stage where we can market products incorporating bioactive chemicals that have been developed through our research, especially those designed for health purposes.

## Bioactive compounds: instrumental in fighting disease

The biomolecular part of the division aims to look for bioactive compounds in Icelandic nature. That is, chemicals that contain biological activity, which can be both negative and positive. The emphasis is mostly on the positive side as it can be utilized in various health products as a way to prevent

various health conditions and disease. Amongst these are: reducing high blood pressure, fighting cancer, prevention of heart and vascular diseases and reduced stress in the human body.

The ocean is a vastly underexplored environment for bioactive chemicals, but holds significant promise for future breakthrough discoveries. Matís has already explored and extracted bioactive material from a range of sources, such as sea cucumbers, shark cartilage, seaweeds and fish by-products using Icelandic enzymes from their microbial collection. To find bioactive compounds, various methods are used to find bioactivity. The activity is measured first in test tubes and in cells that mimic those found in the human body. Once a bioactive compound is found, we research its structure and move on to testing it in animals. Subsequently, we develop ways to isolate the compounds and then prepare for their large scale production and finally work with companies to market the compounds.

## Opportunities in the medical and health industries

Bioactive compounds from Icelandic nature represent very significant opportunities for the future.

The unforgiving conditions of Icelandic nature contribute to the existence of unique and highly potent bioactive material found in Icelandic organisms. This is one element of Icelandic nature which has been little known until recently.

We cooperate closely with local entrepreneurs, companies and Universities with the goal to produce and deliver a finalized bioactive compound into the market. The Division works closely with international parties, in Europe, the United States as well as China. The possibilities mostly lie in the creation of health and medical products, cosmetics and food supplements. We are also looking into incorporating bioactive material into foods to prolong food shelf life naturally.

## World class enzymes

Our research on enzymes combines the two research groups within the division, the biomolecular- and biotechnology groups. Biotechnology is used to find microorganisms at geothermal sites and in the ocean for the production of unique enzymes. These enzymes are powerful catalysts and are active at conditions where most industrial enzymes are not and can find various uses in the food- and chemical industries. Many globally known companies have cooperated with Matís to utilize the Icelandic enzymes in their production. Matís has powerful tools and techniques at its disposal to search for these enzymes in nature, which has resulted in an extensive collection of extremophiles that are unique world wide because of their origin in Iceland's unusual surroundings. One might conclude that the uniqueness of Icelandic nature could be seen as a golden thread, visible throughout our work.

## Fish protein for the treatment of chronic wounds

"We aim to have a finalized product in the year 2012," says Guðmundur Fertram Sigurjónsson, chairman of Kerecis, an innovative company based in Ísafjörður. The company works in research, product development and production of medicinal goods produced from fish protein. Matís has cooperated with Kerecis in its product development and research.

"We aim to produce goods meant for the treatment of chronic wounds. 0,8% of people will suffer from these wounds, which are caused from e.g. diabetes or vascular degeneration in the final years of our lives. Untreatable chronic wounds are the most common cause for people to lose their limbs and have them replaced with prosthetic ones. Products like these are called support materials and are rapidly growing in popularity. They are normally produced from





potentials, mainly because of its abundant supply around Iceland. Compounds with such antioxidants are popular as additives in food or supplements and valuable as such," says Rósa. The research was carried out in the year 2009 and will continue to be conducted in the year 2010.

"Now we know the positive effects of bladderwrack, the next step will be to further identify the compounds. We have also started a project with Chalmers University in Gothenburg and the University of Ljubljana where we look at the progress of these compounds, before and during digestion. We know that they have potential positive effects on reducing blood pressure and other health related issues" says Rósa Jónsdóttir.

## Matís' strength is useful to the Biotechnology research group

"One of our most important projects in the biotechnology research group is the extraction of polysaccharides from shark- and sea cucumber cartilage – also called chondroitin sulfate. This is one of the most important structural components of cartilage and has various uses as a supplement. The research is extensive, it utilizes various divisions and research groups within the company and it is, in my opinion, a very good example of how Matís' numerous strengths can be utilized within the same project," says Guðmundur Óli Hreggviðsson, research group leader for biotechnology.

"The project was carried out all of last year and we have now developed production processes for two kinds of products, both coarse powder and cleaned polysaccharides. We also utilize enzymes from marine bacteria and extremophiles to break down sugars into smaller entities," says Guðmundur Óli. Chondroitin sulfate has also been used in animal feed and in cosmetics, like moisturizers. "By doing this, we are working towards an increased utilization of marine resources and creating valuable products".

## Geothermal organisms make ethanol from waste

Another example of a project conducted within the Biotechnology and Biomolecules Division is the utilization of organisms in energy biotechnology. These organisms live in 65 – 70°C hot springs and can produce ethanol by breaking down and fermenting biomass. Biotechnology experts at Matís use genetics to modify the geothermal organisms to be more capable of serving this purpose.

"Biomass accumulates all around us, as paper or other kinds of waste from agriculture. We see an opportunity to solve certain environmental issues and use this underutilised waste as a cheap material for the production of ethanol and, by doing so, create value" says Guðmundur Óli Hreggviðsson, research group leader for biotechnology.

mammalian protein whereas our products are based on fish proteins, which we consider to have certain advantages, both on the market and in function," says Guðmundur.

Kerecis' material is extracted from cultured cod, obtained from Gunnvör freezing plant in Súðavík. The material is then handled at the Kerecis lab in Ísafjörður, using techniques developed in cooperation with Matís. The handling is then continued at Matís' lab in Reykjavík and finally, the material is tested in cooperation with health officials in Iceland and internationally. "Once the development- and research stages are concluded the production will be situated in Ísafjörður, but until then Matís is an important cooperative partner," says Guðmundur.

## Bladderwrack – is not as it seems!

"In the last couple of years we have been looking at antioxidants and bioactive compounds in edible seaweed and last year we took a special interest in bladderwrack. Research has revealed that it contains bioactive compounds that could be used in various health related products of the future," says Rósa Jónsdóttir, specialist at the Biotechnology and Biomolecules Division at Matís.

"High levels of antioxidants make it possible to reduce oxidation in food, as oxidation forms undesirable compounds in food and, consequentially, in the human body. High levels of antioxidants are therefore sought after for health purposes. We were able to isolate compounds from the bladderwrack that contained high levels of antioxidants and we are confident that we will be able to utilize its production

## A few other selected projects in Biotechnology and Biomolecules

### Novel bacteria from hot springs

The aim of the project is to describe 1-2 novel bacterial species and publish in the international magazine International Journal of Systematic and Evolutionary Microbiology.

### Health products from fish

The objective is to produce and prepare marketing of health products that are either based on traditional nutritional value of fish proteins or the bioactivity of peptides processed from fish.

### Application of protein isolate in fish products

The aim of the project is to test different types of protein isolate to increase yield, stability and quality of frozen, fresh and salted products.

### Improved stability and quality of fish proteins and peptides

The main objective of the project is to develop a production process to produce high quality oxidatively stable fish peptides from saithe with high bioactivity and consumer acceptance.

### Bioactive flavours produced from Icelandic seafoods

The goal of this project is to perform a comprehensive investigation/screening of the bioactivity of flavours produced from Icelandic seafoods. We will investigate their potential to lower oxidation, blood pressure, cholesterol, inflammation and cancer.

### Natural enzymes and antioxidants from byproducts

The goal of this project is the develop and research different novel protease blends from cod viscera with the aim to use them in the production of fish protein hydrolysates with very high antioxidative activity.

### Safe Transportation of Marine Bioactive's from Source to Active Site

The aim of the project is to follow the fate of three groups of marine bioactive compound from raw material to active cellular site; long-chain n-3 polyunsaturated fatty acids (LC n-3 PUFA), fish derived peptides and seaweed-derived polyphenols.

### Production of surimi from byproducts with pH-shift processing

The objective is to develop and commercialize a process to produce high value and quality surimi from low value and underutilized raw materials using the pH-shift process.



# Processing

Franklín Georgsson,  
director of Analysis and Consulting

## thousands of samples every year

The division's name, Analysis and Consulting, defines our aims as we provide services in analysis as well as specialized consulting. We are the biggest laboratory in the country that specializes in service analysis. Our laboratories are placed in Reykjavík and Neskaupstaður and we handle all of the main microbial and chemical analysis for a large group of customers. The consulting department has been built up as a separate entity since Matis' started in 2007 and today the two departments, Analysis and Consulting, supplement each other well.

### Processing thousands and thousands of samples every year

The majority of the divisions' work is within the analysis department, which provides microbial and chemical analysis. Tens of thousands of samples are processed every year that are sent to us by various food production companies, official inspection agencies, environmental agencies and pharmaceutical producers, to name but a few. Our services also extend to regular monitoring processes, where our specialists systematically collect samples to assess certain aspects of our customers' production. We provide services to all food related producers, such as retailers, we go onboard fishing vessels and take samples from their potable water supply, handle the collection of samples and analysis for insurance matters related to food, collect and analyze various water samples from supply systems or for smaller individuals such as vocational homes. This gives an idea of how extensive the field of service analysis is. However, the primary goal is to ensure maximum quality and safety of food products.

The divisions' laboratory withstands a broad spectrum of international requirements and our specialists use about 40 internationally accredited methods for chemical and microbial analysis on a daily basis.

### Official duties towards the country's food safety

One of our projects involves providing a priority food safety service to Iceland. This means that Matis' has to provide a certain minimum in services in the field of food safety

and provide secure analyzes of chemicals and germs that could cause food-borne illnesses. The Icelandic Food and Veterinary Authority and Municipal Health Authorities are directly responsible for monitoring food safety and have priority access to our laboratory – this means we have to be constantly on standby to accommodate their needs. These duties are outlined in the legislation for Matis' and the priority to food safety analysis is based on a contract made with the food control authorities.

### Research is also part of our work

Our operations went well in the year 2009 and our projects reflected the power apparent in domestic food production. The division is very service oriented but research is also a part of our work, just as in other divisions at Matis. We take part in international research projects, primarily with other Nordic countries, dealing with the development and validation of analytical reference methods. For us, it is important that we take part in such research to ensure that we utilize the most efficient methods available in the services we provide. We also collaborate in projects domestically, both within Matis and other outside parties.

### Courses around the country

The consulting department is involved with the quality and safety of food. Management teams in the food industry are consulted through educational courses on how to set up quality systems. Courses are also taught to government officials responsible for control of the food industry, and even for employees at various food production companies. The demand for courses has increased substantially, which drives us further towards improved food safety in Iceland.



## Utilizing Matis' specialized research services

"Ever since its formation, Matis has handled the microbial research of our materials and finalized products, as well as environmental samples. The cooperation is a regular part of Actavis' production and has been highly successful since the beginning," says Herborg Hauksdóttir, responsible for quality assurance at Actavis pharmaceuticals. She also says that Matis saves the company the cost of building a specialized research facility.

Herborg says that updated methods in microbial analysis have always run smoothly with Matis' specialized staff. "Our work is conducted under certain requirements from the drug administration, both in Iceland and in other markets, and we chose to utilize Matis specialized staff and facilities for this purpose," says Herborg.

As well as handling microbial analysis on materials and finalized products for Actavis, Matis handles the processing of environmental samples where, for example, water is monitored as well as other environmental factors within the company. "We must hold out strict requirements and that is why we choose the best research service available to us," says Herborg Hauksdóttir

## Courses: A growing factor

"A wealth of knowledge and material is found at Matís, all of which we utilize in our courses. This is all aiming to improve food safety in Iceland, which is ultimately our role," Says Margeir Gissurarson, project manager for Analysis and Consulting, about the courses Matís organizes all over Iceland.

The division offers a variety of scheduled courses, as well as offering courses on specific subjects requested by our clients. "The courses and their content depend on at which groups they are aimed. In some cases we have courses where all employees within a company take part in the coursework, whereas in other cases we only have its management, quality managers, for example. We have also had courses for employees at the Icelandic Food and Veterinary Authority, whose main role is to monitor food production in Iceland. Matís' involvement through the courses affects many aspects of food production in Iceland," says Margeir. He also considers the demand for courses to be high - regardless of the economic crises. "We have only noticed that the demand for our courses is high and increasing."

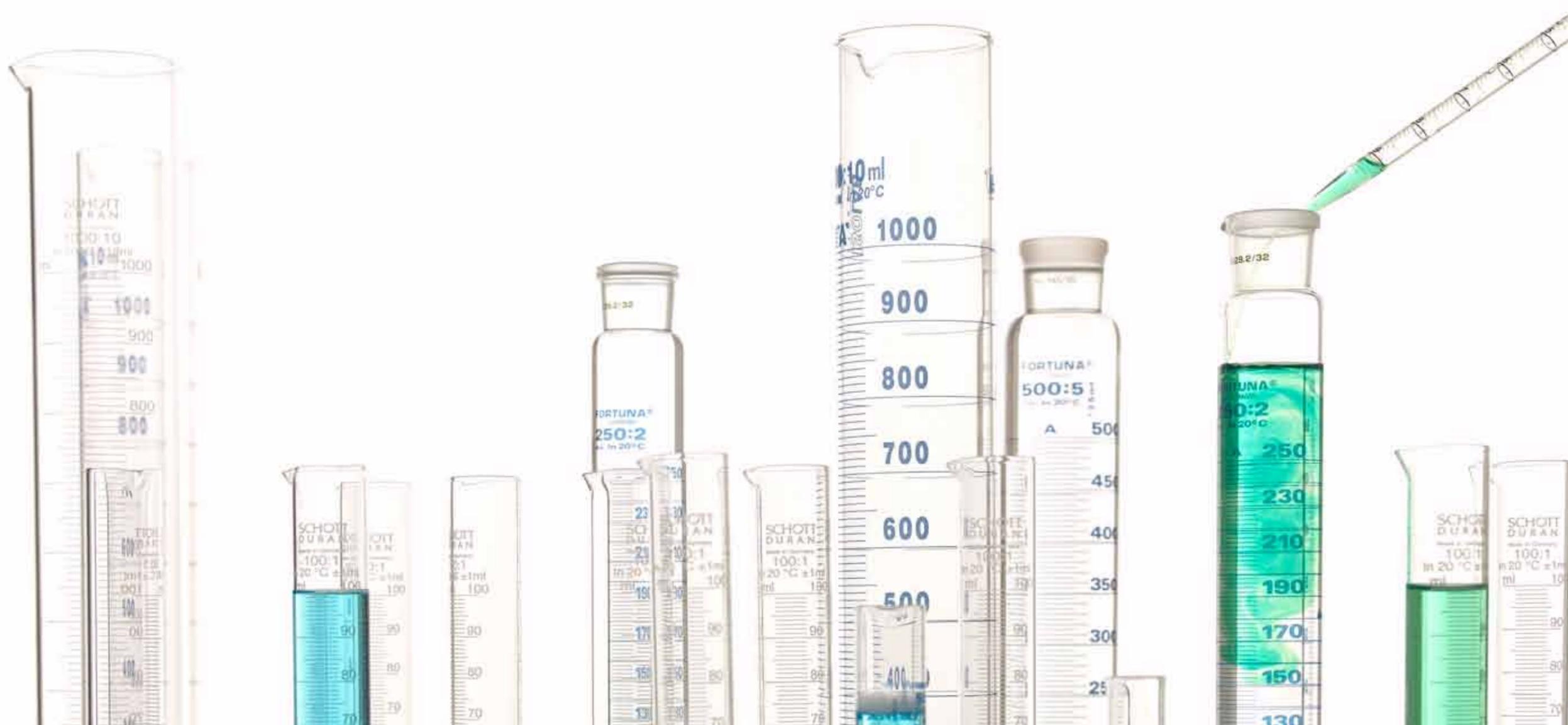
Matís has worked closely with the United Nation Fisheries Training Program, handling the teaching and management of the school's Quality Management line. Matís held, in cooperation with the school, a couple of two-week courses in Kenya, the purpose of which

## No doubt of the course's worth

"We commissioned Matís to develop a course for the employees of Íslandssaga and Klofningur. About 110 people attended and the course covered matters related to production, hygiene, marketing and more. It is very valuable for us to have access to courses like the ones supplied by Matís and I am in no doubt that they will have significant effects," says Óðinn Gestsson, Managing director of Íslandssaga in Suðureyri, about a course Matís held in the beginning of December 2009.

Íslandssaga is a fishing company specializing in catching and processing fish products for export and Klofningur handles fish drying. Matís handled the topics related to production, processing procedures and hygiene whereas the companies' management handled the discussion on marketing. Almost half of the town attended the course, which is not a daily occurrence!

"The course was a gift from Íslandssaga to its employees to mark the company's 10 year anniversary. There is no doubt in my mind that our employees gained significant benefits from attending the course and listening to the informative lectures given by Matís' specialists as well as the discussion that followed, concerning matters relating to production and cleanliness. At the end of the course we received a summary of the course material as well as a



Guðjón Þorkelsson, division manager for Innovation and Consumers

# Revival of local food production and processing

There has been a significant shift in interest towards local food production after the economic collapse. Attitude of producers, consumers and the government changed. 2007 and 2008 saw an increase in small-scale industry and food production and it exploded in 2009. At Mátis we were fortunate to have prepared for this new interest – we had set up a food product development centre for small scale producers in Höfn in Hornafjörður. Now there is a clear revival of home- and small-scale production of all things Icelandic. This revival is here to stay!

## A growing small-scale production

Collaboration with local small-scale producers has increased. We also work on projects that are useful to large production companies both in agriculture and fishing industries and we are partners in large Scandinavian and European projects as well as various collaborative efforts with other divisions within Mátis - an example of which would be the Chill On project where we look at optimizing methods of transporting fresh food in trade between countries. The project aims to ensure the freshness and quality of the product through detailed studies of sensory, microbial properties, logistics, supply chain management and traceability.

## Diverse projects within the division

The division's emphasis can be divided into a few different parts. Firstly, it is on projects dealing with the stability of food, such as taste, shelf life and distribution. The results will benefit exporters, primarily those who export fresh food.

We also study and draw attention to how local breeds, production systems, environment, tradition and treatment make raw materials and food products of Iceland unique. Lamb meat is one example. The lamb muscle has high proportion of omega-3 fatty acids and high amount of iron giving the meat flavour of wild game meat. The flavour is influenced by the wild pastures. It is derived both from

grass and aromatic and spicy plants the lambs graze on. Some subtle differences have been documented between the flavour of meat from lambs grazing in the highlands, lowlands and by the seashore. We are also interested in the promotion of traditional foods to domestic and international markets. We advice farmers on how to adapt traditional Southern European method of drying meat to lamb products. By doing this, we are promoting food tourism and the idea of regional foods. We are also cooperating with Norway and the Faeroe Islands on a similar project where we combine all of our lamb meat traditions, in an attempt to develop the uniqueness of dried lamb meat products.

These projects are all examples of how to create specialized products – which are of significant importance in rural development in Iceland.

Within the division, specialists work on scientific research aiming to assess the consumer's view towards food – with an emphasis on fish. They look at how consumers from different countries and of different ages view fish and its characteristics, depending on how the product looks e.g. fresh or frozen. This helps us to determine the possibility of marketing a product to specific groups of people with a product designed to their specific needs and preferences.



## Food Centres

Mátis' food centre in Höfn in south east Iceland was opened towards the end of 2008, under the division's control. It gives small-scale producers of food the opportunity to seek consultation and start product development and production in a fully equipped accredited facility. The facilities have already been extensively utilized and Mátis plans on carrying out similar operations through other food centres. The year 2009 saw the arrival of two new food centres: one in Egilsstaðir in the East of Iceland and one in the south of Iceland. We will continue in the same direction with projects related to food centres and small-scale production of food.



## The food centre was the key to making Hundahreysti a reality

“The facilities and consultations we received in Matís’ food centre in Höfn in Hornafjörður was the key to making the company a reality,” says Kristín Þorvaldsdóttir, who is a trade expert for the company Hundahreysti which released a new kind of feed for dogs in the beginning of April last year. The feed is based on a Swedish recipe but it contains Icelandic produce. Kristín and her husband Daníel V. Elíasson, who is a food specialist, own the company.

They were first introduced to fresh feed for dogs in Sweden, and after moving back to Iceland they planned on importing the feed but it was impossible due to import restrictions on fresh food. Kristín works within the Icelandic Kennel Club and so she decided to combine her education and her interest and start a company around the production of the feed. This decision was made in fall of 2008, just as the country fell into an economic recession, which suddenly halted all funding opportunities.

“The cost of setting up the production was very difficult for a small-scale producer, but in the beginning of the year 2009 we were informed of the possibility to start our production in Matís’ food centre in Höfn. So, we went and started experimenting with adapting the Nordic feed to Icelandic conditions, after which the production process started. In Höfn, we were able to work in the surroundings needed for the production and access to Matís’ specialists who assisted us throughout the process. We then moved to a 270 square meter production facility in Kópavogur 10 months after the product was launched,” says Kristín..

A group of dog owners were brought in for preliminary testing of the product most of which are devoted customers of Hundahreysti today. About four tons of feed is produced monthly. The feed contains raw Icelandic Lamb meat, beef belly and beef blood. . Other ingredients include: potato fibres, wheat bran, calcium, minerals and vitamins. The feed contains raw meat – which explains why it is fresh feed. The feed is sold frozen and it can be stored for about a year in a freezer. Nordic fresh feed is an all-round feed for dogs that requires no supplementary feed or added ingredients.

Fortunately, we did not allow the economic collapse stop us from carrying out our dream and this is thanks to Matís’ specialized assistance,” says Kristín at Hundahreysti.

## Food tourism to sustain rural communities

“The project’s aim is to utilize locally produced food to increase sustainability in the tourism industry. This aim is primarily based on our ideology to systematically introduce local produce to tourism services in a specific area,” says Guðmundur Heiðar Gunnarsson, Matís’ research group leader in Höfn in Hornafjörður and manager of the Sustainable Food Tourism project, which started in 2009. It is conducted in three regions around Iceland – East-, West- and South Iceland. We then choose smaller core areas from within these regions, based on certain criteria.

“The gain from sustainable food tourism is economic, social and environmental. Profits are optimized within smaller economic areas by connecting small-scale producers with the local tourism industry. However, our main emphasis build up each region as a whole by linking small-scale and larger producers in together. He mentions two examples:.

“In the West of Iceland we have strong fish markets and substantial quotas in Snæfellsnes. In both areas there are travel agencies and both parties could significantly gain from increased business between them. We have also looked into forestry in the East of Iceland and how that can be used in relation with tourism services.”

There is a lot to gain from food tourism because food is a crucial factor to tourists. “Food is one third of people’s consumption when travelling, while entertainment is only one tenth of the consumption. This gives us a huge slice we can and must utilize in a more systematic way,” says Guðmundur H. Gunnarsson

## Local grazing gives local flavour to lamb meat

Sensory and chemical analysis of the flavour of lamb meat has been carried out. Meat of lambs grazing pastures rich in angelica, highland, lowlands and pastures by the shore has been analysed. The aim was to see if a noticeable difference could be detected. Aðalheiður Ólafsdóttir, sensory scientist within the Innovation and Consumers division, says that this was the case.

“The project included odour detection of the meat where we measured volatile organic compounds. When results were then compared to sensory analysis we could connect two volatile compounds to a spicy taste and smell of the lamb meat that had been fed on angelica. These compounds can also be found in angelica, which led us to conclude that the compounds had a direct affect on the taste and the smell of the meat,” says Aðalheiður. After the angelica project, another project was conducted where lamb meat from different feeding grounds was compared.



## A few other selected projects in Innovation and Consumers

### Efficiency and quality in the processing of farmed cod

Cod farming is increasing rapidly in the Nordic countries. In 2001, the production was 1.000 tons of cod, but increased to 15.000 tons in 2008. It is expected that the production will increase further to 35.000 tons in 2010.

### Muscle spoilage in *Nephrops norvegicus*

Muscle Necrosis in *Nephrops* has increased dramatically and currently in some cases it is observed in majority of the catch. Muscle Necrosis (MN) reduced both taste and texture properties of *Nephrops*.

### Fishing, processing and export of live Ocean Clam

Start fishing and processing live Ocean Clam. Further business relationship in Europe for such products will be created. The aim is to increase the current value of the product at least tenfold.

### Chill-on

The aim of this project is to increase reliability the safety of fresh and frozen fish during transport and at the same time improve supply chain management with the overall aim of maximizing the product price with respect to raw material and market conditions.

### Air dried meat in food tourism

The aim of the project is to prepare a collaborative R/D projects between partners in Iceland, Faeroe Islands and Norway on air dried lamb meat in connection with the creation of small and medium companies food culture and food tourism.

### Public fish market

Explore the basis for establishing fish market in Iceland for the public as well as tourists; opportunities and obstacles. Propose ideas for presentation of such a market (within the Capital area vs villages around the country).

### The Quintessence of Fish

The goal of this project is to increase the consumption of Icelandic seafood, increase the value and create a more positive image of it domestically and abroad. This will be done by producing a television series which will show the inexhaustible possibilities of preparing fish for consumption.

### NORA-dried lamb meat

The aim of the project is to find out the interest and need to work together in a Nordic R/D project to solve common safety and quality problems and tasks in the production, marketing and documentation of the processes and the properties of dried and cure lamb meat.

### Ready to eat salted cod products

The aim of the project can be divided in two parts. First to develop salted cod products from off cuts which will be marketed domestically and secondly to develop bacalao balls from more inexpensive raw material e.g. pollock, tusk and ling instead of cod.

### Development of healthier ready to eat meat products

The aim is to develop healthier processed and ready to eat meat products with less salt and energy form saturated fat and with more of positive components that have been proven to slow down weight gain and coronary heart disease.

### Arctic Tilapia

The aim of this project is to develop valuable products to make farming of Tilapia in a simple RAS system using the cooling water from geothermal power plants economically feasible.

### Integration of research on chilling

The objective of the project is to be the platform for optimisation of chilling technologies for fishery products and seafood to ensure their quality and provide stimulus for the practical application of the information and knowledge required for marketing.

### Delights for tourists

The project goal is to assist local people and tourists to access raw material in gourmet fish dishes all over the country. Recipes with local ingredients and herbs will be developed.



Sveinn Margeirsson, director of Value Chain and Processing

## Working alongside the food industry to increase value



The division's primary objective is to help our customers find ways to improve the efficiency of their production processes and to increase value creation and profitability. The basis of our developmental work is the entire value chain; from raw material to final product, and the added value this chain brings. The customer is supplied with a product according to their requirements, so our involvement can be the entire value chain or specific elements.

### Projects diverse in size and scope

The Value Chain and Processing division responds to the demands of the Icelandic food industry, offering consultations, solving problems or conducting projects that help to bring about new production processes and respond to new market opportunities. The goal is to bring in new income for the food industry and reduce expenses; the key is always improved performance.

The division's customers are primarily local food production companies and, until now, mostly the fisheries sector. However, there has been a distinct rise in customers from other sectors and projects are now being conducted in meat and milk production. Our customer group also contains international companies and cooperative partners in various research projects.

Our projects are diverse both in size and scope. The larger research projects are usually built up around ideas brought to us by our collaborating companies, which we first develop into a project and then seek support to conduct. The seafood processing industry in Iceland has received substantial support domestically from the AVS research fund, as well as the Rannís Technical development fund, for projects promoting value-adding activities, which has produced very positive results for the economy as a whole. Other projects are conducted as a service to various companies, where we work as consultants and solve specific problems related to their production processes.

### Value-adding opportunities in the transportation of fresh fish

We cover a wide area of expertise, including processing optimization, applications of traceability, packaging solutions, transportation technology, storing technology and various other factors. Our knowledge is utilized within a certain area of food production, but is often transferrable to other areas. One example might be how traceability applications in fisheries can be utilized in the meat or milk industries.

The company's primary value is the high quality of the employees. Direct cooperation with the Icelandic production industry has given the employees practical experience that cannot be learned through books. Furthermore, the experience and connections we have established have given us an accredited status in international development projects. It is of the utmost important for Matis to retain the highly experienced specialists within the company, as well as building up future cooperation with the food industry and academia.

When marketing food internationally, finding ways to efficiently export products may be a major challenge. Fresh fish exemplifies this challenge and is a good example of a field with a lot of value-adding opportunities. The quality and freshness of the product are most important to customers, but air transport is not economical and has



high environmental impact. A significant percentage of fresh fish has been exported by air, but we sometimes experience fluctuations in temperature in air cargo. It therefore is essential that the packaging used for air travel ensures sufficient handling of the product. Our research over the years demonstrates that this is not always been the case and therefore we have collaborated with packaging producers to solve this issue. Another great value-adding opportunities for the Icelandic export industry is the development of technology that enables us to ship fresh fish overseas instead of by air. Not only do we add value to the product, but we also take a huge step in environmental issues by reducing transport emissions. Reducing our impact on the environment is becoming an important part of our work.

### Experience from the meat industry can be used in fisheries

One of the projects conducted in 2009 was done in collaboration with Mjólkursamlag KS, which addressed the efficiency of cheese production and another was a collaborative project concentrating on meat production costs and the losses in the production process. In many ways Icelandic fish production is more straightforward than the production in meat industry. However, there are various techniques that have been developed for meat processing that can be applied in fisheries. The value of a product increases as it moves further down the value chain, and we see this as an opportunity for the Icelandic seafood sector to go further into high-value product development. Such development would be well within Matis' expertise.

## TrackWell used in projects related to the SeaData-quota databank

"In recent years, TrackWell has developed an electronic fishing logbook. We are, in cooperation with Matís, carrying out various projects that utilize the data from the logbooks and integrate them with data related to production, environmental issues and more. Matís has contributed their specialized knowledge to the projects, which has helped us to build on our knowledge of fishing procedures," says Kolbeinn Gunnarsson, manager of sales and services at TrackWell, the company that produces the SeaData e-logbook software. The logbook is well known to the Icelandic fishing fleet, and will be compulsory from mid 2010. The system has become increasingly popular internationally as well.

The SeaData e-logbook contains in-depth information on the volume of the catch, fishing locations, sea temperature, information on gear type quality assurance and more. Part of this information goes directly to the Directorate of fisheries, but fisheries fish production companies can use the system for their internal management. SeaData provides its customers with an overview on a range of factors and enables them to share and compare data.

"The progress from our cooperation with Matís in developing the system has been highly successful and has resulted in software that gives our customers many functions and a good overview of their work. The primary aim of fisheries is to add value to their production and SeaData is intended to further improve this," says Kolbeinn Gunnarsson of TrackWell.

## Value created from nothing!

The year 2009 saw the end of an interesting project in decreasing deterioration in the value-chain of meat, a project in which Matís employees from the 'Value Chain and Processing' division took part. The project was based on a very simple principle but nonetheless an important one – to create value out of nothing!

The project's primary aim was to decrease post-harvest losses the value chain of meat products, for instance because

they pass their sell-by date. The project was conducted by a wide group of specialists. Matís conducted mapping of the whole value chain; other cooperative partners included Sláturfélag Suðurlands (SS), Norðlenska meat productions, Nóatún and Krónan (retailers), AGR software company and the Commercial Research Center (Rannsóknarsetur Verslunarinnar).

The results from the projects were quite satisfying. AGR implemented software solutions for improved management, based on the mapping of the value chains and utilization improved.

## It is important to have access to companies such as Matís

"It is important for production companies, such as us, to have access to a research company with the caliber of Matís. The milk production industry in Iceland is small, which does not enable us to focus on performing basic research or develop new methods and technologies – that knowledge is mostly acquired from overseas. However, this does not stop us from using Matís' specialized knowledge and resources in various beneficial ways," says Jón Þór Jósefsson, quality manager for Mjólkursamlag KS in Sauðárkrókur.

Matís and Mólkursamlag KS have recently collaborated in a two projects. One of the projects focused on the utilization of the vast amounts of cheese whey produced at Mjólkursamlag KS. The company Iceprotein in Sauðárkrókur has also been involved with the project; one third of the company is owned by Matís. Such projects include product development, production planning, as well as budget planning and ROI calculations for the production.

"The other project involved getting students in industrial engineering at the University of Iceland, under the guidance of Sveinn Margeirsson, director of Value Chain and Processing at Matís, to go over all of our operations, production- and work processes. This was done as a masters' project. The research has been carried out at our facilities and we have been working on ideas on how we can improve the efficiency of our entire operations – such as amounts of hours worked to specific factors in our production process," says Jón Þór.

## Our aim is to help with research and development

"At Vísir, we have had effective and diverse cooperation with Matís. The collaboration enables us to study and develop new methods and technologies - which has brought about significant improvements to the company," says Erla Pétursdóttir at the fishing and fish production company Vísir, in Grindavík.

Erla, on behalf of Vísir, took part in a project with Matís in the beginning of the year 2009 called FisHmark, a project designing margin computational models for fisheries. "The model is based on large amounts of information on fishing trails, catch, ships, production, goods, etc. The software takes data from electronic logbooks into account, as well as data from information systems from production and is supposed to help managers get overview of their operations. This is a very interesting tool for a company such as ours," says Erla. TrackWell and Maritech as well as other Icelandic fish production companies are also involved with the project. "Our role in the project is to assess the equipments user value"

Amongst various production related projects, in the last couple of years Matís has collaborated with Vísir and TrackWell on a project relating to the traceability of products. This was also carried out in the year 2009. "Traceability is becoming an important factor in food production and I think there is a lot to gain from developing it further," says Erla Pétursdóttir at Vísir.



## A few other selected projects in Value Chain and Processing

### Processing in line boats

The object of this project is to improve the process in line boats, by reducing production costs, improve work conditions and product quality. The intention is to carefully observe the process from the bating of the line and until the fish is packed.

### Thermal modelling of chilling and transportation for fish

The aim of the project is to improve techniques and equipment used for fish transportation through analysis of transportation chains, experiments and computational modelling.

### NICE - protein

The aim of the project is to improve the competitiveness of the industry by industry driven research.

### Gathering data for distribution, biology, and utilization of Mackerel

During the last decade Mackerel has been observed in Icelandic waters in increasing numbers. This is most likely due to rising sea temperature. The aim of this project is to gather primary information about distribution of Mackerel around Iceland, it's distribution and utilization.

### Rapid measurement technology for food processing

The project aim is to improve food processing by studying new fast quality indicating measurements for food industry and to design processes that use these technologies.

### Increased value of pelagic species – improved chilling methods

The aim is to invent a new method for chilling and storing pelagic species on board purse seiners. The result will be decreased energy consumption, lower running cost and better quality of landed catch.

### Development of a process for enzyme treatment of liver before canning

The aim of the project is to increase the profitability of canned liver by reducing the production cost and increase the quality of the product. This will be achieved by developing a process for enzyme treatment of codliver before canning, to remove them.

### Homogenisation – increased value of fish minced

The aim of the project is to use homogenisation to improve condition and properties of fish mince for injection into fish fillets.

### Linofima

The project's objective is to establish a powerful R&D network, to enhance project work that will increase the value of fish caught on line.

### Improvements in the food value chain

The aim of the project is to promote improve efficiency and reduce waste in the food value chain.

### Fishing, grading, processing and marketing of mackerel products catches by pelagic vessels

The aim is to examine fishing on mackerel on Icelandic fishing ground, perform geometrician measurements, find the best solution for mackerel for grading by size and species on board and how to process it in freezer vessels.

### SILLQUID

The main object is to verify whether the recently developed MW-spectroscopy tool can be used to predict catch area, fat content, fat composition, lipid oxidation level and certain other parameters of unique herring samples collected.

### e-REK

This project aims to specify, develop/adapt and evaluate an electronic traceability system where different information sources related to food safety and suitable enterprise management systems are integrated.

### Automatic pinbone removal from white fish fillets

The goal of this project is to develop a technology which automatically removes bones from white fish fillets.

# We have a leading role to ensure food safety in Iceland

The primary aim of the division is to ensure food safety and improve the competitiveness of Icelandic food products on the global market. We do this by participating in various monitoring and safety services through chemical and microbial research for the food and fisheries authorities as well as through cutting edge research and risk assessment of undesirable chemicals and microorganisms in food, feed and the environment. The goal is to improve quality and safety in food production and the environment.

## Three research groups

The division is divided into three research groups, each with a different emphasis. The majority of the projects fall under the research groups, chemical and microbial research, where data regarding undesirable substances, nutrients and microorganisms in food, feed and environment are collected. Many of these projects are performed in cooperation with domestic and international food producers, research institutions, universities, governments and organizations that provide various services to the food and feed industry. The third research group specializes in risk assessment and works in cooperation with the other two groups. The risk assessment group has been coordinating the EU project QALIBRA. The central goals of QALIBRA are to develop innovative approaches for the assessment and communication of net health impact of dietary choices. To maximise dissemination and uptake of the project outputs, they will be implemented as web-enabled software for quantitative risk-benefit assessment of dietary choices.

Employees within the research groups have also been working on constructing a databank containing information on undesirable substances in Icelandic food. The aim is to fulfil a need for independent data for food authorities, industry, markets and consumers.

Anna Kristín Danielsdóttir,  
director of Food Safety and Environment

## Chemical research supports exporters of Icelandic marine products

The chemical research is responsible for monitoring of nutrients, as well as undesirable substances in food, feed and the environment. The purposes of these monitoring programs are to gather information and evaluate the status of Icelandic products regarding undesirable substances. Further, they provide documentation that Icelandic products conform to regulations regarding food safety and thus can be used to maintain the good image of Icelandic products. The research is conducted according to international standards and the results are therefore comparable to data from other countries.

The monitoring programs for undesirable substances in seafood was initiated 2003 to gather information on various pollutants in a number of economically important marine species for Icelandic export. Since then this data has been used to support our statements regarding the quality and safety of Icelandic seafood. Furthermore, our contacts within the seafood sector have informed us that this data from Matis has been utilized extensively in the fisheries sector for marketing purposes.

Chemical research and monitoring is also utilized for other foods produced in Iceland e.g. fruit and vegetables. Thus, Matis plays a significant role for the authorities to ensure that the consumers of food in Iceland are eating safe and wholesome food products.

## Molecular methods make the difference in microbial research

Microbial diversity analysis in food and in the environment is an important topic in the division of microbial research. Emphasis is on improving knowledge of microbial diversity and function in various environments in order to enhance food safety and to understand their influence on live conditions for other organisms. Utility and harmfulness of terrestrial and marine microbes for other organisms is addressed to improve safety of Icelandic food products. Places where pathogenic microorganisms can thrive and disseminate causing epidemic outbreaks are mapped. This knowledge is crucial to better understand the origin and spreading of pathogens and to prevent new epidemics.

Progress has been made in developing rapid and more rigorous methods to analyze microorganisms in food and environment. Such methods which are based on genetics have gained international recognition. Results are now obtained in few hours instead of several days with previously methodology. This is a significant improvement, especially as short detection time can be crucial for increasing food security. Food production companies benefit from this improved efficiency, as it enables them to better control their internal quality control and marketing strategies.



## How do various food ingredients influence our health?

"Food contains many beneficial ingredients, but can also contain potentially harmful substances. Potential benefit and harm can be present even in the same ingredient. For example, vitamins and minerals are necessary micronutrients but excessive levels could result in adverse effects. Many other examples can be mentioned e.g. fatty fish may reduce the risk of heart disease but can contain contaminants, fruits and vegetables are good for health but can contain pesticides. Therefore, food and food ingredients can be both beneficial and adverse

In the case of food, it is usually the case in Europe that information on risks and benefits is presented separately. This approach can be unhelpful at best, because it leaves consumers and those responsible for advising consumers, uncertain as to where the balance lies between potentially positive and negative effects. At worst, it could lead to dietary choices or recommendations with unexpected and unwanted consequences.

This is the issue that the EU project, QALIBRA, is aiming to address. Ideally, information on risks and benefits need to be combined to indicate the overall effects of particular dietary choices, and provide an assessment of the resulting impact on health. With this in mind, the key aim of QALIBRA has been to develop improved approaches for the assessment

and communication of the impact of dietary choices on health, and to present the methodology as web-enabled software ([www.qalibra.eu](http://www.qalibra.eu))," says Helga Gunnlaugsdottir, research group leader for chemical research and coordinator for QALIBRA. The QALIBRA project is partly funded by the European Commission's 6th Framework Programme (contract number FOOD-CT-2006-022957). The project began April 1st 2006 and will run until end of December 2009.

"Matís has gained considerably from this project and we have also contributed important knowledge about fish and its nutrient composition," says Helga Gunnlaugsdóttir.

## Research on unique microbial ecology in Skaftárvatn

"Our research on the unique microbial ecology in Skaftárvatn are not only a basic research on extreme life in a unique environment but can also be regarded as applied research at the same time." says Viggó Þór Marteinsson, group leader in microbial research, about the research project in sub-glacial lakes Skaftárvatn. Viggó has, in cooperation with other scientists in the project, been using DNA sequencing technology to detect both cold and heat loving bacteria in

the western sub-glacial lake and similar bacteria in the east sub-glacial lake. The bacteria were detected and isolated from these sub-glacial lakes located under 300-meter thick layer of ice. The research is considered to help scientist to understand how life on other planets might possibly be or detected. Cooperative partners include: The Icelandic Met Office, The National Energy Authority and the University of Hawaii (NASA).

We drilled through the 300 m of ice covering the sub-glacial lakes, revealing the water inside, which is at 100 meters depth. Samples from the water revealed both cold loving and hot loving bacteria. Similar bacteria could also be detected in glacial outburst (jökulhlaup) from the eastern sub-glacial lake.

"New DNA sequencing techniques have enabled Matís to gain better resolution on microbial diversity than was previously possible. Traditional DNA sequencing techniques revealed diversity results that showed quite homogeny diversity but the new technology showed more variation in the bacterial diversity. The unique cold loving community of microorganisms found there (at 2-4°C) live on hydrogen and carbon dioxide, forming acetate which is quite unusual, Such environment isolated from the surface with thick ice makes the habitat rare and one of the more unique in the world," says Viggó.

New strains of cold loving bacteria have been isolated from the sub-glacial lakes and by new technology in genetics we hope produce bioactive molecule that can be used in biotechnology and in other fields.



## Matís takes part in one of Marel's research projects

"We have collaborated with Matís on a few projects and two of them started in the year 2009. These projects deal with automatic cleaning methods and rapid measuring methods" says Kristinn Andersen research director at Marel - an internationally established company in the field of food processing technology.

Automatic cleaning refers to the development of equipment, which is attached to Marel's food product lines and the cleaning process is somewhat automatic. Matís' employees collaborate with Marel's development department and the meat production company Norðlenska. "The technology has been used in meat production but we hope to be able to transfer the development into fisheries and chicken production. The benefits of this would be a more efficient utilization of cleaning chemicals and water, which is scarce in many parts of the world. The cleaning process would be more efficient and the quality of the product would increase, as well as consumer safety. Matís contributes as well their expert knowledge in microorganism that might affect the production process and safety. Microorganisms found in the processing area come mainly from three different sources; from the raw materials such as meat that is handled in the processing line, from the working environment and from people working on the production site. "Matís will also perform bacterial measurements and analysis of the various techniques and technologies that are being developed," says Kristinn.

## A few other selected projects in Food Safety and Environment

### Safety monitoring

This project was started in 2003 at the request of the Icelandic Ministry of Fisheries and Agriculture. Until then, monitoring of undesirable substances in the edible portion of marine catches had been rather limited in Iceland.

### Systematic analyses of analytical data from quality control of drinking water

The quality and safety of Icelandic drinking water has been controlled and monitored for many decades. The current Icelandic regulation on drinking water was issued in 2001 and is based on the EU drinking water directive.

### Factors influencing the quality of the Icelandic cod; a value chain perspective

The aim of this project is to collect more detailed data about the factors influencing the quality of the Icelandic cod, like chemical composition (nutrients, undesirable substances), fillet quality through the processing and the condition of the liver.

### Autocleaning in foodproduction

The objective of the project is to develop and market technology for in-line automatic cleaning in food processing, which will be novel in this field.

### Subglacial lake - Skaftárkatlar

The Icelandic Centre for Research has in 2006 and 2007 funded expeditions to explore the glaciology, hydrology, geochemistry and microbiology of the Skaftárkatlar subglacial lakes beneath the Vatnajökull ice cap in Iceland.

### Nutrient composition of seafoods

The aim of this project is to collect information on the nutrient composition of seafood products and make this information available for consumers, producers and seafood dealers.

### Qalibra

The key aim of QALIBRA has been to develop improved approaches for the assessment and communication of the impact of dietary choices on health, and to present the methodology as web-enabled software ([www.qalibra.eu](http://www.qalibra.eu)).

### Food safety and added value of Icelandic fishmeal

The aim of this project is to develop novel analytical techniques for the simultaneous determination of toxic and non-toxic arsenic species in fish meal.

### SafeSalt: Quality control of bacalo salt

The main objective of the project is to develop a rapid method kit to evaluate the quality of salt used in production of salted fish, in order to reduce the risk of yellow discoloration.



## International Relations

### Significant gains from international relations

International relationships are an important part of Matis' operations, which can be seen through various facets of Matis' work. This includes: collaboration with international researchers on research and science projects, and projects which provide international parties with research services. The latter does not include various collaborations conducted internationally e.g. meetings and conventions, where Matis' employees meet foreign specialists in their field. This all contributes to the enhanced growth of Matis as a company and an increased knowledge base amongst its employees.

Modern technology is constantly improving the way in which international science projects are carried out and Matis utilizes this to its fullest. It enables us to increase sales of research services and, consequentially, an increase in international revenue for the company. It will also improve the knowledge base on which Matis builds its services for its domestic customers.

Gain is a key word for our international collaborations, be that for Matis as a company, its employees, its customers or its owners – the Icelandic government.

## Cooperative partners

Matis emphasizes cooperation and collaboration with domestic and international educational institutions, researchers and companies. Here are a few projects Matis cooperated on in the year 2009.

### Cooperation with Havbruksinstituttet in Norway

Matis and Havbruksinstituttet in Bergen signed a contract in 2009 regarding the use and development of DNA technology, which has been developed in both

companies for the last years. This contract also states that Havbruksinstituttet will market the products in Norway. Matis conducts projects in DNA genotyping of cultured and wild fish and other sea animals and tools to analyse data. Projects also include DNA sequencing of bacteria and viruses for the development of fast RT-PCR methods of detection as well as the development of new genotyping sets for animals.

### Cooperation with the University of Florida

Matis has collaborated extensively with the University of Florida, the second biggest university in the United States with over 50.000 students. The cooperation involves extensive research on the bioactivity of natural substances from Icelandic nature. This research has produced significant amount of important results, which indicate how powerful the substances are against oxidation stress in the body and their ability to reduce blood pressure.

We are now working on profiling cell systems to explore the activity of substances against all sorts of cancers. This knowledge and methodology was transported to our biotechnology lab in Sauðárkrúkur towards the end of 2009. This work has provided significant information that enables Matis to produce stable bioactive material from Icelandic substances with scientifically proven bioactivity. The demand for such substances is increasing and is becoming highly valuable.

### Bitland Enterprises

The cooperation with Bitland Enterprises (BE) has enabled Matis to offer services and consultations to more places in Northern-Europe than before. This includes cooperation with companies in the food industry and various cooperative projects through European research funds. One of Matis' aims is to offer consultations and services to the food industry on an international level and the cooperation with BE will enable Matis to further advance this aim. Matis has already taken its first steps in cooperating with the Norwegian research company SINTEF.

Matis hopes that the contract with BE will improve its opportunities in other areas. BE, which is based in Denmark and the Faeroe islands, has considerable experience

managing projects that have been granted through funds or executed in collaboration with companies from various industries. Matis will aim to offer BE's services in Iceland. "Our primary goal is to offer the food industry in Iceland, the Faeroe Islands and other countries better resources to further improve and develop their industries. We also emphasize the importance of further enabling Matis and BE to take part in innovative projects, especially on an international level" says Sjöfn Sigurgísladóttir, Matis' CEO.

### Joint forces: connecting science and research to businesses

The RU (Reykjavik University) Open University has signed a contract with Matis on developing courses, programs and teaching methods, to further advance education in the Icelandic economy.

Innovative training and education of leaders, specialists and employees of companies has given Matis and the RU Open University the opportunity to increase their competition and enabled them both to be creative forces in these turbulent times of change.

"The Open University's ambitions lie with the ability to offer Icelandic businesses access to highly skilled specialists and we are happy to be able to offer more study programs to our university through our contract with Matis" says Guðrún Högnadóttir, managing director for the RU Open University.

### Part of Matis' Business Partners





Sjöfn Sigurgísladóttir, Matís' CEO, considers the contract with the RU Open University to be a suitable addition to Matís' operations as it fulfils one of the company's primary aims: to be a leading force in promoting high quality education to academia in Iceland and internationally. "In this way that we join forces with academia to connect science and research to businesses" says Sjöfn.

The RU Open University aims to, in collaboration with Matís, enrich Icelandic society through promoting and activating education outside the traditional borders of education at a university level. By doing this, Icelandic companies can now improve their business environment more efficiently than before through systematic training and education of employees.

### Continued cooperation with the Iceland Academy of the Arts

Matís and The Iceland Academy of the Arts signed a contract in 2009 that will ensure successful cooperation between the institutions.

Matís is the largest research company in Iceland in the field of food research and safety. Matís' primary goal is to promote the concentric competitiveness of Icelandic produce and businesses, improved health, enforced food safety and sustainable utilization of the environment through research, innovation and services in the field of food and biotechnology.

The Iceland Academy of the Arts is the only university that has been recognized by the Icelandic government in the field of arts, making it the largest academic researcher and developer of arts and art education. The Iceland Academy of the Arts has made research in the field of art part of its mission and is now preparing and designing research related educational programs at a postgraduate level. This refers to artistic research, which bases its methods on the various fields of art and the innovative thinking involved in the process. The contract was signed to further improve the cooperation between the institutions.

### The contract aims to

- Improve the quality and content of theoretical and practical education that students receive in the fields stated within the contract.
- Enhance research within the fields stated in the contract, as well as being the forerunner and leading specialists in innovative creation within these fields.
- Attract international students and specialists.
- Ensure that the quality of the research performed reaches a high international standard.
- Promote development and increase the competitiveness of Icelandic food production by starting collaborative projects between producers, employees and/or students of The Icelandic Academy of the Arts and Matís.
- Jointly apply for foreign and domestic grants together, to enable innovative development projects.
- Utilize each other's resources when collaborating on projects.
- Increase the number of undergraduate and postgraduate students within the fields stated in the contract.

### Icelandic Food and Veterinary Authority - MAST

A contract where Matís conducts tests and provides security services for the Icelandic Food and Veterinary Authority (MAST) was signed in the beginning of 2009. The contract's primary goal is to ensure that MAST has direct priority access to Matís' security services should any food disease break out. Furthermore, Matís must to the fullest extent, ensure that MAST can perform their legal obligation and provide and supervise food surveillance to ensure the safety and quality of food in Iceland.

### AMSUM: ecosystems in the ocean around Iceland

A yearly surveillance project has been conducted since 1989 on toxins in ecosystems in the ocean around Iceland. The project is conducted under a contract with the Icelandic

Ministry for the Environment and it is financed by the AMSUM group, which works on behalf of the ministry and supervises the project. Individuals within in the group come from Matís, The Icelandic Radiation Safety Authority, the Icelandic Met Office, the Environment Agency of Iceland, the Marine Research Institute and the Icelandic Ministry for the Environment.

The pollution of heavy metals in the ocean around Iceland is generally well under International standards, as stated in the latest report Matís released on the changes in the ecosystem around Iceland. Heavy metals are natural elements but their strength can increase through human actions (i.e. mining).

### The United Nations University

The university is a cooperative project between four organizations/companies: Matís, the Marine Research Institute, The University of Iceland and the University of Akureyri as well as Hólaskóli and the University Center of the West Fjords. The Marine Institute governs the school and the manager is Tumi Tómasson.

The university emphasizes practical knowledge and experience and its students work closely with instructors on projects. Job fairs are an important part of the education and they cover about half of the course's six months duration. The university offers special training courses in 3-4 fields every year and the courses take between 4-5 months. Matís offers all students an introductory course in the quality and production of fish; students that are enrolled in the quality line receive additional courses and practical training.

Five students enrolled in the universities quality field and conducted their final project at Matís in Reykjavík. Two students finished projects from Hólaskóli under the guidance from Matís' employees. These projects include subjects such as: traceability, cooling, drying, quality and shelf life as well as compiling teaching material where students work with the needs of their home countries in mind.

On the 10-year anniversary of The UNU Fisheries Training Program the university held a conference on sustainable

fisheries, which they hope will significantly improve the quality of the teaching at the school. Foreign speakers gave the key note speeches on the future of fisheries and the fish industry around the world and workshops were held on following subjects: fisheries management and fish stock assessment, doing business with fish and fish products and quality management in the fish industry, fishing and aquaculture.

### Matís and Landsmennt sign a statement of cooperation

Matís and Landsmennt, the education fund for the Confederation of Icelandic Employees and workers in rural areas, signed a statement of cooperation in 2009.

Matís has an extensive amount of experience and knowledge that grows more every day. One of the company's primary aims is to transfer this knowledge to businesses through courses that educate employees of various food companies. By doing this, Matís hopes to enforce improvements in the food industry by building up a stronger knowledge background within the companies. This will increase the profitability of companies as well as improving the satisfaction of their employees.

Landsmennt is an educational fund for Icelandic Employees and workers in rural areas. There are twenty-one workers unions within the Federation of General and Special Workers in Iceland that are members. Landsmennt's main objectives are to support other projects and develop and motivate individuals doing vocational education. The fund was created to support courses and promote new teaching materials

as well as giving individuals, unions and companies grants for education.

Landsmennt will ensure the availability of professional courses and continuous education of employees by funding courses supplied by Matís.

Contracting parties have declared their interest to increase their cooperation and offer more companies and their employees' knowledge accumulation, designed to their needs.

### Framework agreement with the Institute of Freshwater Fisheries

The agreement's goal is to implement improvements and offer specialized consultations on research projects. The cooperation will mainly be in the field of genetic research and aquaculture. Cooperation between the organizations has already begun with research in strain variations of Icelandic salmon, as well as monitoring their traveling patterns in Icelandic oceans. This research is a part of an international research project on salmon in the Atlantic Ocean.

The results point to significant amounts of variation in the salmon stock in rivers around Iceland. The Institute Of Freshwater Fisheries has been conducting genetic research on strain variations in fresh water fish and Matís has performed various researches and utilized the nature's genetic resources, which has resulted in the accumulation of significant amounts of knowledge and skills in genetic analysis of all kinds of organisms from the environment.

The Institute Of Freshwater Fisheries and Matís will cooperate closely on research projects. These research projects cover fundamental and applied research of nature and genetics with a specific emphasis on strain variations in salmon, trout and arctic char. These kinds of research projects are useful for the management of fisheries and for fish breeding and aquaculture. The framework agreement will bring about improvements for both parties, through the cooperation and sharing of employees and resources. The cooperation's primary aim is to emphasize the accumulation of high quality knowledge, at an international standard.





## Companies

### Iceprotein Ltd. – subsidiary firm

In 2005, the fish industry's Research Institution started the company Iceprotein Ltd. to develop, produce and sell products from fish proteins to use in fisheries and health products. The company has mostly been operated from Sauðárkrókur. New technology has been developed at Matís, which isolates and cleans fish proteins from leftovers that are dispensed during fish production. The proteins can then be used to maximize the utilization of filleting and also to create products such as fish balls and deep fried fish.

There is also a growing market for products that utilize enzymes, ultra filtration and other technologies. This market is based on the health capabilities of the fish proteins and products that can be produced from them. The majority of Matís' shares in the company were sold to FISK Seafood in Sauðárkrókur, but Matís' biotechnology lab in Sauðárkrókur will still work on projects with Iceprotein. Matís still owns one fourth of Iceprotein.

### Prokaria Ltd. – a Matís brand

Dr. Jakob K. Kristjánsson and his associates started the biotechnology company Prokaria in 1998. The company's first emphasis was to produce enzymes from extremophiles. The company then merged with Matís in the year 2006, which has significantly improved Matís' operations in the biotechnology division. Matís' operations in the biotechnology division mostly emphasize three fields: the genetic division, where DNA methods are used to analyze genes in animals; the biotechnology division, where we work on discovering and developing new enzymes for research in the pharmaceutical and energy industries and also bioengineering to design organisms to build chemicals; and the biochemical division, where we work on isolating, producing, transforming and developing bioactive material and food.

### www.prokazyme.com – a Matís agent; online enzyme store

Arkea, Prokazyme and Matís have joined forces to start the online enzyme store, www.prokazyme.com, to promote the marketing and selling of enzymes for research and industrial purposes. Prokazyme's main purpose is to support the product development and research on enzymes.

### Arctic Tilapia Ltd.

Arctic Tilapia Ltd. and Matís have made an agreement involving the redevelopment and farming of Tilapia in Iceland. The cooperation also aims to implement improvements in the product development and further research in the field. Matís has agreed to support research projects related to farming Tilapia in Iceland and has a priority take in any stock issued by Arctic Tilapia Ltd.

## Conferences and Meetings

Matís takes part in many conferences and meetings every year where the company's operations and projects are introduced. Matís' employees also take part in many international conferences where they introduce their work.

Here are a few examples of conferences and meetings that Matís' employees have, directly or indirectly, taken part in the year 2009.

### Innovation

The Icelandic Center for Research (Rannís) held a conference presenting the operations of Icelandic startup companies in Reykjavík's City Hall on Friday 9th and Saturday 10th January.

The presentations began with a speech given by Össur Skarphéðinsson, Minister for Industry Energy and Tourism. The companies then introduced their operations. A special presentation on how a small startup business can connect with an investors and how official funding can support innovative creations was given on the Saturday.

The conference attracted significant amounts of people and was considered a success.

### The Agricultural Information Conference 2009

The agricultural information conference 2009 was held on February 12th and 13th in deCODE's conference center and the conference halls at Hotel Saga.

The agricultural Information conference is a platform to present results from new and innovative research. The conference reflected the extremely high quality and diverse research and developmental work that has been performed by agricultural organizations all over Iceland. The organizers of the conference organized an excellent event and received due credit for their work.

The conference offered a diverse selection of speeches, many of which Matís' employees delivered, as well as offering various posters and flyers on their projects.



### A date between the job market and the knowledge center

The Vestmannaeyjar Knowledge Center invited representatives from businesses and the public to an open workshop on February 9th, at 17:00 in Alþýðuhúsið.

The aim was to introduce the public and business representatives to the Knowledge Center and its operations. Various smaller workshops were set up where people could share ideas and determine how these ideas could become reality.

Matís was an active member at the conference and took part in many of the workshops.

### The MARIFUNC conference

The second MARIFUNC conference was held on the 19th March 2009 at the Hilton-Nordica Hotel. Matís organized the conference.

The conference lasted for half a day and it covered all the scientific data that covers marine resources and health; the utilization of fat and proteins from marine resources for the production functional foods and what the consumer response is to functional foods from marine resources.

The conference covered research on the influence of seafood, and its contents, on health. It also covered the utilization and quality of fats and proteins, which are used as supplements in functional foods. The conference offered talks, which were based on results from the Nordic Network for Marine Functional Food (MARIFUNC) project conducted by the Nordisk Innovation Center ([www.marifunc.org](http://www.marifunc.org)).

The conference was organized by: Matís and the Unit for Nutrition Research ([www.rin.is](http://www.rin.is)).

### Hundreds of European students want to come to Iceland

Around four hundred foreign students applied for courses in Iceland.

From March 10th to 18th 2009, the Board of European Students of Technology (BEST) held an international course in Iceland.

Eighty-one European universities in 30 countries are members of the organization and students from the University of Iceland began the Icelandic society in 2005. BEST's main purpose is to offer its members education in the form of short courses, as well as offering students the opportunity to experience other languages and cultures.

The course held in Iceland was called "Eat that! Innovation in food technology and nutrition". It was conducted by BEST, in cooperation with Matís and the University of Iceland. Other partners in the course included: the University of Reykjavík, the University Hospital, Marel and Lýsi.

The course covered "innovation through nutrition" in detail. The European students spent a week listening to lectures from professors at the University of Iceland, employees at Matís and working engineers as well as visiting Icelandic companies and going on sightseeing tours.

The course generated a great deal of interest and approximately four hundred European students applied. Only 22 students could be accepted. The high numbers of applicants show that there is a great deal of interest amongst young academics to learn about Icelandic food and nutrition methods, as well as the country itself.

### Knowledge for the country – Matís' spring conference

Matís' spring conference was held on April 16th, and featured talks from many interesting lecturers.

Alongside the conference, there was an exhibition displaying Matís' cooperation with various companies and organizations, such as: the University of Reykjavík, the University of Iceland, Godthaab in Vestmannaeyjar and Norðurskel from north of Iceland. The conference was a great success and those who attended left with great deal of new information.

The Minister for Fisheries and Agriculture, Steingrímur J. Sigfússon, also attended the conference.

The topics from the conference can be found on Matís' website, [www.matis.is](http://www.matis.is).

### Innovation in the fisheries sector – Nordic cooperation

On 12th May the Nordisk Innovation Center, the Nordic-Atlantic cooperation and the Nordic Council of Ministers organized a large conference, which was headed by Iceland and Matís.

The main topics were:

- Supporting innovation and Nordic cooperation
- Fishing gear technology
- Aquaculture
- Production and distribution
- Marine biotechnology e.g. algae

Respected lecturers from Canada and the Nordic countries attended. Part of the conference was in the form of panel discussions, which enabled anyone to comment and contribute their views on how to emphasize and support innovation.



### A conference on drying

The second Nordic conference on drying was held from June 17th -19th.

This year's theme was technology, processes and produce that is important for communities and companies, for example, the challenges one must consider in relations to quality, development, problem solving, utilization of energy and the impact on the environment, climate and the entire ecosystem.

### Matís' research introduced at an international conference in The United States

The Institute Of Food Technologists' (IFT) yearly conference was held in the first week of June. Matís' research was introduced and the company contributed a total of 15 posters to the conference.

Matís had 15 posters/lectures at the IFT convention, which was held in Anaheim, California. The IFT convention is the largest food science convention in the world and many thousands of people attend every year. Matís introduced its research into bioactive peptides and multi-phenols from seafood, the operating characteristics of fish peptides and also research into the quality of taste of dried salted cod. The research projects received a lot of interest and many parties sought to collaborate with Matís. The conference showed that a lot of interest is building up in bioactive products from the sea and Matís is a leading force in the field. The next IFT conference will be in Chicago in 2010 and Matís aims to make an impact there as well. Matís' biotechnology research is based in their biotech laboratory in Sauðárkrókur and their laboratory in Reykjavík, in close cooperation with the University of Florida.

### The TAFT conference in Copenhagen

The third Trans Atlantic Fisheries Technology Conference (TAFT) was held in Copenhagen from 15th – 18th September 2009, where many leading scientists from Europe, USA and Canada who have been researching marine resources and its utilization came together to compare their books.

The conference was organized by: The West European Fish Technologists Association (WEFTA), which is an organization working in the field of research into the fish industry in west Europe; and The Atlantic Fisheries Technologists Conference (AFTC), which is an organization of scientists from North America and Canada.

Anna Kristín Daniélsdóttir, division Manager for Food Safety and Environment at Matís, was in the conference's science committee. A few of Matís' employees attended the conference and presented various material from the company e.g. at the conference's poster presentation.

### Researchers' Night 2009

Researchers' Night 2009 was held on Friday 25th September at the Reykjavík Art Museum. Matís was an active member of the conference and many people made their way to Matís' booth. The company introduced their operations and emphasized their new website [www.hvaderimatnum.is](http://www.hvaderimatnum.is), which stores nutritional information. The information used in the website come from the ÍSGEM databank, which stores nutritional information on food within the Icelandic market, exported goods and raw materials. The databank enables people to find the nutritional information of over 1100 foods. This includes information on fat contents, protein, carbohydrates and added sugars as well as information on supplements such as vitamins and minerals.

The day was dedicated to European scientists and was celebrated in many of Europe's main cities. The Researcher's

Night's main goal is to bring science closer to the public's eye, introduce the scientists behind all the research and to emphasize the importance of scientific research in society.

### Game - handling and treatment

Matís, The Icelandic Shooting Society (Skotveiðifélag Íslands), Icelandic Food and Veterinary Authority and Úlfar Finnbjörnsson at Gestgjafinn organized an open meeting on the handling and treatment of game on 22nd September. Over two hundred people attended the meeting.

Slides on the subject can be found on Matís' website, [www.matis.is](http://www.matis.is)

### Matís at the Matur-inn show in Akureyri

The MATUR-INN show 2009 was held at the Akureyri sport center between 3rd – 4th October. The show is the biggest event in the Local Food organization's operation. The last show was held in the fall of the year 2007 in the Verkmenntaskóli in Akureyri.

The 2007 show was attended by about 10 thousand people, which led the organizers to move the next show to another location. The Akureyri sport center was chosen and it was converted into a food center and a harvest station in the first weekend of October. Matís had a booth in the show which many people visited. The show aims to be diverse and is the culmination of North-Icelandic food culture. The show offered display areas for companies and organizations, market space where the companies and individuals could sell their produce or any food related products. The show also offered various competitions, seminars on food and food culture and finally a forum on Icelandic food. The show offered knowledge and entertainment, and thousands of visitors attended.

## Lectures on opportunities and threats in the farming of Arctic Char

On 13th - 14th October a conference on the farming of Arctic Char in Scandinavia was held. Opportunities, potentials, obstacles, threats and other factors related to the profession were discussed. Sjöfn Sigurgísladóttir, Matís' managing director, gave a speech.

Sjöfn's speech covered the possibilities of increasing the demand for farmed arctic char and the opportunities that lie with Iceland. Matís can play a significant role in marketing farmed arctic char through the knowledge the company's employee's offer.

## The MNÍ food day

The Icelandic Food and Nutrition Society's (MNÍ) food day was held on Thursday 15th October 2009 at Grand Hotel. The conference dealt with food production and currency creation. There were seven speeches, one of which was given by Hörður G. Kristinsson, division manager at Matís. In it he analyzed the possibilities of new production and currency creations. The conference had around 90 participants. The conference manager was Guðbrandur Sigursson, managing director of Nýland. The Minister of Finance, Steingrímur J. Sigfússon, started the conference.

The conference commenced with Ragnheiður Héðinsdóttir presenting the "Fjöregg MNÍ", which is an award handed out each year for commendable achievement in the field of food. The Federation Of Icelandic Industries gives the award, which is designed and produced by Gler in Bergvík. "Beint frá býli" was given the award for creating opportunities for diversity and increased home production where safety and quality of the production is emphasized.

Matís gave a speech on the day and the company's employees wrote various articles in the Food day's publication, "Matur er mannsins megin". These articles can be found on Matís' website [www.matis.is](http://www.matis.is).

## Nordic Values in the Food Sector

The conference "Nordic Values in the Food Sector" emphasized safety, sustainability, health and traceability of food that is produced in the Nordic countries.

Amongst the conference's subjects were:

- Food safety in a globalized world
- Interaction between animal welfare, health and analysis of food in the market
- Innovation in the food industry
- Nordic culture and image vs. innovative creation
- The position of the food industry in Scandinavia and its global potential

The conference's goal was to assess the state of the food industry in Scandinavia with regards to safety and innovation globally. The conference also attempted to define the challenges and future potentials of Nordic foods.

Matís took part in the organization of the conference alongside The Icelandic Food and Veterinary Authority and the Ministry Of Fisheries and Agriculture, who also led the conference.

## Crowded meeting - Matís, AVS and SF's meeting on opportunities in Icelandic fisheries

A meeting on opportunities in Icelandic fisheries was held in the beginning of December. Matís, The AVS research fund and The Federation of Icelandic Fish Processing Plants, organized the meeting.

Many people attended the meeting and around 160 people listened to speeches given by Þorsteinn Már Baldvinsson, Samherji's managing director, and Sveinn Margeirsson, division manager at Matís.

The meeting's aim was to emphasize opportunities and possibilities in increased utilization and value. Icelanders are a leading force in the utilization of their marine resources and they have strong and efficient seafood companies with extensive experience in meeting the demands of the market. However, our resources are limited and it is important to utilize them to the fullest.

## Registered Trademarks

Registered trademark - MateMeRight, [www.matemeright.com](http://www.matemeright.com)

Pairing of fish in aquaculture. MateMeRight is a program used to choose parents by making sure the genetic variations are maximized. The program assesses the affinity trades in fish, their relations and performs breeding assessments.





## Publications

### Reports in 2009

Aðalheiður Ólafsdóttir, Ólafur Reykdal, Óli Þór Hilmarsson, Gunnþórunn Einarsdóttir, Kolbrún Sveinsdóttir, Þóra Valsdóttir, Emilía Martinsdóttir, Guðjón Þorkelsson. Vörubröun á hollari unnum kjötvörum. Skýrsla Matís 25-09, 111 s.

Ásbjörn Jónsson, Irek Klonowski, Sigurjón Arason, Sveinn Margeirsson. Þróun á búnaði og ferli fyrir ensímmeðhöndlun á lifur fyrir niðursuðu. Skýrsla Matís 26-09, 40 s.

Ásbjörn Jónsson, Jónas R. Viðarsson, Sigurjón Arason. Nýtingarstuðlar bolfsktegunda. Skýrsla Matís 40-09, 26 s.

Björn Margeirsson, Lárus Þorvaldsson, Sigurjón Arason. Frýsting og þíðing grálúðu. Tilraunir og CFD hermun. Skýrsla Matís 33-09, 26 s.

Björn Margeirsson, Sigurjón Arason, Halldór Pálsson. Thermal Performance of Corrugated Plastic Boxes and Expanded Polystyrene Boxes. Skýrsla Matís 01-09, 24 s.

Emilía Martinsdóttir, Cyprian Ogombe Odoli, Héléne L. Lauzon, Kolbrún Sveinsdóttir, Hannes Magnússon, Sigurjón Arason, Ragnar Jóhannsson. Optimal storage conditions for fresh farmed tilapia (*Oreochromis niloticus*) fillets. Skýrsla Matís 38-09, 74 s.

Eyjólfur Reynisson, Sveinn Haukur Magnússon, Árni Rafn Rúnarsson, Viggó Þór Marteinsson. Sólarhringsgreining óæskilegra örvera í matvælum. Skýrsla Matís 42-09, 28 s.

Eyrún Harpa Hlynsdóttir, Jónína Þ Jóhannsdóttir, Rannveig Björnsdóttir. Þróun aðferða við myndgreiningu matvæla – B-hluti. Notkun myndgreiningar við rannsóknir á samsetningu vöðvaþráða í lömbum. Skýrsla Matís 31-09, 9 s.

Guðjón Þorkelsson, Hörður G. Kristinsson. Bioactive Peptides from Marine Sources. State of Art. Report to the NORA fund. Skýrsla Matís 14-09, 19 s.

Guðjón Þorkelsson, Rósa Jónsdóttir, Aðalheiður Ólafsdóttir, Óli Þór Hilmarsson. Beit á hvönn og bragð af lambakjöti. Skýrsla Matís 20-09, 36 s.

Guðmundur H. Guðmundsson. Veiðar og vinnsla á lifandi og ferskum humri. Skýrsla Matís 49-09, 56 s.

Guðmundur Heiðar Gunnarsson, Óli Þór Hilmarsson. Fullvinnsla svínakjöts frá vistvænu bó. Skýrsla Matís 44-09, 21 s.

Gunnþórunn Einarsdóttir, Ása Vala Þórisdóttir, Fanney Þórsdóttir, Kolbrún Sveinsdóttir, Emilía Martinsdóttir, Friðrik H. Jónsson, Inga Þórsdóttir. Viðhorf og fiskneysla ungs fólks 16 til 20 ára: Íhlutun á Akureyri. Skýrsla Matís 03-09, 54 s.

Gunnþórunn Einarsdóttir, Emilía Martinsdóttir, Þóra Valsdóttir, Guðjón Þorkelsson. Þróun á bökunarvörum úr íslensku korni. Skýrsla Matís 29-09, 7 s.

Hannes Magnússon, Héléne L. Lauzon, Kolbrún Sveinsdóttir, Björn Margeirsson, Eyjólfur Reynisson, Árni Rafn Rúnarsson, María Guðjónsdóttir, Kristín Anna Þórarinsdóttir, Sigurjón Arason, Emilía Martinsdóttir. The effect of different cooling techniques and temperature fluctuations on the storage life of cod fillets (*Gadus morhua*). Skýrsla Matís 23-09, 36 s.

Hannes Magnússon, Lárus Þorvaldsson, Kolbrún Sveinsdóttir, Héléne L. Lauzon, Kristín Anna Þórarinsdóttir, Emilía Martinsdóttir, Sigurjón Arason. The effect of liquid cooling at processing and different cooling techniques during transport of cod (*Gadus morhua*) fillets. Skýrsla Matís 34-09, 33 s.

Helga Gunnlaugsdóttir, Björn Þorgilsson. QALIBRA Final report from the cluster activities. Skýrsla Matís 46-09, 63 s.

Helga Gunnlaugsdóttir, Jeljer Hoekstra, Marco Zeilmaker, Nynke de Jong, Bas Bokkers, Helen Owen, Andy Hart, Lynn Frewer, Nikos Avouris. QALIBRA Dissemination material for first end-user workshop. Skýrsla Matís 47-09, 118 s.

Helga Gunnlaugsdóttir, Nynke de Jong, Matthew Atkinson, Heleen van Dijk, Meike Wentholt, Lynn Frewer, Björn Þorgilsson, Heiða Pálmadóttir, Andy Hart. Qalibra - Heilsuvogin. Third Annual Report. Skýrsla Matís 30-09, 48 s.

Hrönn Ólína Jörundsdóttir, Sasan Rabieh, Helga Gunnlaugsdóttir. Undesirable substances in seafood products. Results from the monitoring activities in 2007. Skýrsla Matís 28-09, 32 s.

Hrönn Ólína Jörundsdóttir, Sasan Rabieh, Hulda Soffía Jónasdóttir, Þuríður Ragnarsdóttir, Helga Gunnlaugsdóttir. Mengunarvöktun í lífríki sjávar við Ísland 2007 og 2008. Skýrsla Matís 24-09, 64 s.

Jóhannes Sturlaugsson, Hrönn Ólína Jörundsdóttir, Franklín Georgsson, Helga Gunnlaugsdóttir. Kvikasilfur og önnur óæskileg snefilefni í urriða úr Þingvallavatni. Skýrsla Matís 48-09, 28 s.

Jón Örn Pálsson. Votfóður fyrir þorsk. Skýrsla Matís 08-09, 27 s.



Jónína Þ Jóhannsdóttir, Agnar Steinarsson, Rannveig Björnsdóttir. Framleiðsla hjóldýra fyrir þorskeldi. Skýrsla Matís 10-09, 18 s.

Jónína Þ Jóhannsdóttir, Rut Hermannsdóttir, Rannveig Björnsdóttir. Þróun aðferða við myndgreiningu matvæla. Notkun myndgreiningar til að meta hrygg súlugalla strax á lírfustigi þorskeldis. Skýrsla Matís 02-09, 10 s.

Kristín Anna Þórarinsdóttir, Kolbrún Sveinsdóttir, Þóra Valsdóttir, Irek Klonowski, Aðalheiður Ólafsdóttir, Hannes Magnússon, Arnljótur Bjarki Bergsson, Ragnar Jóhannsson, Emilía Martinsdóttir. Sprautun og þæklun tilapíuflaka. Skýrsla Matís 39-09, 37 s.

Kristín Anna Þórarinsdóttir, Magnea G. Arnþórsdóttir, Irek Klonowski, Arnljótur Bjarki Bergsson, Sindri Sigurðsson, Sigurjón Arason. Jöfnun – aukin gæði og bættir eiginleikar marnings. Skýrsla Matís 15-09, 25 s.

Kristín Anna Þórarinsdóttir, Valur Norðri Gunnlaugsson, Guðrún Anna Finnbogadóttir, Kristján Jóakimsson, Sigurjón Arason. Vinnsla og gæðastýring á eldisþorski. Skýrsla Matís 13-09, 14 s.

Lárus Þorvaldsson, Björn Margeirsson, Sigurjón Arason. CFD Modelling and Quality Forecasting for Cooling and Storage of Pelagic Species. Skýrsla Matís 12-09, 16 s.

Margeir Gissurarson, Hannes Magnússon, Ragnheiður Sveinþórsdóttir, Cecilia Garate. Samantekt fyrri rannsókna á loðnuhognum. Skýrsla Matís 07-09, 14 s.

Margeir Gissurarson, Ragnheiður Sveinþórsdóttir, Þórgímur Kjartansson, Sigurjón Arason, Guðjón Þorkelsson, Sindri Sigurðsson, Jón Helgason, Björn Erlendsson. Bættir vinnsluferlar loðnuhogna. Skýrsla Matís 16-09, 28 s.

Margrét Geirsdóttir. Isolation, purification and investigation of peptides from fish proteins with blood pressure decreasing properties. Skýrsla Matís 36-09, 34 s.

Patricia Y. Hamaguchi, Sigrún Mjöll Halldórsdóttir, Hörður G. Kristinsson, Arnljótur Bjarki Bergsson, Guðjón Þorkelsson. Bioactive properties of whey proteins. Skýrsla Matís 06-09, 7 s.

Ragnar Jóhannsson, Sjöfn Sigurgísladóttir, Guðjón Þorkelsson, Arnljótur B. Bergsson. Hrein vöðvaprótein úr fiski. Skýrsla Matís 19-09, 10 s.

Ragnheiður Sveinþórsdóttir, Hörður G. Kristinsson, Jónína Jóhannsdóttir, Arnljótur Bjarki Bergsson. Fituflegnar ufsaafurðir. Skýrsla Matís 27-09, 8 s.

Ragnheiður Sveinþórsdóttir. Veiðar, flokkun, vinnsla og markaðir fyrir makríl veiddan af uppsjávarskipum. Greining sýna og flokkunareiginleikar. Skýrsla Matís 41-09, 16 s.

Ragnheiður Sveinþórsdóttir. Veiðar, flokkun, vinnsla og markaðir fyrir makríl veiddan af uppsjávarskipum. Markaðir. Skýrsla Matís 04-09, 10 s.

Rannveig Björnsdóttir, Jónína Þ Jóhannsdóttir, Jón Árnason, Þorleifur Eiríksson, Cristian Gallo, Böðvar Þórisson, Þorleifur Ágústsson, Björn Þrándur Björnsson, Guðbjörg Stella Árnadóttir. Þróun iðnaðarvædds þorskeldis. Stjórn vaxtar og kynþroska með háþróuðum ljósabúnaði. Skýrsla Matís 37-09, 35 s.

Róbert Hafsteinsson, Albert Högnason, Sigurjón Arason. Marningskerfi. Skýrsla Matís 21-09, 15 s.

Róbert Hafsteinsson, Albert Högnason, Sigurjón Arason. Vinnsluferill línuveiðiskipa. Skýrsla Matís 18-09, 36 s.

Rósa Jónsdóttir, Aðalheiður Ólafsdóttir, Óli Þór Hilmarsson, Guðjón Þorkelsson. Bragð og beitarhagar. Framvinduskýrsla. Skýrsla Matís 45-09, 11 s.

Sigurjón Arason, Hrönn Ólína Jörundsdóttir, Einar Lárusson, Helga Gunnlaugsdóttir. Mælingar á salti, málmögnum og saltfiski við greiningu á gulumyndun í saltfiski febrúar til maí 2009. Skýrsla Matís 22-09, 6 s.

Sigurlaug Skírnisdóttir, Sigurbjörg Hauksdóttir, Eyjólfur Reynisson, Sigurður Helgason, Guðmundur Óskarsson, Sigríður Hjörleifsdóttir. Ichthyophonus hoferi sýking í síld og fleiri fiskum. Skýrsla Matís 35-09, 17 s.

Sigurlaug Skírnisdóttir, Þorsteinn Sigurðsson, Ólafur K. Pálsson, Sigríður Hjörleifsdóttir. Þróun erfðagreiningaraðferðar til tegundaákvörðunar helstu nytjastofna Íslands. Skýrsla Matís 17-09, 23 s.

Sólveig K. Pétursdóttir, Snædís H. Björnsdóttir, Sólveig Ólafsdóttir, Guðmundur Óli Hreggviðsson Lífriki í hverum í Vonarskarði. Skýrsla Matís 09-09, 80 s.

Valur Norðri Gunnlaugsson, Óli Þór Hilmarsson, Ásbjörn Jónsson, Guðjón Þorkelsson. Úttekt á aflífun lamba og kælingu lambakjöts haustið 2008. Skýrsla Matís 05-09, 30 s.

Þóra Valsdóttir, Brynhildur Pálsdóttir, Theresa Himmer. Tillögur um stofnun smásölufiskmarkaða á Íslandi. Skýrsla Matís 32-09, 80 s.

Þóra Valsdóttir, Irek Klonowski, Eyjólfur Friðgeirsson. Kryddlegin söl. Skýrsla Matís 43-09, 6 s.

Þóra Valsdóttir, Óli Þór Hilmarsson, Guðjón Þorkelsson. Loftþurrkað lambakjöt. Forathugun. Skýrsla Matís 11-09, 26 s.



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## Graduated Students

Student's Name	Specialty	Thesis Title	Degree	University
Árni Rúnarsson	Biology	Changes in the oral microflora of occlusal surfaces of teeth with the onset of dental caries	M.Sc.	University of Iceland
Cyprian Ogombe Odoli (UNU)	Food Science	The effects of temperature abuse at the beginning of storage on the quality and shelf life of freshwater arctic char ( <i>Salvelinus alpinus</i> )	M.Sc.	University of Iceland
Magnea Guðrún Arnþórsdóttir	Food Science	Application of additives in chilled and frozen white fish fillets	M.Sc.	University of Iceland
Ofred J. M. Mhongole (UNU)	Food Science	Microbiology and Spoilage Trail in Nile perch ( <i>Lates niloticus</i> ), Lake Victoria, Tanzania	M.Sc.	University of Iceland
Sigríður Helga Sigurðardóttir	Biotechnology	Bioethanol production of ethanol with anaerobic thermophilic mutant strains	M.Sc.	Univ. of Akureyri
Tom Brenner	Physics	Aggregation behaviour of cod muscle proteins	Ph.D.	University of Iceland
Wang Tao (UNU)	Food Science	Enhancing the quality of seafood products through new preservation techniques and seaweed based antioxidants - Algal polyphenols as novel natural antioxidants	Ph.D.	University of Iceland
Ragnhildur Einarsdóttir	Food Science	The influence of enzyme activity on physical properties in cod fillet products	M.Sc.	University of Iceland
Kolbrún Sveinsdóttir	Food Science	Improved seafood sensory quality for the consumer. Sensory characteristics of different cod products and consumer acceptance	Ph.D.	University of Iceland

## Knowledge Index

To ensure the proper running of a company, certain measurements must be performed where important factors are analyzed. Usually, when one analyzes the operations of a company he/she looks at the company's production and financial figures, however to analyze Matís, other methods must be used. The financial figures are assessed like at other company, but to analyze the company's operations one must use unorthodox methods. Matís is a knowledge-based company that performs innovative food research on behalf of businesses, public health and food safety. Matís' production is based around the knowledge created through various research conducted all over the country. Matís' management has designed a model to measure the knowledge numerically and therefore define the level of the knowledge creation every year.

The model is called Matís' knowledge index and it is made up of three basic elements that reflect the company's purpose, which is to perform effective food research to ensure the nation's food safety. The model's three basic factors are: research, knowledge and human resources (their importance is displayed in the brackets).

### Matís' research (50%)

This part of the index deals with all of the research conducted at the company. This is done by assessing the quality of the research, which is reflected in, for example, the number of articles published in international science publications.

### Research:

- Number of peer-reviewed articles published
- Number of general articles published
- Number of patent applications
- Open Matís reports
- Book chapters
- Lectures at science conferences
- Posters at science conferences

### Matís' knowledge (30%)

A large part of Matís' research is conducted in cooperation with Icelandic academic institutions at a university level. Important research, in Iceland, in the field of biology, food science and other fields related to Matís, is conducted within the walls of these institutions and many postgraduate and PhD students work on their research in cooperation with Matís. The company's educational role has increased significantly in the last few years and the company is now an important connector between academia and the corporate world. An emphasis has been placed on connecting research and innovation in food to the corporate world and to bridge the gap between companies and universities.

### Students

- Number of Ph.D. students graduated
- Number of M.Sc. students graduated
- Other university students that have graduated

### Teaching

- Number of employees that have permanent positions at universities
- Number of employees that have part time positions at universities

### Matís' Human resources (20%)

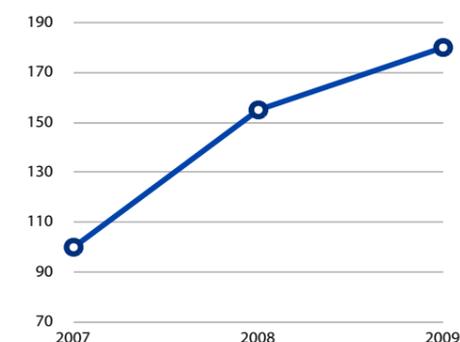
The quality of Matís' employees is the basis of the company's operations and its ability to conduct research of an international standard. The company's research environment is international and there is a lot of competition in developing research and in applying for international research funds e.g. on behalf of the European Union. This scale indicates the company's future potential and ability to conduct research and project knowledge to universities and businesses in Iceland.

A base value was given for knowledge creation in the year 2007, which enables the model to indicate changes in knowledge creation at the company from its first year of operations. Below is a summary of the index for the last three years.

Matís' Knowledge Index - Years 2007-2009		
Year	Points	% change
2007	100	-
2008	156	+56,0%
2009	182	+16,7%

There is a lot to gain from using the knowledge index. It inspires employees and management and provides self-restraint to the company in excess of traditional measures of assessment. The index gives, above all else, a clear indication of the company's development in the field of knowledge creation.

### Matís' Knowledge Index



## The United Nations University Fisheries Training Program

**Tumi Tómasson,**  
Director, The United Nations University  
– Fisheries Training Program

### Matís, an important foundation to the school

One of Matís' cooperative projects is The United Nations University – Fisheries Training Program. The Marine Research Institute, the University Of Iceland, the University of Akureyri and Hólaskóli are cooperative partners in the project. In 2009, 18 students started a six-month course at the school, all of which received a basic course in the quality and production of fish. Five of the students, studying in the quality faculty, received lessons and practical training at Matís and four conducted their final projects at the company. The projects were all conducted with the needs of their home countries in mind. One of the projects dealt with creating a quality index scale for mackerel; another project dealt with the affects of sorbat and chitosans on the shelf-life of mackerel; the third project dealt with the creation of teaching material to make a HACCP system for the fish industry in North-Korea and the fourth project dealt with setting up a traceability system for the domestic market in China.

Tumi Tómasson, director for the United Nations University, considers Matís to be an important foundation to the school. "Cooperation with Matís is ever increasing. As well as supplying the basic courses all of our students receive, the company organizes a six-week course and every year, some of our students conduct their final projects at Matís. Last year four of our students did their PhD's at Matís, one of which graduated. Two of our former students graduated with post-graduate degrees, both of which conducted their projects at Matís. The connection between the United Nations University and Matís is strong, so much that one could define Matís to be a part of the University," says Tumi Tómasson.

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