THIS IS MATÍS

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The best defence is a good offense

Fridrik Fridriksson, Chairman of the Board

They say the best defence is a good offense. Over the last few years we have experienced a recession in Iceland, changes in the business sector, and the downsizing of public funding in, research endeavours, amongst other areas. In many instances, these situations can be the soil upon which new opportunities grow and which then in turn, foster evermore growth. In short, this demonstrates the recent experience of Matis. Through the systematic work of both directors and employees, changes in the business environment have led to a re-orientation of priorities. Under these conditions, Matis has advanced and succeeded both in Iceland and in foreign markets.

Matis was founded five years ago and in that time has secured its place within the Icelandic community in many ways. Matis is viewed as a leading company in food research. It is an impetus for business innovation and growth, a company that joins the research community, universities, and the business sector. We are at the front line in future opportunities for creating new business ventures. In particular, we can mention the biotechnology research that has already created jobs as well as awakened the interests of foreign parties for collaboration. This is exemplifies how, at Matis, offence is the best defence.

Throughout its five year history, Matis has garnered trust and a strong reputation within the community which is highly valuable for future operations. This has been achieved, for example, by a systematic participation in media discussions, both on behalf of the company and by individual scientists.

Every day, we are working on remarkable projects within the walls of the company that concern people and companies throughout the community, and it is important that the public realizes what Matis stands for and how the company is valuable to Icelandic society.

Through Matis' "offense tactics", the focus has been on participating in international projects. This has provided a wide range of successes. Firstly, it increases our specialist knowledge and thereby, scientific research in the country. Secondly, it creates interest abroad for research in Iceland and participating in such projects. Thirdly, these projects create avenues for Matis' Icelandic collaborators to advance their business into other countries. Finally, these foreign projects provide valuable income for this young company, not the least important in light of the current economic situation. These points of emphasis have provided such results that there has been little hindrance to Matis' continued development over the last five years.

Matis' employees are the company's greatest assets. We must endeavour to cultivate and sustain this capital. The managers put great emphasis on allowing employees to do their duties both as individuals and as employees. It is satisfying to see the education level at the company rise consistently, as well as the so-called "knowledge-index". These indices are yet another confirmation that Matis is on the right track, and all to the benefit of the country and nation.

Matis – in an international context

Sveinn Margeirsson, CEO

In the annual report of Matis' fifth year of operations, we offer insight into how Matis has acquired, despite its recent beginnings, both good connections and a strong reputation abroad. Matis has systematically increased its emphasis on international projects, whilst strengthening the company's operations in Iceland – not to mention scientific work in the country in general. As a result, Iceland reaps the benefits of an increased number of various business opportunities.

Iceland's contribution to Europe's communal research funds is considerable and through scientific collaboration with other countries, we can, in a way, get that contribution back with excellent interest returns if done well. The basis for doing so is a strong core of scientists which is indeed representative of Matis. As our track record in international collaborative projects grows, so does interest from foreign parties.

We have much to offer and can strengthen Iceland's position through the knowledge acquired from this co-operation. Through our international projects, we gain access to facilities otherwise unavailable and establish connections with specialists in various expert fields.

By increasing international scientific collaboration, we can say we are turning an important page in Icelandic history. Throughout the centuries Icelanders have exported goods, notably seafood. In this respect, we are talking about both exporting raw materials, as well as the finished product. Through our scientific work, we are moving away from exporting raw material and towards the utilization of Icelandic knowledge in our traditional core industry; that of food production. The "raw material" of knowledge is transformed into an even more valuable product to further our work abroad, as well as in Iceland, and also the development

Sveinn Margeirsson, Ph.D.

CEO

of food production. This benefits not only Matis, but other Icelandic researchers, institutions, universities, and companies.

Matis' development and initiatives make it possible for us to advance into foreign countries. We have specialized knowledge in many areas of the fishing industry and are in a unique position here in Iceland for biotechnical research due to the geothermal areas, the glaciers, and the nature both on land and sea.

Many business sectors can benefit from the international collaboration Matis has initiated, although the opportunities are perhaps most clear in the seafood, where Iceland has the opportunity to create an even stronger position for our seafood to compete within world markets. Matis' international projects will aid this work in the coming years, for instance with more emphasis on marketing related projects, focus on environmental issues and impact as well as reliable monitoring of food safety.

A similar story is evident in the Icelandic agriculture industry. Possibilities abroad will open up in this sector in the near future, not in the least due to an increase in scientific research work. Matis aims to scope out and explore these possibilities.

Our scientists deem our reputation abroad to be something upon which we can build even further. Not just because we are Icelandic, but because of what we can do and what we know. Of this we can be proud, and we shall continue in this direction.

Matis operates in all continents

Hordur G. Kristinsson, Ph.D., Director of Research

International collaboration is the key to the advancement of research

Hordur G. Kristinsson, Director of Research

"Matis is not only a powerful research- and knowledge-based company on an Icelandic scale, but is fully comparable to similar foreign companies and institutions. For example, it is difficult to find a company with as much extensive knowledge and experience in terms of research on marine products. In this field, we can confidently claim that Matis is among the best in the world,"

From the beginning, Matis has emphasized international research and development work has expanded with foreign collaborations which are now a large part of the company's operations. Matis' employees have both the education and the comprehensive experience useful for endeavours around the world. "This international emphasis is necessary to maintain Matis' solid operations and to connect even further with other strong and established research- and development groups abroad. International collaboration is the key to the advancement of research which in turn, clearly benefits Icelandic society. An example of the success Matis currently enjoys is that we are participating in approximately 30 international research projects. Of those, Matis is a leading partner in ten large projects, all involving several international co-operations," states Hordur G. Kristinsson.

New methods – new approach

Hordur refers to Amylomics and Ecofishman as examples. The two projects are generously supported by the EU's Seventh Framework Programme and have received an outstanding evaluation. The projects are entirely dissimilar and thus, according to Hordur, demonstrate easily the broad field and expert knowledge that is to be found within Matis. "The goal of the Amylomics project is to discover new, robust enzymes from Icelandic hot springs and then transform starches in an innovative way. This could lead to a revolution in how starch variations are utilized in the food industry as one example, as well as in the production and capitalization of novel, Icelandic enzymes. The Ecofishman project is focused on developing a new integrated fisheries management system in which stakeholders have the opportunity to influence the development of the fisheries management. The end result shall lead to necessary improvements to the current fisheries management system for the benefit of all involved," says Hordur.

Matis in all continents

Aside from large, continental European projects, Matis' Nordic collaborations have also been quite robust. Matis was outstanding in receiving grants from the Nordic Innovation

Program in the Fall of 2011. Matis is leading five substantial projects that received grants from the Program, and is a key participant in nearly all supported projects. "This is a good example of the energy and ambition that characterizes Matis' work. The projects vary from developing new consumer produce from Icelandic seaweed to creating a marketing strategy for Nordic white fish products," says Hordur. Matis' collaborations are not only on a European scale, but extend to almost every continent. As one example, a development programme was commenced with the Tanzanian government in 2011. It focuses on the research of fish, fish processing, and an evaluation of the social status of fishing communities around Lake Tanganyika. Over the last few semesters, Matis has worked on other pertinent developmental programs in Africa, such as in Kenya and Mozambique, geared towards quality control and the training of fisheries inspectors and technicians. As further examples, on the other side of the Atlantic Ocean, Matis has been involved in fish farming projects in Chile, as well as researching bioactive chemicals in US seawaters in collaboration with both universities, and large corporations. In Canada, a project has just been launched to research fish proteins on Type 2 diabetes, a growing world-wide problem. These projects are all due to the specialized knowledge and experience of the Matis employees whose skills are highly sought after.

Record number of student projects

Matis' role and influence in the education and training of students has been growing and the company has strong ties with several respected universities abroad. Hordur mentions a successful collaboration with the United Nations University (UNU) since its foundation, in which Matis employees play an important part in the teaching of quality management, while providing Matis' facilities to students working on their final projects.

"Last year we had a record number of students with us here at Matis working on various projects. Included were many foreign students from around the world, all benefiting from the guidance of Matis' scientists and the excellent facilities the company has to offer them. They find Matis an exciting option due to the company's links to both companies, and the university environment, since most of the student projects are scientific in nature but with a desire for practical application."

Iceland is a large producer of food

Oddur Már Gunnarsson, Director

Foreign projects strengthen Matis

Oddur Mar Gunnarsson, Director

Income from Matis' foreign projects now represents 20% of the company's overall operations; a figure which has been increasing over the last few years. "I see this development continuing as it is important for us both professionally, and in terms of operations" says Oddur Már Gunnarsson, Director of Business Development at Matis.

Matis is a state-owned company and as such, receives contributions from the Icelandic state. These contributions have diminished in line with overall cutbacks to public spending following the economic recession in Iceland. However, it is safe to say that Matis has managed to effectively respond to these restraints by expanding evermore into foreign projects. This has resulted in the company posting profits over the past few years despite the recession in Iceland. Further, the company has not had to take austerity measures, such as employee cutbacks, like so many other companies have had to do.

Europe and Scandinavia the most important

"We are involved in projects in many continents, but the largest and most important ones are in Scandinavia and in Europe. We can be proud of the success we have achieved and it is a clear indication of Matis' current strength. Competition for foreign projects is substantial, but in 2009, we systematically embarked on the task of guiding our staff on how to apply for grants and then, set about looking for projects and funds in foreign markets in a pragmatic manner," states Oddur Már. A large part of these foreign projects is funded by the EU's Seventh Framework Programme (of which Matis is an active participant), and by Nordic innovation and research funds, such as NICe and Nora.

Tiny nation – large producer of food

The foreign projects for which Matis applies are, in all cases, collaborative projects with several other partners: similar research companies and institutions, as well as various other companies and universities. In many cases, there are also other Icelandic partners involved and it is not uncommon that Matis leads such projects. "Our company builds on an extensive knowledge base and we have had years of experience in establishing contacts. Matis was built upon this base and in only a few years, has become a powerful research facility and garnered a strong international reputation. The development of Matis, as well as its priorities coincide well with the similar emphasis of many of our foreign projects; we are experts in areas such as biotechnology, genetic technology, energy, geo-thermal heat, and research for the fishing industry.

In many regards, Iceland is a dwarf among nations; it hardly measures up when counting population figures. However, we are indeed large when it comes to fisheries and the manufacturing of fish products. At Matis, this stature is utilized to forge ahead and substantiate our future success."

A good project finance system is
one of the keys to generating trust

Guðlaug Þóra Marinósdóttir, Office Manager

Greater confidence in Matis' financial oversight in international projects

Gudlaug Th. Marinosdottir, Office Manager

aFinances are a vital part of our research projects and this is especially clear when it comes to Matis' international projects, which are constantly expanding. This is an element that depends heavily on those who finance and fund our projects, our partners in those projects and the staff at Matis that directs them. Of course our scientists follow the financial elements of these projects but it could be said that our job is to ensure that they can devote themselves first and foremost to their specialty and their scientific work," says Gudlaug Th. Marinosdottir, Office Manager at Matis. She says that a good project finance system is one of the keys to generating trust among our associates and backers, "and our experience is that we are increasingly given financial oversight of projects. It varies by the nature and size of the project how they are handled financially but in many large projects the financial oversight is entirely in our hands. This means that we follow projects from start to finish, ensure that the payments make it to us so we can pay our associates as the agreements demand and thus ensure the projects proceed efficiently," says Gudlaug and names Amylomics, EcoFishMan, NordChar and SAFE Consortium as examples of large, important international projects that their staff oversees.

Gudlaug mentions that Matis is on good terms with the Icelandic National Audit Office, which oversees the audit of the annual financial statements for the company. "We want to keep everything in order and have been working with the National Audit Office over the last few years on improvements to our bookkeeping and procedures regarding internal controls. Overall we feel a great sense of confidence from our international partners regarding financial management and the oft-discussed financial collapse here in Iceland has not affected that confidence. We felt the effects for the first year after the banks collapsed but the only echoes we feel today are over the amount of paperwork involved in starting new bank accounts for a new project.

"A large part of our international profits comes from funds inside the EU and Scandinavian funds. Our associates in these projects are companies and institutions located in Scandinavia and other European countries and as such we need to maintain banking transactions in numerous countries and with several currencies. Our goal at Matis is to do a good job in all fields, both in the scientific sector and in our handling of projects, including the financial factor. In fact they are vitally important in our work when all is said and done," says Gudlaug.

Matis

Matis 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. Matis has played a significant role in promoting healthy living and food safety in Iceland.

Matis' 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. Matis' divisions are:

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

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

Another important factor in Matis' 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.

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

The headquarters of Matis are situated in Reykjavík. The company also operates in the Westmann Islands, Hofn in Hornafjordur, Neskaupstadur, Fludir, Akureyri, Saudarkrokur and Isafjordur.

Board Members

Fridrik Fridriksson, chairman, Einar Matthiasson, vice-chairman, Arnar Sigurmundsson, Agusta Gudmundsdottir, Halldora Loa Þorvaldsdottir, Jon Edvald Fridriksson og Laufey Haraldsdottir.

Science and Technology Policy Council Motivation Award

Second time a Matis employee receives this award

Hordur G. Kristinsson, Ph.D., head of research at Matis and director of the biotechnology and biochemistry department received this award, which was granted to him at the Research Forum of The Icelandic Centre for Research (Rannis) June 8. 2011. This is the second time an employee of Matis has been afforded this award, the first being Anna Kristín Daníelsdóttir in 2000, then employed at the Marine Research Institute. Hordur received the award directly from the prime minister who is also the chairman of the Science and Technology Policy Council. This award is recognition of Hordur's contributions and the work that goes on behind Matis' doors.

Hordur was born in 1972. He completed basic biology studies at the University of Iceland in 1996 and moved from there to the United States for further education. As he studied for his master's degree at Washington University in Seattle he researched the use of seafood by-products through the application of enzymes using the same techniques widely used today with good results. In 2001 he completed his doctoral studies in food biochemistry at the University of Massachusetts where he studied the properties of fish proteins. The results of his doctoral research have been used to develop new methods of isolating and using new proteins from by-products and underused fish types, such as the blue whiting and the capelin. Thus it could be said that they have both added to our understanding of marine resources and had great practical benefits. On the last year of his doctoral studies he was offered the position of associate professor at the Food Science and Human Nutrition Department at the University of Florida, one of the largest and most progressive in the BNA. There he built for himself a potent laboratory devoted to the field of food biochemistry with a particular emphasis on the useful applications of seafood. Hordur moved to Iceland in 2007 and began working with Matis a year later but still maintains a position as a docent at the University of Florida.

Hordur has acted as a trailblazer in improving our understanding of biochemicals and bioactive chemicals in Icelandic nature. He was instrumental in building up the Matis Biotechnology Centre at Saudarkrokur which opened in 2008. There specialists work on both local and international research projects, often working closely with the food industry in Skagafjordur and elsewhere in Iceland. An emphasis is placed on offering facilities and professional assistance to develop both products and methods with the goal of speeding the process of idea to product and thus

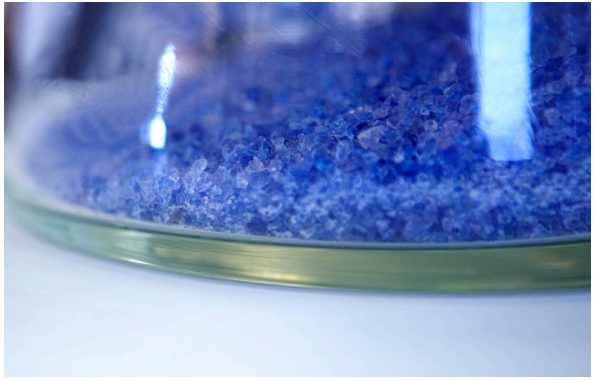
lower the cost of its development. On that note the new facility for companies just starting up, known as Bruin (the Bridge) bears mentioning. There one can find powerful biotechnology firms such as Kerecis and Primex which have their headquarters in the vicinity of Hordur and his co-workers.

Hordur's research has yielded great practical benefits, and he is in fact the holder of three published patents. Hordur has published articles about his research in highly respected scientific magazines and given lectures at conferences the world over. He is an active participant in international cooperation and currently heads up a number of multinational research projects. He has also been active as a teacher and no fewer than ten of his students have thus far completed their doctorates, with another nine holding their masters' degrees.

Through his work Hordur has shown himself to be an excellent scientist, teacher and director. He has shown initiative and led the way to building a new area of science that has already begun to bear fruit. He is an excellent role model to his students and colleagues as well as a key member of a growing company. It was the unanimous decision of the judges that Hordur G. Kristinsson fulfils all the requirements for the Motivation Award and is a more than worthy recipient of the award for 2010.

About the award

The Science and Technology Policy Council's Motivation Award is awarded to scientists who distinguish themselves early on in their careers and raise expectations for the advancement and gives rise to expectations that he will contribute to the advancement of science that will improve the quality of life in Iceland. The prize, which now totals two million kroner, has been awarded each year since 1987, the first time being on the fiftieth birthday of the employment department of the University of Iceland. The purpose of the Motivation Award is to encourage scientists through incentive and raise the public's awareness about the value of research and the tasks of scientists.



Human Resources

A great emphasis is placed on the work satisfaction of the Matis employees. To gauge the success of this effort Matis takes part in the annual workplace survey "Company of the Year". This year Matis landed in 11th place out of 85 large enterprises. To better understand the primary elements that lead to employee satisfaction a survey was conducted in November in cooperation with professionals in the field, though its results will not be apparent until the beginning of 2012. The results will be applied in early 2012 to begin improvements to the workplace.

A great number of summer employees worked for Matis in the summer of 2011. In total there were fifty summer employees who worked partly at the Matis headquarters in Reykjavík and partly at its rural outposts. The majority of summer employees were hired in conjunction with the work effort of the Ministry of Fisheries and Agriculture, the Icelandic Student Innovation Fund, the AVS Research Fund and the Directorate of Labour. Great satisfaction was felt at the end of the summer with the success of the work where students gained valuable job experience with research projects where a range of innovations in the fields of food science and biotechnology took place. In addition several foreign scientists are employed at Matis, both full-time and for specific projects.

Great steps were taken in the spring months in environmentally friendly transport at Matis when the transportation policy was introduced to the employees. This policy encourages employees to use healthy and environmentally friendly methods of transportation, such as bicycling, walking or taking the bus to and from work. The majority of Matis employees participated in this last summer and signed an agreement where they agreed to use such methods at least three times a week and were compensated by the company. This shift has awoken much interest in the Icelandic community and several other companies are offering similar agreements.

Every year the employees at Matis take a trip to one of the company's branches in the countryside. There are now eight such outposts where approximately twenty per cent of Matis employees work. Through these trips all employees at Matis are given a chance to meet other employees and get to know the various places where the company is located. This year the trip took them to Vestmanneyjar. There they visited the local companies, such as Vinnslustodin hf. and Grimur Cook, and explored the island itself.

A new workers' council at Matis was elected in October. These are always in term for a period of two years. The existence of this workers' council is somewhat special with regards to the labour market. Its purpose is not to organize diversions such as anniversaries or office parties. Its task is instead to work on various issues connected to the work of Matis and the role of its employees. Its purpose is to be involved in improvements in the company and the employees' facilities, for instance to set in motion suggested changes to work methods, conditions and efficiency as well as make suggestions regarding staff policies.

Educating our employees is an important part of Matis' operation. Regular lectures are held through the winter months which involve both seminars where employees introduce their research and where foreign specialists are brought in to explain their own research or the work they are involved in. These lectures are used both to disseminate information among the five business fields at Matis as well as introduce recent advancements in the fields of food safety and biotechnology.

No. of employees per. division	Number	Positions
Innovation and Consumers	13	10,95
Value Chain, Processing and Aquaculture	15	14,4
Biotechnology and Biomolecules	16	15,5
Analysis and Consulting	20	19,5
Food Safety, Environment and Genetics	17	16,6
General Operation and Business Development	18	17,12
	99	94,07

Locations - no. of employees	Number	Position
Reykjavik	82	78,22
Saudarkrokur	4	4
Akureyri	4	4
Neskaupsstadur	3	3
Vestmannaeyjar	2	2
Isafjordur	1	1
Hofn in Hornafjordur	1	1
Fludir	1	0,5
Egilsstadir	1	0,35
	99	94,07

Education	
Food science	22
Biology	21
Research Education	9
Engineering	6
Business	7
Biochemistry	3
Molecular Science	3
Chemistry	3
Fisheries	2
Biomedical	2
Nutrition	1
Other	20
	99

General	
Number of employees	99
Number of positions	94,07
Average age of employees	46,0
Average number of years at Matis	10,0
Education - degrees	
Ph.D.	23
M.Sc.	29
B.Sc.	20
BA.	1
Cand. Oecon	1
Speciality	14
Other	11
	99

Education - degrees	
Ph.D.	23
M.Sc	29
B.Sc	20
BA	1
Cand. Oecon	1
Speciality	14
Other	11
	99

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 Matis, 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. Matis is a knowledgebased company that performs innovative food research on behalf of businesses, public health and food safety.

Matis' production is based around the knowledge created through various research conducted all over the country. Matis' 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 Matis' 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).

1) Matis' 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 Matis reports
- Book chapters
- Lectures at science conferences
- Posters at science conferences

Matis' knowledge Index		
Year	Points	% change
2007	100	-
2008	156	56,0%
2009	182	16,7%
2010	238	30.8%
2011	217	-9,7%

2) Matis' knowledge (30%)

A large part of Matis' 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 Matis, is conducted within the walls of these institutions and many postgraduate and Ph.D. students work on their research in cooperation with Matis. 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

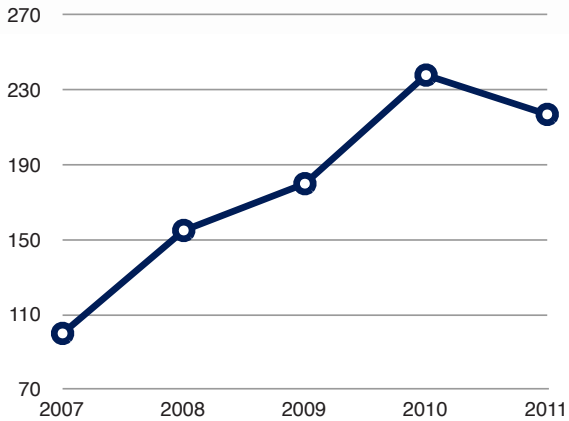
- Number of employees that have permanent positions at universities
- Number of employees that have part time positions at universities

3) Matis' Human resources (20%)

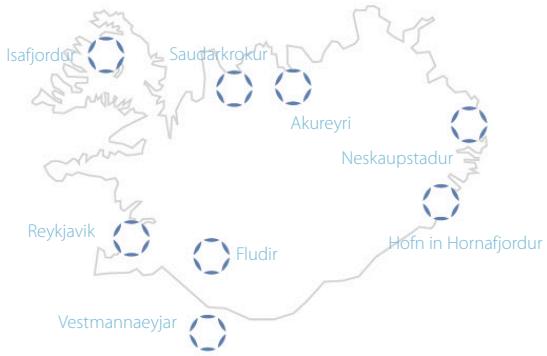
The quality of Matis' employees is the basis of the company's operations and its ability to conduct research of an international standard. The company's research environment is international and there is a lot of competition in developing research and in applying for international research funds e.g. 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 it first year of operations. The knowledge index has risen greatly since 2007, despite a slight drop since 2010-2011. This drop is primarily explained by the fewer doctorate students graduating in the year 2011 and the greater emphasis on product development compared to prior years. Þaraskyr (a kind of yoghurt based on kelp) is one example of the success of product development within Matis, but is not counted in the knowledge index..

Matis' Knowledge Index



Organizational Chart



matís
okkar rannsóknir
allra hagur

Board
Chairman
Friðrik Friðriksson

CEO
Sveinn Margeirsson

Director of Research
Hörður G. Kristinsson

Finances
Kristinn Kolbeinsson

Innovation and Consumers	Value Chain, Processing and Aquaculture	Biotechnology and Biomolecules	Analysis and Consulting	Food Safety, Environment and Genetics
Guðjón Þorkelsson	Arnljótur Bjarki Bergsson	Hörður G. Kristinsson	Franklín Georgsson	Anna K. Daníelsdóttir

General Operation and Business Dev Oddur M. Gunnarsson

Values, Role and Vision

Matis' Values

- Initiative
- Creativity
- Ambition
- Integrity

Matis' 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

Matis' Vision

- To contunue 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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27/7 2011
LIFTAEKNI
Thermo
SCIENTIFIC

Professional emphasis

Matis works on various projects in the food industry where the emphasis is on innovation and increase in value. This is done in cooperation with local producers of food, universities and all those who in some way serve the food industry.

Work is done to systematically boost cooperation with foreign research groups and companies through international research and development projects.

Biotechnology and biomolecules

Hordur G. Kristinsson, Ph.D., Director

In the field of biotechnology and biochemistry research is conducted on biochemical compounds and advances in biotechnology. The aim is to use Icelandic nature sustainably to produce chemicals and enzymes, find, isolate and classify natural, organic substances that have positive effects on human health and can boost the sustainability of food sources. Work is also done into the use of unused resources, for instance algae and chum, and unused saccharide from the environment, such as from seaweed, cartilage, chitin and cellulose. The division works closely with the producers of foods, foundations and colleges both in and out of the country.

The year 2011 was very eventful for the field. Multiple new and exciting projects were started that year. One example of this is Amylomic, a large undertaking across Europe which this division leads. The project, which builds on both physical sciences and practical research, is intended to find a new enzyme in Icelandic hot springs to transform starch in new ways. The results could lead to revolutions in starch-based products, for example in the food industry, as well as bring new Icelandic enzymes into production.

Understanding of thermophilic microorganisms in hot springs creates great interest globally but a heavy emphasis is placed on finding heat-resistant organisms that can be used in industry and research. These enzymes could for instance be used to transform polysaccharide to make it more useful in food production. In addition it may be possible to find special enzymes that can produce valuable materials or energy from unused biomass.

The project Einstök vistkerfi Vonarskarðs (Vonarskarð's unique ecosystems) which was funded by the Techonology Development Fund of Rannís began in the autumn months. It unites many fields of research and revolves around investigating the ecologies of the geothermal hotspots in Vonarskarð and the special types of microorganism that can be found there. These results are vital to increasing our understanding of unique Icelandic ecologies but could also point out interesting organisms that could be exploited.

During the year work was done on various projects related to the production and use of biochemical compounds. Chemicals that have biological effects can be found throughout nature. Testing is done to establish their effects, both positive and negative. Positive effects are sought after for the creation of health products and the prevention of various problems and diseases. These include the lowering of blood pressure, combating cancer, protection against heart and blood diseases and more.

Much research and development has been done on chemicals from large Icelandic algae and many such projects began this year. For instance much work was done on the development of new skin products that incorporate biochemicals extracted from seaweed, and the use of seaweed-based chemicals to improve the taste and preservability of food products was researched to great success. Results of consumer testing suggest that the chemicals may be used to reduce the salt content of products that incorporate them.

The Biotransport project worked on in conjunction with Chalmers University in Sweden and the University of Ljubljana in Slovenia finished this year. The project, which involved investigation into the changes made to

biochemicals when digested, brought to light some interesting conclusions. It turns out the Omega-3 acids can turn rancid when digested, but bioactive peptides extracted from trimmings and antioxidants from seaweed can negate this process if ingested simultaneously. Much work was done to develop and scale up the production process of bioactive peptides and develop several new protein products for human consumption from various waste products of fish, such as bone marrow. Extracting the so-called surimi from these waste products has gone well and there is much interest among foreign companies in the products and methods researched. The division's work has piqued the interest of numerous groups which began working with the division this year developing biochemicals and researching their effects.

The division's biotechnology research is conducted at the headquarters of Matis but the Biotechnology Center in Sauðárkrókur is also vital to its work. It contains specialized equipment and additional facilities for research into biotechnology. The staff moved there around the end of the year to glorious new accommodations at the Center and works closely with local businesses.

Several students from all grades of study came to the division this year, both in Reykjavik and Sauðárkrókur. The work of students was especially useful during the summer of 2011 and they contributed numerous valuable projects, often working closely with local businesses. This year two specialists joined the team which greatly strengthens the field of biotechnology. The division's work was very energetic this year, which shows clearly in its results, particularly in project acquisition both in and out of the country.

Food Safety, Environment and Genetics

Anna Kristin Danielsdottir, Ph.D., Director

In the Food Safety, Environment and Genetics division research is done into chemistry, microbiotics, genetics and risk assessment. The division also monitors the safety of chemical, biological and genetic research for the authorities. They aim to assess the danger posed by harmful chemicals, microbes and genetic modifications in food products and environment.

With chemical research the division aims to improve the security, quality and wholesomeness of foodstuffs. New methods of chemical analysis are developed and research is done into the beneficial and harmful effects of chemicals in foodstuffs, fodder and environment. The situation of Icelandic foods is observed with regards to nutrition and pollutants. The division also monitors the quantity of unwanted chemicals in seafood and pesticides in fruits and vegetables.

The division's microbiology research revolves around investigating the diversity and spread of microbes in food and environment. Knowledge development in these fields and the development of new methods of analysis are intended to improve the safety and wholesomeness of Icelandic products. Thus, for instance, the effects of microbes on the shelf life of foodstuffs can be evaluated, their processing methods and environment investigated with a view to discovering microbes in the area, observing their behavior and the spread of germs. The division's research spans a great variety of environments, from the coastal waters and volcanoes to hot springs and glacial waters, for example.

The division leads in the field of genetics in Iceland and develops new methods of stock, origin, connectivity and parental analysis useful for resource management, strain analysis, breeding and traceability studies. Genetic research involves, among other things, genotyping commercial and wild stocks, parent analysis of animals, sequencing DNA and developing new genetic markers. The division's understanding of wild marine animal stock is unmatched in all of Iceland.

It also took part in the EU project QALIBRA, which entails the development of software that can be used via the internet to assess the risk and reward of any given foodstuff. The division is also involved in the development of a database of Icelandic foods for consumers, governments and companies. This year the EU approved a research grant to take part in two new and extensive European cooperative projects. One involves the area of chemical research and risk assessment, "TDS-Exposure," which revolves around research into how many unwanted contaminants people ingest in their foodstuffs. The other is in the fields of microbiology and bioinformatics, "MicroB3" regarding research into marine microbes around beaches and oceans.

Analysis and Consulting

Franklin Georgsson, Director

Extensive evaluations by accreditation agencies of the quality control systems used by the Matis analysis services were performed in the year 2011 and have led to the conclusion that the state of the company´s quality control is excellent. Most analyses are now quality controlled according to international standards. By the year 1997 the foundation was set for the international quality control currently upheld by Matis and the company has much experience managing an accredited analysis services. Demands for quality and information regarding certain elements of test results are constantly rising, necessitating further education and training of employees and raising costs as well.

Service in the field of microbiological analysis is most common due to various food science projects but it is increasingly being directed at other types of projects. Among these are analysis of the microbiological activity of disinfectants, the purity of cosmetics, drugs and more, measuring environmental effects and the manufacture and sale of research and testing equipment used in purity tests for food production and distribution centres.

The scope of traditional projects increased in the year 2011 as it has every year from Matis' beginnings in early 2007. The company has a special agreement with the Icelandic Food and Veterinary Authority (Matvælastofnun/MAST) regarding safety and priority research in the field of microbiological analysis. Over the year MAST performed a special evaluation of the safety of smoked seafood and all analysis in this project were done by Matis.

An extensive research project regarding the analysis of measurements of the quality of the drinking water in the reservoir of Reykjavik Energy (Orkuveita Reykjavíkur) was completed this year. The project was funded by the company's Environment and Energy Research Fund and was part of the master's degree studies of the students at the University of Iceland.

In most recent years both local and foreign university students have worked temporarily for the division with various projects in the field of microbiological research. Last year a student at the University of Iceland worked on a project to study the microbiological safety of seafood in the shallows around Iceland. The project was supported by the Project Fund of the Ministry of Fisheries and Agriculture and was a link in understanding whether a catch from the shallows is comparable to a deep-water catch in terms of microbiological safety.

The scope of Matis Reykjavik's analysis service rose considerably in 2011 just as it had the past few years. This year a new technique of measuring the chemical composition of foods more quickly than was previously possible was tested. The testing is a step toward building up a database that can be used for reference when calculating the results of these tests and it is believed that it will soon be possible to offer this service for numerous food types.

The scope of Matis' analysis in Neskaupstadur was similar to recent years. The greatest changes are related to the significant increase in mackerel fishing in recent years which have resulted in increased analysis of fishmeal and other seafood products.

This year the accreditation of regular microbiological and chemical analysis of drinking water was completed, along with other kinds of chemical analysis of samples of fish and fish products. It could be said that the project of implementing international quality control of most common analysis practises used in Neskaupstadur is now complete. This means that it is now possible to grant public food monitoring agencies an analysis service up to the most stringent standards of quality. Thus Matis' service dependability grows, as it is now possible to offer steady and comparable analysis service in two locations in Iceland.

Innovation and Consumers

Gudjon Thorkelsson, Director

A number of projects and a great deal of cooperation with small producers, companies and public authorities around the country defined the work of this division in the year 2011. Also worth mentioning are the employee training, education and promotion tasks and cooperation with groups in the Nordic countries and Europe regarding the properties and characteristics of foods in various parts of Europe and the development of products where health and environmental issues are concerned.

At the Food Innovation Centre at Hofn Matis was involved in a number of projects concerning the fishing, processing, and use and product development of lobster. Other projects involved the processing of capelin fillets and megrim, as well as the drying of herring fillets. The Food Innovation Centre at Fludir was formally opened in May and products such as snacks with fish proteins, dried mushrooms and salsas have been developed. Among other things in Eastern

Iceland assistance was rendered with the development of products based on forestry products, the founding of a meat processing plant at Eigilsstaðir and a study done on the possibility of starting a plant devoted to the full processing of pelagic fish at Neskaupstadur. A conference was held at Stykkisholmur regarding the use of kelp in products for human consumption. In addition, assistance was rendered with the development of kelp products. The facilities in Reykjavík were also used, among other things, in the production of so-called 'þjálfarabrauð' bread, power bars for athletes and for the development and processing of crab products based on the catch from Faxafloi Bay and other parts of Iceland.

The division was also involved in an employee seminar on the salting, smoking, drying, pickling and jam-making of foods held across the country.

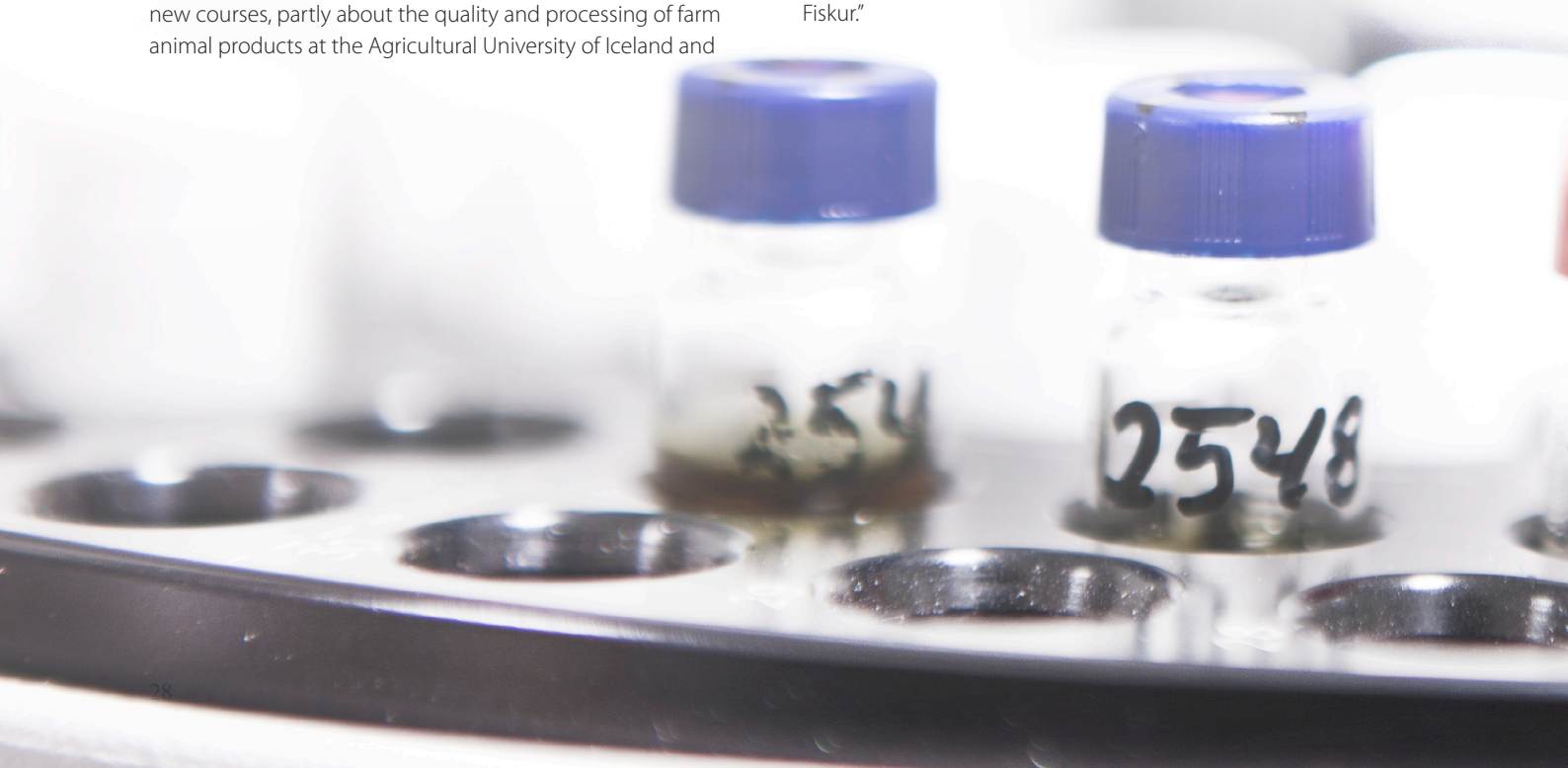
A new website called www.kjotbokin.is, an information site regarding the processing, quality and properties of meat was launched in September. Employees of the division were also involved in the creation of television episodes in cooperation with Sveinn Kjartansson, Aslaug Snorradottir and Sagafilm, all of whom hoped to pique the interests of the populace in the preparation of fish. The programme Fagur Fiskur (www.fagurfiskur.is) was highly successful and won an Edda award in February.

The division's employees organized and took part in teaching new courses, partly about the quality and processing of farm animal products at the Agricultural University of Iceland and partly the environmentally friendly food innovation taught at the University of Iceland in cooperation with other state universities and the Iceland Academy of the Arts. In addition a cooperative venture has begun with the state universities to introduce an international master's degree in food science.

Matis cooperates with European partners (www.foodunique.eu) to draw attention to development projects regarding the characteristics of fish stock, processing systems, products, consumers and cultures in different parts of Europe.

An employee of the division was at the time in charge of the New Nordic Foods project. Matis is also a part of Electrophelia and works there with Innovation Centre Iceland and organizations in food processing in Europe toward the ecologically friendly innovation of foods (www.ecotrophelia.eu).

A group of students worked for Matis in the summer on the development of þaraskyr (a kind of yoghurt based on kelp). The group took part in a European innovation contest at the food show Anuga in Köln in October. A large European project, Chill-On, finished around the turn of 2010 to 2011, having involved the production, distribution and sale of chilled foods. Matis lead many parts of this project. Among the Nordic projects is one regarding healthier school foods, titled "Healthier choices for the young consumers," which finished this year, and "Taste of the North Atlantic," which is about the creation of television series in the spirit of "Fagur Fiskur."



Among other things, research was performed into the infusion of seafood dishes with biochemicals and a study done on the views and consumption tendencies of Icelanders aged 18-80 with regards to seafood. It was discovered that in the last five years the frequency of fish consumption and the variety of seafood products has risen and opinion regarding them changed. Younger people are open to new things, have fewer worries and feel that more fish foods and greater variety offered at restaurants would increase their intake.

All these challenges were performed with the goal of strengthening the Icelandic food industry and creating work and value in the scattered communities across the country while assuring consumers have good, varied, safe and healthy food from choice stock.

Value Chain, Processing and Aquaculture

Arnljotur Bjarki Bergsson, Director

The primary task of the Value Chain, Processing and Aquaculture Division is to contribute to added value in the value chain of food products as well as improved public health. Goals are set regarding increased efficiency and quality in gathering raw materials, production, processing and transport of foods. An emphasis is placed on the interaction of sustainability, traceability, communication and the use of information for both the food industry and the consumer. Ways of improving production methods in the most efficient manner concerning the properties of raw materials are sought.

The division's strategy involves value-added innovation and limiting the cost of food production. It works on development projects that involve the value chain as a whole or specific parts of it. Its operations build on the fact that food has its origin in raw materials, goes through some kind of processing and, in that process, gains value. The final stop is the consumer's dinner table, when he gets a product of certain quality according to his or her expectations. The division's employees possess a diverse knowledge base on a variety of subjects regarding the value chain and work closely with companies, universities and research associates on projects and development in the value chain.

The division's projects are mainly worked on for and with local food companies and those involved in the food industry. It dispenses advice regarding solutions to problems in food production and conducts research aiming to create new products, new techniques and new markets. Means of lowering costs, such as the cost of feed in farming and general production and processing costs, are actively sought. Thus the groundwork is laid for added productivity in food production and a better result.

Feed-based projects were more extensive in the field of fish farming in 2011 than projects searching for technical solutions. Work with databases increased following prior work regarding traceability.

Matis - Around Iceland

From the beginning Matis has been built upon a network of branches around the country. These branches now number eight, including the company headquarters in Reykjavík, and their employees are experts in every field the company operates on. The latest branch is in Fludir, begun at the end of 2010 and formally opened in spring of 2011.

The emphases of these branches vary, reflecting the wide range of Matis and the specialist knowledge inside the company. In the same vein the branches also pay attention to the local community in each location and the needs that exist there. Thus the branches at Isafjordur and Vestmannaeyjar are positioned at two of the main fishing centres in the country, the branch at Hofn at Hornafjordur does a great deal of work with the lobster industry and at Saudarkrokur biotechnology is the key to cooperation with the local food industry. The analysis service in Neskaupstadur is valuable both for producers and public health regulators in Eastern Iceland and Matis in Akureyri has built up a significant understanding of fish farming. Finally the three food innovation centres Matis has built up over the last few years in Hofn at Hornafjordur, in Fludir and in Reykjavík deserve mentioning. Their doors are opened for many interested local producers of food and they are given help to make their dream products and business innovations become a reality.

By operating across the country Matis underlines the company's desire to work with parties at home on numerous projects that could contribute to the economy, improve innovation and create jobs. Matis' strategy in the coming years is to display this focus more prominently across all of Iceland.

International Cooperation

More vital now than ever before

International cooperation is a vital part of the day-to-day running of Matis. This is evident in a number of ways. One manner in which it becomes clear is the company's work with foreign institutions in research and development projects, another is when foreign parties hire Matis for research directly, but in this report are included a few select examples of projects Matis took part in alongside foreign allies in the year 2011. This is not counting various cooperative ventures on foreign soil, such as meetings and forums, where Matis employees meet foreign professionals in their own field of study. At any given time there are many foreign researchers and specialists working with Matis, often all year. All of this results in direct benefits for the structure of Matis as well as aiding the understanding of its employees.

With modern technology it is constantly becoming easier to take part in multinational scientific endeavours and Matis takes full advantage of this. It grants both opportunities to aid the sale of the company's research services, thus adding to its foreign income, and the chance to strengthen the knowledge base Matis is building up for local customers.

Thus, when it comes to international cooperation, whether for Matis as a company, its employees, its customers or its owner, the Icelandic nation, the word of the day is "Advantage."

Matis cooperates in the establishment of parameters for the Nordic marine sector

Sigurjon Arason, Chief Engineer

Nordic collaboration

Valuable Nordic collaboration in marine research

Matis collaborates with the other Nordic countries in various ways; through individual projects involving other research companies, institutions and production companies, and in many cases, in projects where Matis leads Icelandic institutions and companies into such Scandinavian projects.

Several of these projects are within the fishing industry, a primary industry in Iceland. The fishing industry in the other Nordic countries is in many ways similar to the Icelandic one, and some of the fish stocks in the Northern seas are straddling or migratory, meaning that such fish stocks belong to more than one national jurisdiction.

Sigurjón Arason, Chief Engineer at Matis, sits on two working committees which establish the parameters for marine research and collaboration within the Nordic countries and belong to the Nordic Council of Ministers. They are; the Committee of Senior Officials EK-FJLS which forms the policy of the Nordic Council of Ministers in fisheries and fish aquaculture, and the so-called AG-FISK field of work which supervises these projects and provides grants to various projects of the Committee of Senior Officials.

Sigurjón states that this Nordic collaboration is highly important. It is valuable for Iceland as a fisheries nation, and

also in order to share Iceland's experience and knowledge with other nations. "These Nordic projects are varied, from the utilization of marine resources to developments in fish processing and technique. The goal of such projects is of course first and foremost to improve the finished product and increase the value of seafood, thereby improving the marketing position. But also, we have cases that pertain to political dilemmas such as the communal utilization of fish stocks. The solution for such cases often lies in dialogue and collaboration with scientists," says Sigurjón.

Although Icelandic fisheries have many things in common with the Norwegian and Faeroese fisheries, Sigurjón says it is highly important to also benefit from the experience of other Nordic countries in the field, such as Denmark, Finland, and Sweden, who are all EU members and a part of the EU's Common Fisheries Policy. "This benefits us all; the research company Matis, as well as other Icelandic companies and institutions, and Iceland itself as a dynamic fisheries nation," says Sigurjón.

Pelagic fish stock researched

One of the most extensive research projects Matis has undertaken over the last few years has revolved around the herring stock in the North Atlantic. This is a Nordic project funded by the project fund of the Ministry of Fisheries and the Nordic ministers' AG-Fisk group. Participating in the project along with Matis are the Icelandic Marine Research Institute, the Faroe Marine Research Institute, the University of the Faroe Islands, the Herring Processing plant at Neskaupstaður, the Institute of Marine Research in Bergen, Norway and DTU Food in Lyngby, Denmark. The title of the project is Þverfagleg rannsókn á síldarstofnum í Norðaustur-Atlantshafi (Multidisciplinary research into herring stock in the north-eastern Atlantic) and the title explains Matis' approach to the project. It will include specialists from many fields of study, including genetics, chemistry, food science and engineering, to name but a few.

Herring stocks in the area are at once region-bound and migratory. This means that a catch could be of mixed stock depending on location and time of year. Anna Kristín Daníelsdóttir, division director for the Food Safety, Environment and Genetics division says that companies are interested in the gathering of information relating to the nature of the stocks and their behaviours where the processing properties

Based on our information, the producers can determine which properties will be aquired based on the area and timing of the fishing

Anna Kristin Danielsdottir, Ph.D., Director

of the herring vary from stock to stock. "This is a diverse project wherein we are observing the number of stock units in the north-eastern Atlantic, using genetics to determine population structure, as well as the degree of differing stock units in a given catch when fishing and then draw a link between its genetic information and processing properties and chemical content. In so doing we hope to find answers to (among other things) the question of what percentage of a catch is from the same stock, whether different processing properties are related to the stock of the catch or whether there are other factors to be considered, such as environmental conditions. Based on this information the producers can determine which properties will be acquired based on the area and timing of the fishing," says Anna Kristín. Work began on the project in the year 2009.

Other pelagic species in this area also present a worthy subject for study for the same reason and Anna Kristín names the blue whiting, the capelin and the mackerel as examples, which have, in a short time, become important species for Iceland's fisheries. The plan is for this inve-

stigation to lay the groundwork for another, larger European project wherein these and other species will be researched.

"The project is in this way an example of the development of many international research projects conducted here at Matis. They often begin here in Iceland, and then move into a Nordic forum through cooperation with other Scandinavian countries before widening even further in scope and turning into larger projects with support from the nations of the European Union. In this case we hope to widen the scope of our research according to how the behaviour of fish stock is changing along with the weather patterns. The mackerel is an example of this and it is important for the research to have access to all those European nations that fish for mackerel," says Anna Kristín. Around the end of 2011 a grant from the NORA fund was approved specifically to study the mackerel.

"We have already suggested this larger research project in the EU's Seventh Framework Programme for the year 2013. We are hoping then to research fish stock that we know migrate around large areas of the ocean and move in and out of national borders even as their migration patterns are changing," says Anna Kristín. In addition to the aforementioned fish species, plans also exist to study how salmon travels through the deep sea as much of their behaviour deep underwater is unknown. These investigations may answer several questions that have long sat in the minds of marine biologists.Good track record with the mackerel catch (42)

One example of a successful marine research project is that of the fishing and processing of mackerel.

Over the last few years, mackerel has been seen – and caught – around Iceland in ever increasing amounts, resulting in the speedy development of processing techniques of the product. Matis was the lead partner in research on the fishing and processing of mackerel in close collaboration with fishing and service companies, with the goal of making as much of the catch as possible suitable for freezing and human consumption.

The project utilized information from others with experience in the fishing and processing of mackerel.

Mackerel is a fish that has been found in increasing numbers around Iceland, resulting in an increase in the fishing of it, but knowledge of its habits or nature is scarce. It is caught during the summer months around Iceland, when the sea is warmest. Mackerel enter Icelandic waters rather slim but fatten up in a short period of time. A fish with oily meat, it grows quite fast and is therefore delicate to handle and can spoil quickly when it is caught fresh around the island.

Through collaboration with the Icelandic fishing companies, it has been revealed that by using the ships' powerful cooling systems and by taking in only a small catch with a short haul each time, you can cool down the mackerel quite quickly, or to -1.7 degrees. By doing so, the effects of digestive enzymes (Krill; Calanus finmarchicus) on the fish are decelerated. By then keeping the mackerel cool through on-shore processing, its quality is maintained until the catch has been frozen. These methods are now the norm on board Icelandic mackerel ships, with the result that during the mackerel season of the summer of 2011, nearly all of the catch was transformed into valuable frozen products. Research and collaboration with the fishing industry thereby produced lucrative results – and an improved performance within the field.

Timber for the fuel tank

Biotechnology is a thriving field of interest at Matis and particularly, the use of this technology to develop new methods of production and secure new knowledge. One of Matis' Nordic collaborations is a project for developing efficient ethanol production technology utilizing wood derived biomass - essentially transforming timber for use in the fuel tank. Wood and straw are considered major biomass resources that can contribute to securing the future of energy supply in the Nordic region.

The research parties involved in the project are Matis (Iceland), Statoil ASA, Wayland AB, SINTEF (Norway), INNVENTIA AB (Sweden), the Technical University of Denmark

(DTU), and the Technical Research Centre of Finland (VIT). This is a center of excellence project funded by the Nordic Council of Ministers..

Different expertises come together in this project in an effort to accomplish the task of developing efficient and economical production of bio-ethanol from this abundant but difficult biomass. It can be stated that the biotechnological exploitation of these resources for biofuel production is greatly hampered by unsuitable production organisms and lack efficient pre-processing technologies. By recruiting expertises across various disciplines the project represents a concerted effort to accelerate research and development in this field.

Matis' role in this project is to develop a thermophilic organism for efficient and economical production of ethanol. Thermophiles are also robust by nature, living in the harsh, high temperature environments of geothermal habitats and they have the required wide substrate range for utilization of lignocellulosic biomass. They produce a great diversity of polysaccharide degrading enzymes and are potentially capable of simultaneous saccharification and bioconversion using all the lignocellulose sugars, i.e., glucose, xylose, arabinose, mannose and galactose. Thermophiles have the potential of becoming the key factor in the technology chain enabling sustainable production of biofuels and commodity chemicals from lignocellulosic biomass.

Experiments in new feed for farmed arctic char

In the year 2012 a new research project begins with the cooperation of Icelandic, Norwegian and Swedish associates to test a new type of feed for the farming of arctic char. It could be said that its predecessor is the research and development done by Matis, Hólar University College and Icelandic arctic char producers with a new source of protein and raw material. Jón Árnason, feed expert and director at Matis, will be leading the project. He says that since Iceland is the world's largest producer of arctic char, Icelanders should stand at the fore of research and development.

"Along with farming companies we have been studying the protein needs of arctic char and whether it would be feasible to use a different source of protein than fish meal, thus increasing efficiency. In the Scandinavian project we will be performing tests alongside fish farmers in all three countries to observe the results under different circumstances. Afterwards we will be observing the effects of the environment on the farming process, judge the growth of the fish and feed efficiency based on the new feed, observe the effects all the way out to the markets and the reactions of consumers. As we are bringing this new protein source in from the rainforests of Brazil and the plains of America we will also be evaluating alongside those involved in the farming and marketing whether this change will affect the char's reputation as a Nordic fish species. The end of the project will thus be a kind of meeting with everyone on the value chain of the arctic char," says Jón.

Along with Matis and Hólar University College the project will involve two Icelandic fish farms, the Norwegian company Polarfeed and one Norwegian farm. In addition one Swedish farm and the Swedish University of Agriculture will take part. The project will last two years.

It is important that both risks and benefits from food consumptions are analyzed

Helga Gunnlaugsdottir, Ph.D., Research Group Leader

European collaboration

Risk and Reward in the Consumption of Foods

Helga Gunnlaugsdottir, director of chemical analysis and risk assessment at Matis, has recently taken part in a European project where a knowledge base was formed regarding the analysis of risk and reward in food consumption. Representatives of seven European countries took part in the so-called SAFEFOODERA project, in most cases funded by the research funds of their respective countries. Despite that such support could not be gained from Iceland Matis chose to take part regardless with its own funds.

To ensure that it is possible to weigh the pros and/or cons of certain types of foodstuffs it is necessary to be able to evaluate their direct impact on the consumer's health. This can only be done with a risk-versus-reward analysis. The analysis of risk and reward is a relatively new field of research and few techniques usable for food consumption have been developed.

Helga says that the goal of this project was to use the understanding of risk-versus-reward analysis built up in other fields, such as medicine, microbiology, ecology, sociology and economics and adapt these methods for use in food science and the study of nutrition.

"Analyses like these are used, among other things, by the administration to advice on the consumption of foodstuffs and it shines a light on both the risk and reward factors. This is very important, as in many cases the rewards well outweigh the risks. In this European project we have in fact been evaluating where we are in the field of food science and nutrition and whether it is possible to utilize knowledge and methods from other fields of study to develop and improve the risk-versus-reward analysis in food science and nutrition," says Helga. The group's task has been completed and the results can be found in the 2012 January edition of the science magazine "Food and Chemical Toxicology." It is also possible to view the results at the website www.sciencedirect.com.

Developing new methods for fisheries management

In 2011, Matis began working on the EcoFishMan project for the European Union. This project is to develop a responsive fisheries management system that will be useful when working on changes and improvements to the EU's Common Fisheries Policy (CFP).

Fourteen European companies and institutions are participating in the project which is led by Matis. "The CFP is constantly under revision, but we can say that our role is to develop a management plan which will be a useful tool when improving the policy. Our innovation is that we factor in the influence of decisions made on fisheries policy and how they have affected several components, such as the environmental impact, the social impacts on specific areas, ecology, and the economy. The idea is that after we develop the management plan which will take three years, it can be connected to the existing, basic data for each area in order to estimate the impact of the fisheries policy on the aforementioned components in each given area" states Jónas Rúnar Viðarsson, Research Group Leader at Matis who has been working on the EcoFishMan-project. He says this work will facilitate the EU to relegate decision making to the individual countries and areas within the Union, thereby building a more varied and flexible decision making system. An important aspect of this work is to increase stakeholder involvement when it comes to setting down goals, decisions, and follow-up.

"In this way we are not creating a new system for managing fisheries for the EU, but developing important techniques when it comes to increasing flexibility to further develop the current CFP" states Jónas. The project is due to be completed in 2014. Among the institutions participating in the project are the Departments of Business Administration and Social Sciences from the University of Iceland. Other schools, companies, and institutions are in, for example, Norway, Scotland, UK, Faeroese Islands, Portugal, Spain, and Italy.

Development of a system will be useful when working on changes and improvements of the EU's Common Fisheries Policy (CFP)

Jonas R. Vidarsson, Research Group Leader

System tested in four areas

The first part of the project is to define the basic components but later, the methodology will be tested in four different areas with different fishing techniques. Firstly, the Icelandic mixed demersal fishery which Jónas suggests as extremely suitable since Icelandic waters are almost exclusively fished by Icelandic ships, and thus, all decisions are first and foremost tied to Iceland; the fish stock is localized, etc. When the test- and development period is completed in Iceland, the system will then be tested on the Portuguese crustacean bottom trawl fishery, followed by the North Sea mixed demersal fishery and finally, the mixed demersal trawl fishery off of the Italian coastline.

"This selection of areas reflects the great variety within European fisheries, the various methods of fishing, and the unique circumstances in terms of each community. Icelanders have much to offer in research work such as this, due both to our knowledge of fishing and fish processing, as well as from how we have developed our fisheries management. Aside from being useful in decision making when it comes to EU fisheries, these techniques can also be useful for future decision making plans in Iceland" says Jónas.

What are the environmental effects of fish products?

Traceability and the environmental impact of fish products are the main themes of the Seventh Framework Programme (FP7) sponsored WhiteFish project in which Matis is participating, alongside parties in Norway, Sweden, United Kingdom and the Netherlands.

The project is focused on developing methods to evaluate the environmental effects of fish produce, from the time of fishing until consumption. The environmental analysis is based on a Life Cycle Analysis (LCA) which results in it extending to all areas of the value chain. Therefore, it factors

in components such as the state of the fish stocks, the effects of fishing techniques, energy consumption in processing and transport, waste management throughout the whole process, and the elimination or recycling of packaging, etc.

"Judging from the experience we have had from the eco-labelling of sea products, this sort of information is most important for wholesalers and retailers. Most consumers are not prepared to delve into these issues, but on the other hand, they trust that the party selling the seafood is offering a product with an acceptable environmental track record. Big chain stores have their own standards in regards to this and with the WhiteFish-project, we are taking things one step further than the "traditional" eco-labelling and calculating the environmental impact of the product's whole value chain" says Jónas Rúnar Viðarsson, Research Group Leader at Matis.

"Over the last few semesters, wild fish from the North-Atlantic Ocean have been facing increased market competition from less expensive, farmed fish from Asia and Africa, such as pangasius and tilapia. With the WhiteFish-project, we hope to be able to show that when all things are considered, our fish has less environmental impact than its competitors."

Fresh fillets from Iceland are used for the development of the project and also, the same process is examined for fresh whole fish from Iceland which is transported in containers to

Grimsby, UK where it is then processed. The third research topic is sea-frozen fish from Norway and finally, pre-packaged fishmeal produced in Sweden.

"From this project a side-project has developed, supported by the Nordic Innovation Centre, in which we are looking at what information the market is demanding, i.e. the retailers and the consumers, in terms of both content and form. These are questions such as whether or not consumers wish to have accessible information regarding fishing methods and the state of the fish stock, how detailed the content descriptions need to be, or if it is better to develop a computerized coding system in which the consumers can obtain further information on-line and track the process themselves, etc. Developing how to best present this information to consumers can create a unique advantage for Nordic fish products and in that way, make this research more sought after" says Jónas Rúnar.

Developing enzymes for industrial production

The biosphere of Icelandic geothermal areas is the centre of the EU funded AMYLOMICS project which began in the summer of 2010.

The aim of the project is to develop innovative and durable thermophilic enzymes for the starch and carbohydrate industries. Usually, there is an advantage in using high temperatures (60-100°C) in these industries for lowering the viscosity of polysaccharides and increasing enzymatic access.

Geothermal environments are often extreme in more than one aspect, i.e. thermo-acidophilic and thermo-alkalophilic and enzymes adapted to these environments are not only thermostable but also often resistant to proteases, organic solvents and extremes of pH. Consequently, enzymes from thermophiles are tolerant to many of the adverse conditions encountered in industrial processes.

Matis leads the AMYLOMICS projects, but 8 other European institutions, companies and universities are also integral

The biosphere of Icelandic geothermal areas is the centre of the AMYLOMICS project

Gudmundur Oli Hreggvidsson, Ph.D., Research Group Leader

partners. Thereof are two Icelandic companies, Prokazyme and Roche NimbleGen. Also part of the project is the French company Roquette Frères: a world leader in starch processing.

Dr. Guðmundur Óli Hreggviðsson, Research Group Leader at Matis, is the project manager for AMYLOMICS. He claims that European starch processing companies are frontrunners in developing and utilizing biotechnological procedures for extracting and processing carbohydrates from biomass. 'Companies are always looking for better enzymes to improve existing techniques, but also for production of novel, higher value starch products. An important part of the project is to develop a robust methodology of extracting genes encoding suitable enzymes directly from the geothermal environment'.

The idea for the project came from Matis' experts who have acquired a wealth of expertise in in exploiting the unique genetic resources of Icelandic geothermal areas.

By developing techniques to produce enzymes with such unique qualities, we intend to create possibilities for their use in the chemical and food industry," states Dr. Guðmundur Óli Hreggviðsson.

Valuable enzymes in Icelandic hot springs

"Exogenome" is the name of a biotechnological project and the beneficiary of an SME grant from the European Union, a grant given to laboratories, growth companies, and small or medium-

Valuable enzymes can be found in Icelandic hot springs

Viggo Th. Marteinsson, Ph.D., Research Group Leader

sized enterprises (SMEs). The project originated with Matis' and Prokazyme's experts, and built upon the pioneering work of the growth company Prokaria, now a part of Matis. The name Prokaria is still used by Matis as a label for its project on the development of industrial enzymes.

Matis collaborates with Prokazyme when it comes to the production and selling of these enzymes. It is the study of enzymes from thermophilic viruses found in Icelandic hot springs which constitutes the subject of research in the Exogenome projects. Prokaria was a former company that concentrated, amongst others things, on seeking out and then defining viruses that infect micro-organisms in hot springs. One of their findings was the discovery of a unique enzyme which can connect single-stranded DNA molecules. This enzyme is now marketed by the US company Epicenter, where it is the basis for a variety of new methods in genetic engineering. The continued research of thermophilic viruses can therefore be highly profitable.

Participants in Exogenome are research labs and companies in Iceland, Denmark, Poland, and the UK, although Matis from Iceland plays the largest part. The other participants are focusing their efforts on how to find applications for these enzymes

Exogenome is directed by Dr. Jakob V. Kristjánsson, CEO of Prokazyme.

European research into extremophiles

"Carex is a cooperative network with the aim of coordinating research into extremophiles in Europe. These are life forms that live outside the so-called 'norm conditions' and could be plants, animals or bacteria that live in extremely hostile conditions. Examples of such conditions include extreme heat or cold, such as geothermal vents or glaciers, the deep sea or even the stratosphere; anything outside conventional levels of heat or pH," says Viggó Marteinsson, research group

leader at Matis who has been a part of the nine-man coordinating group of the Carex network, a three-year project by the European Union that recently concluded.

In Europe, and indeed all around the world, a great many investigations have been conducted in recent years that, one way or another, relate to extremophiles. The idea behind Carex was to synchronize and coordinate these investigations. The network included 79 research institutions in 25 countries and the fact that Viggó represented the Matis on the coordinating group says a great deal about the company's standing.

"What's left now is to summarize the project through classifying investigations based on the extremophiles involved, their various conditions, and their habitats and so on. As part of this process various projects related to it have been organized including working groups of scientists, support for research grants for young scientists, courses in summer schools revolving around extremophiles and more. For example in Iceland a test of research equipment was conducted in nature where they were stress tested in both hot and cold environments," says Viggó. He believes that the road map of extremophiles that the Carex project has delivered will be of great use to scientists and governments to inform their decisions regarding the most urgent investigations into extremophiles in the coming years.

With the processing of these samples we create a very large databank which gives a picture of salmon stocks and comparisons between them

Kristinn Olafsson, Research Scientist

"The success of the project is thus not the least that we have both brought scientists and their investigations together into one network of information on extremophiles. That network may even be expanded upon in the coming years," says Viggó, pointing out as he does so that Matis and Iceland have a strong standing in this field.

"Iceland is in fact one great big research center for extremophiles due to the many and varied areas that can be found here; high and low ph levels, high and low temperatures, geothermal vents in the ocean and even deep sea, glaciers and highlands and more. We have already shown a great understanding of extremophiles and their use but we have a great deal more to offer in that field," says Viggó.

Genetics used in research of the North Atlantic salmon

An interesting investigation into salmon has recently closed after having been active since 2009. The project was overseen by SALSEA-Merge and Matis was among the research associates. Some are interested in beginning a new project in the areas of Greenland and North America based on the same ideology and experience. This investigation will utilize an improved understanding of salmon stock both in rivers and oceans.

"The point of the project was to genotype salmon across the area, from northern Spain in the south to Iceland and Russia in the north. Overall 26.813 samples from 284 rivers were recorded and analyzed in this area. With these we were able to map the salmon stocks in the rivers, analyze different genetic patterns and use them to gain a picture of the genetic differences between the salmon stocks in the area," says Kristinn Ólafsson, a specialist in genetics and biotechnology at Matis, who was tasked with genotyping samples from Icelandic rivers.

"One of the biggest motivations for the project is the state of salmon stock in the south, i.e. Spain and the surrounding area. Due to changes in the weather pattern the local salmon stock is in serious danger. In addition there are many unanswered questions regarding salmon, such as what happens when they go from rivers to oceans."

Participants in the project included research associations such as Matis, universities and institutions in charge of fisheries regulation. "With the processing of these samples we created a very large databank which gives a picture of salmon stocks and comparisons between them. To get a clear picture of this comparison we decided on fifteen microsatellites that everyone analyzed in the same way. With this number of samples and the databank created by the processing of these samples we can now potentially take salmon from the sea

and analyze where it originates. This has been tested already and that gives us an idea of how the salmon behaves when it migrates to the ocean. We certainly don't have instruments that provide answers to all our questions but it gives us a clearer picture than we had before," says Kristinn.

As it is not permitted to fish salmon in the ocean near Iceland samples have been taken from salmon that has been caught as a side-catch during mackerel fisheries. Kristinn says that in this way the big research project is useful to get a clearer picture of salmon behavior in Icelandic rivers.

"We hope to follow up with a similar project for North America and Greenland. That would give us a holistic picture of the total area inhabited by the North Atlantic salmon. The project would be conducted similarly to how it was in Europe, that is to start basic work by taking samples genotyping fish from rivers and then analyzing samples from oceangoing fish," says Kristinn.

Research in Europe

Matis is one of fourteen participants in the SAFE Consortium; a platform of research bodies that specialize in food safety. Matis is leading the network and over the next few semesters will be in charge of virtually all operations. "One of the things we do is instigate new projects concerned with food safety, and in 2011, we have overseen this work," says Oddur Már Gunnarsson, Director of Business Development at Matis.

Another example of Matis' participation in various European projects is its employee's committee-work. "Matis has two people: Anna Kristín Daníelsdóttir and myself, who sit in the European Union's management committee for these projects as one example, and thereby represent Iceland in its participation in the EU framework programme," states Oddur Már Gunnarsson.

African Collaboration

Quality Control Lessons for Students from Third-World Countries

From the day the United Nations University Fisheries Training Programme was established here in Iceland nearly eleven years ago Matis has handled the teaching of quality control for the school. Margeir Gissurarson, project manager at Matis, oversees the teaching but many employees of Matis from its various fields have a hand in it. "Groups averaging around twenty students arrive in this class and a number of those then continue their work at our company when their final projects involve quality control and fish processing," says Margeir.

The quality control lessons at Matis last for about five months. The first part is an introduction to the quality, safety and processing of seafood products but after that it varies by the students' individual fields of study and their projects. Instructors for these projects then arrive from Matis.

"Those students who have done well with us often go on to a master's or doctorate degree at the University of Iceland of universities in other countries, but all of these students come from third-world countries. The connections that have formed through our work for the United Nations University Fisheries Training Programme mean a great deal both to Iceland and to our company. Indeed Matis has received

United Nations Fisheries Training Programme was established in Iceland nearly eleven years ago

Margeir Gussurarson, Project Manager

projects in these countries directly through our connections with the United Nations University Fisheries Training Programme and our own former students. For example we might name a course held in Uganda and Kenya. There is no doubt that it is a great victory for Iceland to be connected to the third-world countries in such a way in the field of fisheries as the students almost always move on to high-ranking, official posts in their home countries," says Margeir.

Advice regarding fishing and processing in Tanzania

In autumn 2011 Matis signed a contract with the Tanzanian government regarding a project at Lake Tanganyika in Tanzania. The project is funded by a loan from the Nordic Development Fund (NDF) located in Helsinki. It was offered to Nordic research groups of which Matis proved most capable.

Lake Tanganyika is among the largest freshwater lakes in the world, approximately nineteen thousand square kilometres in size. It is also the second deepest freshwater lake in the world, with fifteen hundred metres at its deepest. Four countries border the lake: Tanzania, Congo, Burundi and Zambia.

Consultation and number of courses in foreign countries are increasing

Franklin Georgsson, Director

Tanzanians fish in Lake Tanganyika, but both fishing and processing are done with primitive methods. Matis' task was, among other things, to assist with the development of methods that would better use the qualities of the fish and make it more valuable. Matis has made a deal with the Icelandic companies Radgard Skiparadgjof ehf. og Verkfraedistofa Johanns Indridasonar ehf. (VJI) for a portion of the project. Radgard will provide advice and oversee the construction of a special ship to be used to research Lake Tanganyika and the fish stock in the waters while the VJI offices will direct the project's purchases. In addition Matis has come to an agreement with the Gosh Company in Tanzania which will oversee the socioeconomic area of the project and interaction with fishing communities by Lake Tanganyika.

"This project is a great challenge for us as conditions there are very primitive and unlike what we're used to dealing with. Thus we will need to find ways to develop their fish processing using what is available and cannot assume the presence of electricity, oil or other sources of power like we can elsewhere. A large part of this project also revolves around training and teaching locals to handle the fish and we have taken to sending out people who pick a few villages by the water and travel there to instruct the locals. It could be said that part of the project will be done here at home and in the later stages we will be working on site, according to our plans. This will be a very exciting project and we hope for it to be among the high points of 2012," says Oddur Már Gunnarsson, director at Matis, who is also in charge of the Tanzania project. Margeir Gissurarson, project manager at Matis, leads it alongside Oddur.

Consultation and courses in Africa

Consultation and courses in foreign countries are among the projects that have been steadily growing at Matis. In the year 2011 a sizeable two-week course was held for the United Nations University Fisheries Training Programme in Iceland and the Icelandic International Development Agency where fish inspectors were instructed in quality issues regarding the treatment of fish and fish products including food safety, legal and regulatory matters, fish processing methods, packaging and sample-taking, among others. The course was organized and prepared in cooperation with locals with they take over the course later which would then become independent and be taught regularly from then on. Matis began a similar course in Kenya in the year 2008 and it is now taught regularly at one of the country's universities.

Increase in value through full utilization of by-products can easilly be realized

Arnljotur Bjarki Bergsson, Director

Asian Collaboration

Rewards of Cooperation in Asia

Matis is party to a three-way agreement with the University of Iceland and the Tokyo University of Marine Science and Technology in Japan. The initial agreement was made prior to the turn of the century and renewed in autumn of 2008. Thanks to this cooperation the Japanese university has taken on a newly-graduated doctor who studied at the University of Iceland within the walls of Matis and granted him tenure. In addition Matis also cooperates with a research institution in Hokkaido, Japan. This institution has previously taken part in the project Gagnleg gerjun, overseen by the seafood production company Brimberg in Seydisfjordur. The project revolves around the development of a fish sauce and this is why Matis has taken part in an international forum based on the development of this product.

Matis is also working on the project titled 'The farming and processing of Japanese sea cucumbers,' on which it cooperates with the company known as Saebyli. In this it also works

with Dalian Fisheries University in China as well as an extensive network of Saebyli's contacts in Japan, Hong Kong and China. In addition the project Brjosksykrur and bioactive chemicals from sea cucumbers was worked on in the year 2011 along with the company Reykofn in Grundarfjordur. The Asian connection is vital to this project and indeed its origins lie in the exchanges between Iceland and China as an idea to boost the value of a by-product.

Among Matis' other Asian connections is a second Vietnamese doctor who graduated from the University of Iceland in 2011 and did his research with Matis. The first graduated in the year 2010. Additionally, each doctorate student from China and Iran has graduated after a research position inside Matis' walls.

despite its research capacity Matis' size ensures efficient and expedient service

Ragnar Jóhannsson, Ph.D., Research Group Leader

Kinship analyses of the South-Chinese Turbot

Matis boasts specialized technology for kinship analysis in fish farming and many fish farming companies make use of it. One example is a turbot farming company in southern China, a short way north of Hong Kong.

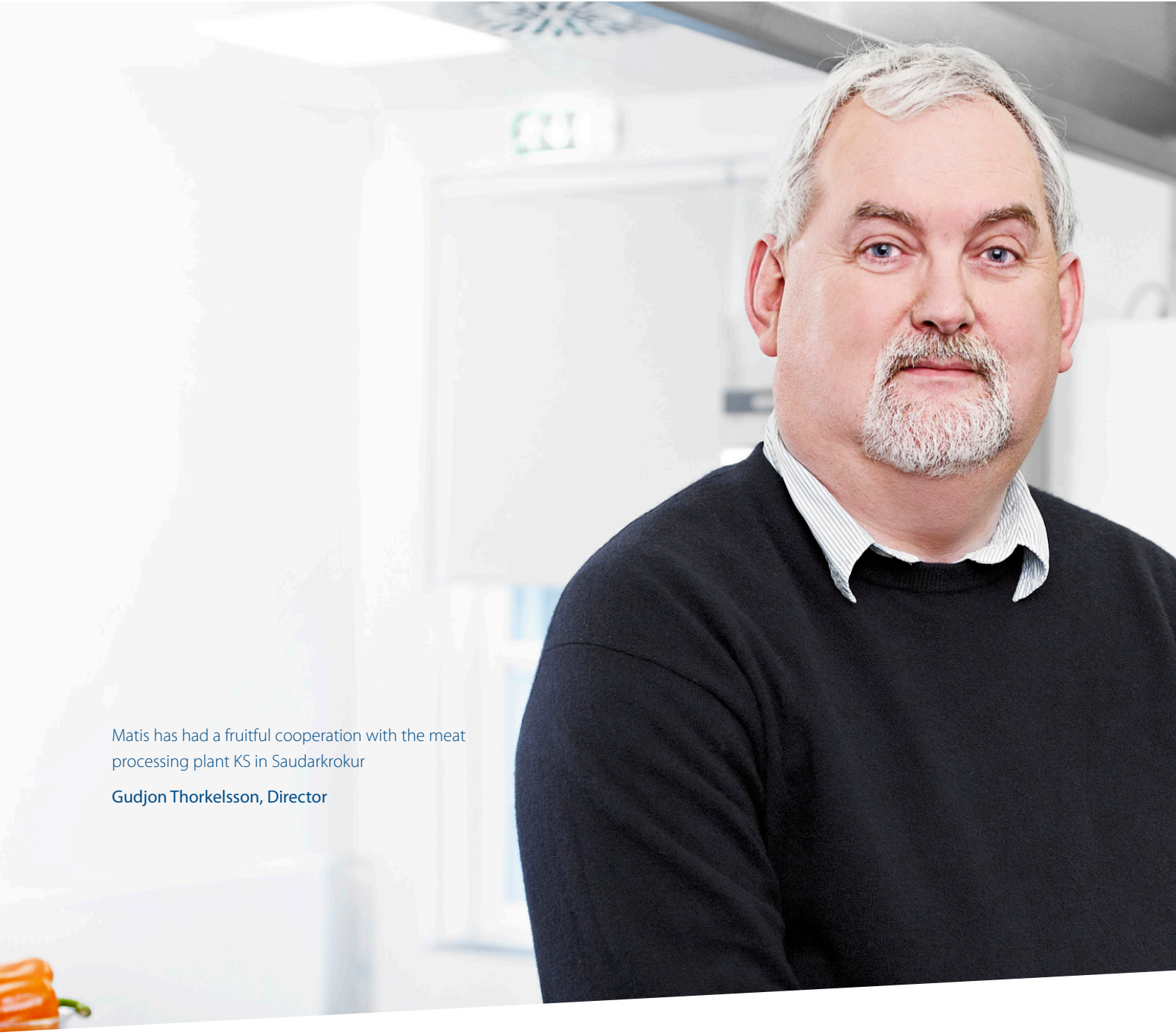
The turbot is raised indoors in closed circulation systems and the company produces approximately 300 tons of it each year. One of the most important details in farming like this is to monitor kinship in the spawning stock and this is done by taking regular samples and genetically analyzing them. The leaders of the company say from experience that Matis accomplishes this task quickly and effectively. In a way it could be said that despite its research capacity Matis' size ensures efficient and expedient service. Though the distance between China and Iceland is great the company has benefited from outsourcing this element to Iceland.

Courses in Vietnam

"Over the last few years we have twice held courses in Vietnam and are planning to hold more, in addition to the thousands of slides and teaching materials we have translated to Vietnamese," says Sigurjón Arason, Chief

Engineer at Matis, but with every year Matis' connections with Vietnam in the fields of fisheries and fish processing grow stronger. The courses which Sigurjón and other Matis employees were involved in were held in the years 2003 and 2005 and there he spoke of the processing of fish, the properties of products, quality and processing technology. The courses were held in cooperation with the United Nations University Fisheries Training Programme.

"Through the work of the Fisheries Training Programme here in Iceland we gain valuable connections with the far corners of the world, such as Vietnam and other Asian nations. In fact, here at Matis two Vietnamese students have completed their doctoral studies in recent years with projects revolving around the transport of fresh fish fillets in one case and saltfish processing in the other. These connections will further strengthen the bonds with Vietnam, as both students left to work there," says Sigurjón.



Matis has had a fruitful cooperation with the meat processing plant KS in Saudarkrokur

Gudjon Thorkelsson, Director

Oceanic collaboration

Knowledge of meat processing sought from New Zealand

The meat processing plant KS in Saudarkrokur has gained a head-start in the processing of meat in Iceland through systematic research and development over the past few years. The plant has worked on various kinds of project, for instance with Matis. The key to its competitive edge has been cooperation with a New Zealand-based consulting firm whose experience is utilized in various ways at the plant, both to develop new products and reorganize production methods.

Agust Andresson, manager of the plant, says that these methods have certainly strengthened the company's standing in the business world, both in the local market and in the field of exports. Iceprotein, a company that represents the fruits of the research and development done by Matis, was at one point involved with the work with KS through data processing that formed the basis of the project that the consulting firm did for the plant. In fact the firm designed a development plan spanning the next few years which the company has followed and will continue to follow for the foreseeable future.

"It involves optimizing the slaughter and processing of our lamb products. In requesting help from New Zealand we seek experience in the field of meat processing where it is most concentrated and our current standing shows just how well it has worked. It revolves around a number of principles; the training of staff, development of new products, technology, methodology, facilities, and so on. We began this work in 2003 and it could be said that this was a turning point for us," says Agust. An example of the change would be that the processing and packaging of products now runs alongside the slaughtering. At the same time slaughterhouse performance has increased by half, and this change is apparent to consumers by new products in stores, changes in packaging and so on.

South-American collaboration

Matis gives advice on the development of fish feed in Chile

Jón Árnason, feed expert and division director at Matis, has been part of the development committee of one of the largest producers of fish feed in Chile, Salmofood S.A., for several years. The company is owned primarily by Chilean fish farming groups and produces approximately 60 thousand tons of feed per year. The development committee includes representatives of the company who direct its efforts, two representatives of Nofima in Norway, which is one of the world's largest companies where the research and development of fish feed is involved, and Jón, as a representative of Matis. He says that his position there is without a doubt a recognition of the knowledge and experience that Iceland has accumulated in the matter of fish feed over the past few years.

"It began ten years ago, when I was singled out for participation in this project, though at the time I worked with the feed producer Laxá hf. Since then we have spoken regularly at work meetings in Chile, and the long time I've been with

Our work has brought changes that have strengthened Salmofood S.A.

Jon Arnason, Ph.D., Project Manager

the group shows that they feel they gain valuable knowledge for the development of their feed production by my experience from Iceland," says Jón. The committee has worked with information regarding the nutritional requirements of the fish, the composition of the feed and elements that directly affect efficiency in the production process.

"Our work has brought changes that have strengthened this company and thereby strengthened the standing of the owners, primarily fish producers in Chile. Most of the produce is Atlantic salmon, Pacific salmon and rainbow trout, and thus the development of feed has to be aimed at those types," says Jón. The committee meets on average twice a year in Chile and works consecutively for a week afterwards.

"We observe all the latest advances in the study of feed, discuss specific issues that have come up in farming or production, go over quality issues and at the same time often visit customers of the company in Chile and talk to them directly. Being a part of this is to me a very valuable asset for us at Matis and for Icelandic fish farming, both to keep up with the latest developments in the field and to form connections with groups on the level of Nofima in Norway. Within that company are leading individuals in the study of fish farming and feed production and forming ties with them is of vital importance," says Jón.

North-American collaboration

Research with Canada and Scandinavia into cod livers

Matis employees are involved in an extensive research project between Scandinavia and Canada where the goal is to increase the quality of fry produced in the farming of cod. The project is funded by Canadian members and the Nordic part by the 'NORA Nordisk Atlantsamarbejde' fund. Icelanders working on the project include Rannveig Bjornsdottir from Matis and the University of Akureyri, Ragnar Johannsson, Anna Kristin Danielsdottir and other members of Matis, and Agnar Steinarsson at the Marine Research Institute.

Iceland, Scandinavia and Canada all have high hopes for the farming of cod. In Iceland Matis has approached research projects in cod farming with individuals who have worked with this young branch of research and built up an understanding of various elements of farming within Matis. A large part of this research has been done under Rannveig Bjornsdottir at Matis' offices in Akureyri. Rannveig and her group have placed a heavy emphasis on research into the first stages of farming, i.e. the larval stage, where the most losses occur.

Most losses occur during the first stages of fish farming, i.e. the larval stage

Rannveig Bjornsdottir, Ph.D., Research Group Leader

In the COD-Atlantic project the larval stage is being investigated specially. The goal is to gain a better understanding of how the composition of feed affects the growth of the cod larva and their health. In other words the question being asked is 'what composition of feed delivers the most living larvae?' Another element of the COD-Atlantic project is to boost the growth rate of the farmed cod through the optimization of the feed. It is vital to the development of cod farming to first gain an understanding of the larger elements that affect the profitability of the farming. Both the right composition of fodder and minimal death of fry are of great importance.

Genetic information of arctic char in the northern hemisphere mapped

"Here at the NordChar project we are observing alterations to the ecosystem of the northern hemisphere alongside changes in temperature and especially the effect this has on the arctic char in this investigation. First and foremost we are observing the wild char, the effects of changes in weather pattern to its natural habitat, but we are also watching for changes to the natural environment and hunting and a part of this is looking to the development of arctic char farming," says Ragnar Jóhannsson, research group leader at Matis in charge of its contribution to the NordChar project which Matis is now taking part in along with partners in Canada, Norway and Scotland and which is directed at the arctic char in the North Atlantic. Ragnar coordinates the project for Matis but others taking part are both universities and research groups. Along with Matis the Institute of Freshwater Fisheries will be representing Iceland in the NordChar project.

"This is a genetics project where we create a genetic database for the arctic char wherein we map the genetic and physical properties of the char in various areas. By gathering together genetic information into a central database we can use that information to observe their development or even predict it," says Ragnar. The project involves sequencing mitochondria from fish samples taken from a very large area. Samples are drawn from rivers in mainland Europe, Scandinavia, Iceland, Scotland, Greenland and Russia. "Mitochondrial DNA is passed from the mother to the offspring and

thus we gain an image of the maternal family tree of the arctic char in the area of the northern hemisphere. With that we can later connect all kinds of information, such as rate of growth, diseases and so on, to information from the DNA of the char and thus produce valuable evidence that can for instance be used in future farming of arctic char. Genetic information can be used directly to bring forth the properties in the fish that the producer desires. But the first step, and the one that NordChar is all about, is to create this 'family tree' and thus lay the foundation of the future. We are in fact drawing information from the past to predict the future or even affect the char's evolution in favor of farming or capture of wild arctic char," says Ragnar.

The project makes good use of the sequencing technology that Matis has at its disposal in the genetic research being done. The first step in this project will be finished around the beginning of 2012 and it could be said that that is when the real work begins in building up the genetic database, along with recording the relevant information available to us within each sample. The project is expected to finish around the end of 2012.

Fish Proteins to Fight Diabetes

Matis is now in charge of a cooperative project with both Icelandic members and a Canadian university that is expected to run at least two years and revolves around researching the effectiveness of fish proteins in the battle against type 2 diabetes, a disease that arises due to insufficient production of insulin in the body. Diabetes affects approximately 6% of the planet and this number continues to grow over time. Thus all research into the disease and development of new chemical compounds to combat it is considered urgent.

Dr Hólmfríður Sveinsdóttir, an employee at Matis' offices at Sauðárkrókur, directs the project but it benefits from the support of the AVS fund in Iceland. Alongside Matis the project is being worked on by Iceprotein, Prokazyme, the University of Iceland and Laval University in Qebec, Canada.

Hólmfríður says that over the past few years Matis has used its biotechnology research to build up a strong understanding of the production of bioactive peptides from fish proteins. The effects of these peptides have included decrease in blood pressure, inhibition of inflammations and antioxidation. Processes have been developed to produce high-quality bioactive peptides from various by-products.

The effects of non-fatty fish compared to fatty fish showed that the consumption of non-fatty fish leads to fewer cases of type 2 diabetes compared to fatty fish

Holmfridur Sveinsdottir, Ph.D., Project Manager

Results of epidemiological research have brought to light fewer cases of type 2 diabetes in nations where fish consumption is high. The positive effects of fish consumption were at first believed to be related only to fish fats but recent observations of the effects of non-fatty fish compared to fatty fish showed that the consumption of non-fatty fish leads to fewer cases of type 2 diabetes compared to fatty fish. As non-fatty fish is composed mostly of protein scientists have hypothesized that the positive effects of fish consumption on insulin deficiency are the result of fish proteins rather than fish fats. Results of tests on animals and humans support this hypothesis as cod proteins boosted insulin production in overweight rodents and insulin-deficient humans. In addition tests reveal a drop in oxidative stress after consumption of cod proteins while increased oxidative stress is believed to be one of the causes of type 2 diabetes. Research into Icelandic seafood reveals that it contains considerable amounts of antioxidants.

"The experience we at Matis have built up has revealed important opportunities to gain a better understanding of the effects of bioactive fish proteins and peptides in new fields in conjunction with the world's finest specialists. Currently on the market are bioactive fish peptides that can (for example) lower blood pressure and that are being sold at a very high price. Similar dietary supplements related to diabetes, produced from fish proteins, are not currently available and thus we have a new, exiting and valuable niche to fill," says Hólmfríður.

Magnea Karlsdottir, Hélène Liette Lauzon, Ph.D., Sigridur Sigurdardottir og Sigrun Mjoll Halldorsdottir.
Not in the picture: Asta Heidrun E. Petursdottir

Collaboration with the University Community

Knowledge into Value: Matis fosters the knowledge-based environment and constructs a pathway to creating capital goods.

Matis puts a great emphasis on collaboration with universities. On each given time there are a number of graduate students doing their research at Matis, or in projects related to Matis. Actually, a large part of Matis' research is connected to Icelandic or foreign university-level educational institutions, involving graduate students more often than not.

2011 was no different in this regard, apart from the ever-increasing number of students connected to Matis' scientific and research work. In fact, 2011 was a record year in the number of students working on different Matis projects. These students came from various places, enjoying the guidance of Matis' scientists and benefitting from the excellent research facilities the company has to offer. Also, Matis enjoyed a good relationship with both domestic and foreign students working on research and other scientific work in today's large international community.

A few Ph.D. programmes worth mentioning this year

Hélène Liette Lauzon, Ph.D., researched the role of micro-organisms in cod farming, so as to improve the survival rate and to assist with larval growth in the early stages of farming. The big problems in cod farming are more often than not to do with these early stages, that is to say the hatching and development during larval stages.

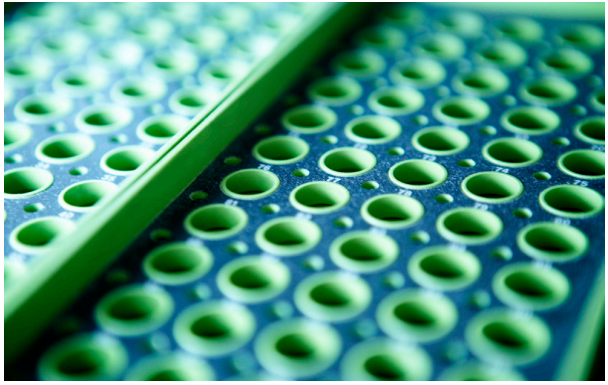
Probiotics can play a key role in creating the environment that leads to increased growth, vitality, immunity and survival, for example by preventing growth of unwanted bacteria. In her research, Hélène was assisted by scientists at Matis

and at the University of Iceland, as well as foreign probiotic experts such as dr. Birgitte B. Budde from Denmark and Prof. Seppo Salminen from Finland, who instruct on LGG research, Einar Ringø, professor of microbiology was one of Hélène's opponents in her doctoral defence.

Einar comes from Norway, a country at the forefront of cod farming. This collaboration has led to further collaboration with both Einar and other probiotic experts around the world in relation to the writing of book chapters and scholarly articles on probiotics. Hélène graduated in December 2010.

Sigridur Sigurdardottir is a Ph.D. student in industrial engineering at Matis, in collaboration with the University of Iceland. Sigridur's instructors are Sveinn Margeirsson, Ph.D., and Sigurjon Arason at Matis, Pall Jensson, Ph.D., professor of industrial engineering, and Birgir Hrafnkelsson, Ph.D., at the Science Institution of the University of Iceland.

Sigridur's research project has to do with creating models for fisheries management, and is a part of two international projects that Matis participates in; EcoFishMan and BADMINTON. The first is a collaboration of companies and institutions from around Europe, which aims to develop and contribute to the implementation of a new integrated fisheries management system in Europe. The resulting product will then be researched in three different case-studies and looked at in a comprehensive manner, that is to say from a biological, social, legal and political perspective, at the same time putting an emphasis on reducing bycatch and maintaining the diverseness of the species. Sigridur, in collaboration with other domestic and foreign participants in the EcoFishMan project, will work on solving this problem.



The BADMINTON project is a European research into bycatch. Collaborating with Bent Herrmann, Ph.D., and Niels Madsen, Ph.D., at DTU Aqua, Sigridur will build a model that will provide information on how much economic effect different methods of decreasing bycatch would have.

In the fall of 2011, Sigridur attended the University of California where she took courses in simulation and

biological modelling alongside her research with Lee W. Schruben, honorary professor at UC Berkeley's department of industrial engineering and operations research. They plan on publishing a scientific article to be introduced at the Winter Simulation Conference in Berlin at the end of this year.

The Ph.D. programme of Asta Heidrun E. Petursdottir, has to do with developing a reliable method of analysing inorganic arsenic in seafood. Inorganic arsenic, a poisonous form of arsenic, poses a danger. The European Food Safety Authority has handed in a scientific opinion, which will be taken into consideration in the legislation process, stating that it is important to put a limit on the amount of inorganic arsenic in food and feed, including seafood. However, from the point of view of chemical analysis it can be difficult to detect inorganic arsenic in marine products, which poses the challenge in Asta's doctoral programme.

The research is mostly conducted at the University of Aberdeen, as Asta Heidrun received a SORSAS grant (Scottish Overseas Research Students Award Scheme), an award scheme to attract outstanding research students to Scottish Universities. A collaborative agreement was made between Matis and the University of Aberdeen. The project is guided by Jorg Feldman, Ph.D., a leading expert in arsenic speciation, and Helga Gunnlaugsdóttir, Ph.D., programme director and an expert at Matis. Two scholarly articles have already been approved by peer-reviewed magazines in relation to the programme. Asta plans on graduation in 2013 / 2014.

Sigrun Mjoll Halldorsdottir, Ph.D. student, is working on extensive research in collaboration with the University of Iceland and the University of Florida, in the field of bioactive peptides that are created from fish protein, but the results of the research indicates that bioactive fish peptides have a positive effect on people's health, even more so than the traditional nutritional value.

There are opportunities for bioactive peptides as an ingredient in food supplements, sold at high prices in the fast-growing health market. Sigrun has, among other things, produced peptides from isolated protein from fish muscle (isolates), isolated with using an acid-alkaline method. Thereby allowing for the production of protein out of

Few of Matis´ Partners

otherwise underutilized raw material, and to increase its value significantly. Also, oxidisation is a great problem when producing peptides, and Sigrun has focused on following the oxidisation that takes place due to an enzymatic hydrolysis. A number of bioactive components of the final product are measured, such as the antioxidants, and the effects that lower blood pressure and improve the immune system. Isolated chemicals from Icelandic bladder wrack have been used as antioxidants to resist the oxidisation.

Research and development of the antioxidant chemicals from bladder wrack have been on-going at Matis for

quite a while, stretching out to Norway, with Ingrid Undeland, Ph.D., leading the way. Sigrun's research has caused deserved attention in, among other places, India and China. Sigrun has been offered to hold lectures in conferences in 2012 in India (International Conference on Environmental Security for Food and Health) and in China (2nd Annual World Congress of Marine Biotechnology 2012). Also there have been requests for collaboration from Ph.D. students in the USA and Thailand. Sigrun plans to graduate early 2013.

Examples of projects in 2011

Production development of lumpfish

The aim is to study present on-board handling of lumpfish and recommend necessary changes to ensure better quality of raw material for production and develop more valuable end products.

EcoTroFood

EcoTroFood aims at improving the access of the food industry to information and knowledge on eco-innovation, in particular for SMEs and service providers.

Practical testing of experimental results regarding feed for char

Earlier research programmes have shown that both protein content and use of fishmeal in diets for Arctic char can be considerably lower than in present commercial diets. These findings give room for 10 - 15% reduction of production cost of Arctic char.

Taste the North Atlantic

The aim is to promote a positive image and strengthen the food culture and tourism in Iceland, Greenland, Faroe Islands and Norway in an innovative Food TV programme where chefs from each country present local raw materials and food culture. The emphasis will be on local food presented in an original and exciting way without losing its uniqueness. The intention is not only to appeal to tourist but also to inspire local food industry and the people of Iceland, Faroe Islands and Greenland.

Drying of herring fillets

The project goal is to create increased value through processing of herring products in Iceland by starting production of dried herring for human consumption in domestic and foreign markets. The goal is to develop a process that aims to shorten the procedures of an ancient Japanese method of drying herring known as the Migaki method.

Dried and cured whale meat

The aim of the project is to increase economic development and innovation in Akranes city, by develop a product from dried and cured whale meat, with defined physical- and flavour properties.

EXGENOME

EXGENOME is an EU- SME bio prospecting project that aims at enriching for and sequencing phage metagenomes from Icelandic hot springs. Genes encoding for various enzymes for potential utilization in molecular biology research will be expressed and characterized. Three SMEs, Prokazyme from Iceland, AABiotec from Poland and Exiqon from Denmark as well as research institutions and universities in these countries are collaborating in this project with Matis.

Food safety

The purpose of the project is that Icelandic authorities and institutions will be more able to apply to the acquis in the selected areas of food safety, i.e. residues of plant protection products, chemical contamination, and food borne toxins, food composite and genetically modified organisms

Raise awareness regarding food safety issues among key institutional and sectorial stakeholders and increase consumer trust

The unique microbial ecosystems in Vonarskard

The objective is to assert which factors control microbial hot spring community structures in Vonarskard. Morphology and mineral features of specimens from microbial mats will be examined using microscopic methods including SEM-EDS.

Tomorrow´s aquaculture systems

The objective of the project is to develop the next generation of land based fish farms. The technical, biological, economical and environmental performance of existing farms in the Nordic countries and Canada will be documented. The information will be used to suggest modifications

and improvements to design of existing farms and stimulate innovation in the design of future land based fish farms. Furthermore, the project will identify new species suitable for intensive land based farms.

Statistical analysis of Icelandic marine pollutants trends

The environmental condition of the sea around Iceland has been monitored since 1989, nevertheless, limited statistical evaluations have been performed on the available data on the Icelandic marine biosphere. The objective of this study is to analyse temporal trends of pollutants to establish if the concentration of pollutants is significantly increasing or decreasing and at what rate these changes are taking place.

Genetic diversity of Cyclopterus lumpus (lumpsucker)

The aim of this project is to determine if lumpsucker in Iceland is represented by multiple stocks and to answer the question if gene flow is restricted among areas using 6-8 neutral microsatellite markers.

Hedinn protein plant

The aim of the project is to develop an automatic fish meal factory. In order to reach that goal the manufacturing process and equipment will be redesigned in various ways. Instead of the traditional cooker there will be developed a pipe cooker, and instead of a press there will be a decanter that separates fish oil from the liquid. Instead of an evaporator is a pre-dryer, electrodes will be used for drying, and waste heat will be used for cooking.

CodAtlantic

In this project the Nordic countries and Canada will join forces to identify the characteristics and the molecular mechanisms mediating the successful transformation of cod larvae into juveniles of high quality.

Culturing and utilization of marine algae from the sea surrounding Iceland

The main goal of the proposed project is to search expedient plankton suitable for culturing and utilization, for example as nutrition for zoo planktonic animals.

Stock structure of Atlantic Mackerel

In this project there will be developed and tested microsatellite markers using state of the art genome sequencing technique. The marker set will be tested on mackerel samples from different spawning and fishing grounds.

Seaweed as feed ingredients

The aim of the project is to collect, analyse and process different seaweed as ingredients in aquaculture feed.

Processing of capelin fillets for product development of arctic anchovy

The aim is to increase the value creation in the capelin industry in Iceland and to develop arctic anchovy products. Explore the market both domestically and abroad. Investigate whether it is possible to create enough value in the capelin fillets for future investments in fully developed capelin fillet machines for a big volume production of fully developed Arctic Anchovy.

The Chef's Lobster-stock.

The aim is to enter the cafeteria, restaurant and hotel market both domestically and abroad with the Chef's Lobster-stock. Also to design and develop new packaging and products. By reaching the goal it will increase the output in the lobster-stock production as well as create value and employment in Hofn.

Processing of lobster claws

To use meet from lobster claws to explore the possibilities of production and sale of bread lobster and lobster sausage from the meet of the lobster claws. The goal is to create increased value out of a second class material that otherwise is thrown away in the Icelandic lobster industry.

Improving opportunities in vegetable and fruit production in Iceland

Increase domestic production of vegetables and fruits on the cost of imported goods and discover new opportunities for Icelandic manufacturers.

Healthy meals from the ocean

The aim is to increase the value of raw materials from sea and increase market share. Seafood dishes enriched with bioactive compounds from the ocean, such as seaweed, fish proteins and fish oil will be developed to meet market demand.

New technology for added value of ground fish

The aim of the project is to develop technical innovations for value addition to ground fish catch. The solutions will be implemented to improve on-board handling and processing of the catch. This will result in higher productivity, increased filleting yields and higher utilisation of secondary raw materials for processing on shore.

Data collection and user software for Fish Selector

The aim of the project is to collect additional data from Fiskvali and to develop user applications that make the data accessible for further processing. Fiskvali is designed to enhance selectiveness of fishing gear and to assist fishing vessel operators to take advantage of the data for decision support.

Improved quality and yield of salted fish with fish proteins

The goal is to develop a new technique to produce natural fish proteins from by-products to increase quality and yield of salted fish products. There exists a significant need for new natural techniques to aid Icelandic salted fish producers in maintaining a competitive edge on the market. Preliminary trials have shown that using natural fish proteins during processing of salted fish can help with this.

Anti-diabetic fish proteins

Diabetes type 2 is a dangerous, fast growing disease in the world. Researchers have shown that fish proteins and peptides can prevent and help people suffering from this malady and thereby improve their health. At the same time, if successful, the project does lead to improved value of seafood.

Icelandic skin care products form seaweed

The goal of this project is to develop, design and market locally and abroad new skin care products from Icelandic seaweed.

Historic Atlantic cod

We propose to quantify the genomic potential for fisheries induced selection in cod, allowing a deeper understanding on the importance of FIE for fisheries management.

CodMorph

The aim of the project is to establish morphological and life history markers for the identification of sub-stock structure of cod in Icelandic waters, based initially on the analysis of a large number of archived samples, followed by the evaluation of the markers using data collected by an informed and strategic sampling scheme.

Naturenzymes does the job

The aim of the project is to produce enzymes from ground-fish viscera, to remove the membrane and the ringworms from liver before canning.

Optimizing and increasing Icelandic turbot culture (MAXIMUS)

The project´s aim is to maximize production and profitability in juvenile and on-growing phase of turbot culture. Furthermore to develop new feed for sustainable higher growth and lower feed costs, thereby increase Iceland's overall competitiveness in fish farming.

Linking coastal and frontal feeding behaviour of Atlantic cod

The aim of this project is to analyse data from Data Storage Tags (DSTs) to assess location of capture and recapture. Also to assess migration pattern of the two behavioural types of cod (coastal and frontal feeding migration), as well as depth and temperature pattern and growth rate.

Aquaponics - Green growth

The project´s aim is to implement aquaponics in the Nordic countries through a common initiative in Norway and Iceland with technology transfer from Canada. Aquaponics combines aquaculture and horti-culture through the utilization of nutrient rich waste water from aquaculture.

Superchilled ground fish - pre-rigor

The projects aim is to experimentally investigate the effect of super-chilling of whole fish on product shelf life and quality. If the results will be positive, the products of the project can be used for designing and building a super-chilling system on board fishing vessels.

The application of edible seaweed for taste enhancement and salt replacement

The aim of the project is to develop flavour ingredients from Ascophyllum nodosum and Laminaria saccharina with the potential to enhance flavour and replace sodium in food products. The aim is to develop and optimise enzymatic processes to produce healthy flavour ingredients and salt reduced food products from seaweed.

Hikers' food and special food from fish

The aim is to develop hikers' food and other special food based on marine ingredients in flexible canning bags so the products will be stable for a long time at ambient temperatures. By using the production facili-ties at MURR in Sudavik for product development and by the correct market links it should be possible to add value and create jobs in the region.

Ready to eat dishes from salted cod

The aim of the project is to develop frozen ready-made meals, bacalao-balls and meals, from offcuts of fish and less valuable raw material and thereby increase the value of seafood. The aim is to sell the products in the Nordic countries, Spain and in Iceland. This will also promote employment at Arskogsstrond where the company operates.

Beautiful fish in the sea

The aim of the project is to promote a positive image, increase the value, consumption and interest in Icelandic seafood products by promoting the unique-ness, quality and potential of local raw materials in different regions in an innovative and exciting way in continuation of the TV series "Beautiful fish in the sea". In the new series the focus will be on introducing new species of fish.

Quality salt for fish salting

The aim of the project is to develop processes for production of food grade salt from saline ground water (sea water) which can be used for food production. Characteristics of salt for salted fish production will be measured based on the effects of salt on utilization and quality of salted products, as well as direct measurements of the composition of salt.

Opportunities in processing Megrim in Icelandic seafood industry

Analyse and develop knowledge of catching and processing Megrim and create value from the usage of the fish stock.

New approach in fisheries management

The aim of the project is to develop a new methodology for fisheries management. Drivers for discarding of unwanted catch will be examined and recommendations made on how to minimise discarding.

Workshop on SME´s and Nordic Food Competence Centres

This seminar/workshop is intended to bring Nordic Competence Centres together for two days to get to know and learn from each other; build a network and to discuss and come with proposals on how these activities can support and strengthen New Nordic Food.

Whitefish

The aim of the project is to develop and validate a method for Batch-based calculation of sustainability impact of cod and haddock products. The project is especially developed for the benefit of SMEs in the cod and haddock supply chain so that they can document the sustainability of their products and processes, and thereby gaining competitive advantage through improved market access, price and consumer preference. The project is funded by the European Commission.

WHITEFISHMALL (North Atlantic Whitefish Marine Living Lab)

The main goal is to build a branding platform for whitefish from the North Atlantic that differentiates in terms of sustainable production and superior consumer benefits. Also demonstrate how a Living Lab can be established in the marine sector, dealing with a specific innovation challenge, where the solution is co-created, explored, demonstrated and evaluated with a user-centric approach in real-world environments.

Fish proteins in bread

The aim of the project is to develop a new product at MPF Iceland in Grindavik from fish by-products that can be used in bread. MPF aims at selling those proteins to the baking industry suppliers both in Iceland and abroad and thereby sustain employment and innovation in their local area.

Gourmet Diving

To research and evaluate the supply and quality of edible marine organisms at various potential scuba diving sites in the Westfjords with the aim to establishing service with diving and snorkelling tours that involve collecting seafood, which can be consumed on the surface as part of a gourmet food experience.

Novel bioactive seaweed based ingredients and products

Marine seaweeds are a highly underutilized resource in Scandinavia with great potential. Seaweeds, including bladder wrack, are known to contain unique compounds which can find many uses in consumer products. Scandinavia is in a unique position to create significant value from its very abundant seaweed resources.

Micro B3

Micro B3 stands for "Microbial Biodiversity, Bioinformatics and Biotechnology" which reflects the three main pillars the project will address. The central concept of Micro B3 is to team up an interdisciplinary and intersectoral set of world class European researchers to overcome current obstacles in marine biodiversity research and blue biotechnology.

Raw material process in shrimp factories

The objective of this project is to increase know-how in Icelandic shrimp industry by using poly-phosphate in raw material treatment.

Microfeed

The aim of the project is to use the chemical energy from two types of polluting waste streams and turn them into valuable products. These waste streams are on one hand geothermal exhaust gases (GEOGAS) that are released from geothermal power plants and on the other hand, organic chemicals found in wood processing bio refineries that use the sulphite process for cellulose fibre production (REFINE). By growing the suitable microorganisms on the chemicals in these waste streams, they can be turned into biomass or Single Cell Proteins (SCP) that are suitable as protein-rich components in fish feed.

Small scale production of dried meat products

Five small scale producers in South Iceland will develop and market dried and fermented meat products with the help of Matis, Dimms Design and Atvinnuþróunarfélag Sunderland's.

Total Diet Study- Exposure

Total Diet Studies (TDS) allow getting information on real dietary exposure to food contaminants consumption and estimating chronic exposure to pesticide residues in food and food additives intake. TDS consider total exposure from whole diets and are based on food contamination as consumed rather than contamination from raw commodities, thus ensuring a realistic exposure measure.

Utilization of projects

The importance of transforming knowledge into value

Matis emphasises the utilization and the marketability of all projects and operations. There are great opportunities in getting research and development results into production and into the market, as this leads to an increase in the making of capital goods for the Icelandic market, and for the benefit of the public.

Intellectual Property Protection for design

Matis, along with collaborators Promens Tempra, Wessex Institute of Technology and the designer, Björn Margeirsson, received the intellectual property protection rights for a new round foam box for transporting fresh fish products. The new container helps keeping the temperature low, maximizing the quality of the product upon reaching its final destination, whether in domestic or foreign markets. This increases the competitiveness of fresh, Icelandic seafood, especially when it is transported in air.

Limited companies

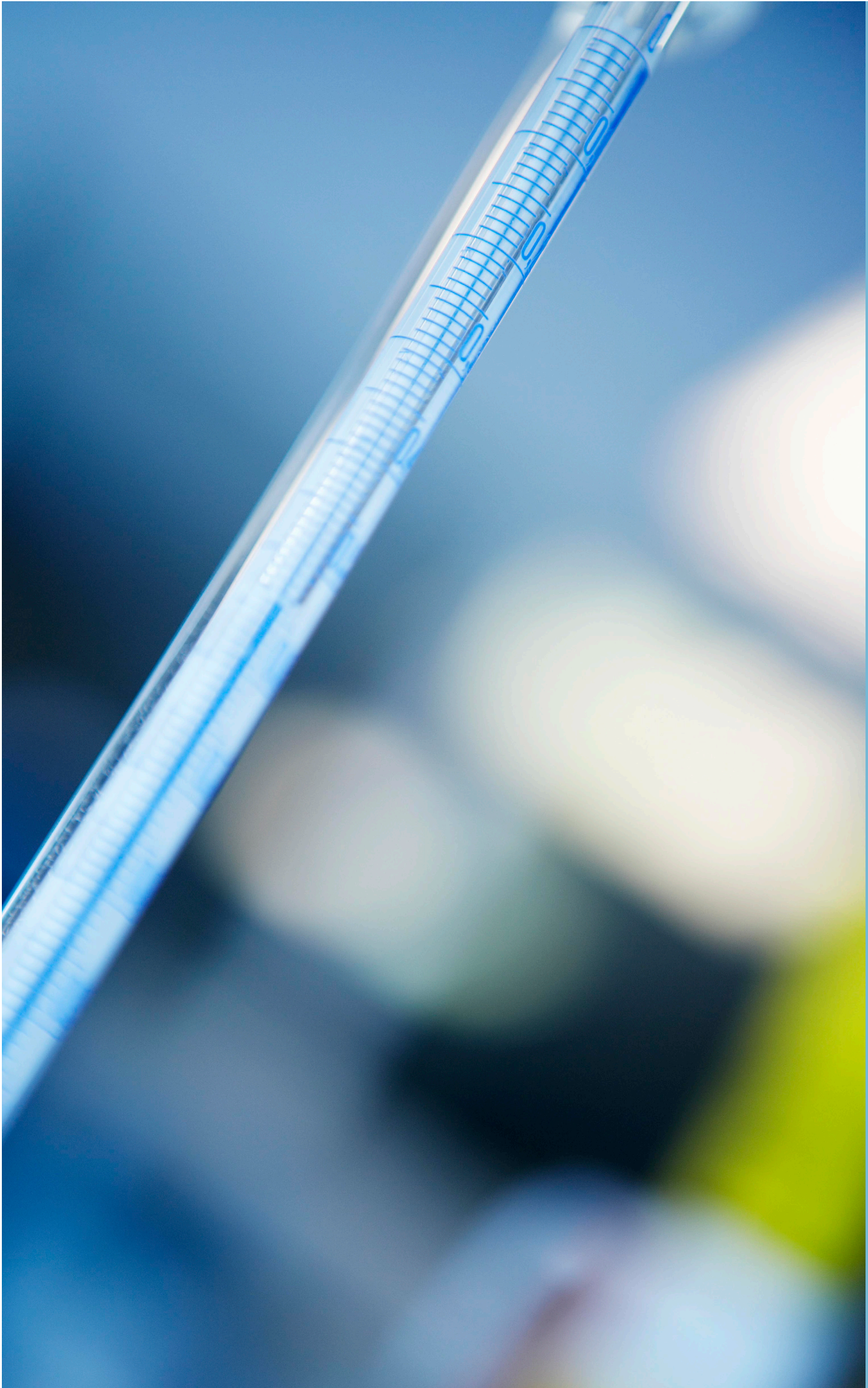
Iceprotein ltd.

Iceprotein was founded in 2005 by Rannsóknastofnun fiskiðnaðarins (e. Research Institution of the Fish Industry) to develop, produce, and sell products made from fish protein, to be used both in the traditional fish industry and in health foods. The company is located in Sauarkrokur. New technology, developed by Matis in collaboration with Iceprotein, makes it possible to isolate and clean fish protein from cut-offs during traditional fish processing. The proteins can then be used to improve utilisation of fish processing, and also for ready-made products such as fish patties and deep-fried fish.

There is also a growing market for products created with enzymes, ultra filtering, and other technology. This market is built upon the health beneficial qualities of fish protein and products derived from it. At the end of 2008 Matis' majority share was sold to FISK Seafood in Saudarkrokur, but Matis' Biotechnology Centre in Saudarkrokur will continue working on these development programmes with Iceprotein. Matis still maintains a quarter shares in Iceprotein.

Prokaria ltd.

The private biotechnology company Prokaria was founded in 1998 by Jakob K. Kristjánsson, Ph.D., and his co-workers. At the beginning there was an emphasis on thermophilic microorganisms and enzymes from these. In 2006 Prokaria merged with Matis, which has greatly empowered the Matis' operations in the field of biotechnology. Matis' operations in the field are mostly in three areas; Genotyping, using genotyping in parental analysis for breeding of animals and fish as well as tracing of origin and for monitoring and management of wild stocks; biotechnology, where Matis develops innovative enzymes to be used in the pharmacology and energy industry, as well as using bioengineering to construct production organisms for synthesis; and biochemistry, working on isolation, production, mutation and development of bioactive chemicals and foodstuffs.



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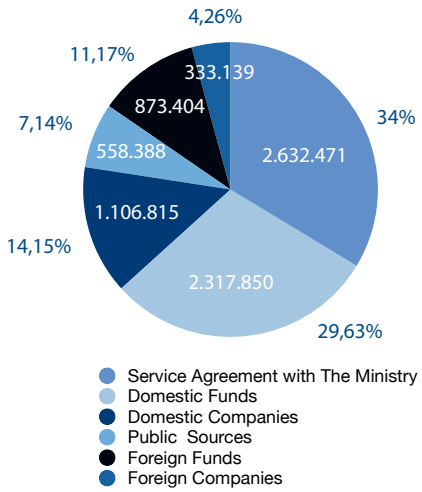
Graduated Matis students

Student	Professor	Speciality	Title	Degree	University
Nguyen Van Minh	Sigurjon Arason	Food Science	Effects of Different Processing Methods on the Physicochemical Properties of Heavily Salted Cod	Ph.D.	University of Iceland
Maria Gudjonsdottir	Sigurjon Arason	Chemical Engineering	Quality changes during seafood processing as studied with NMR and NIR spectroscopy	Ph.D.	NTNU Norway
Kristin Lif Valtysdottir	Sigurjon Arason	Mechanical Engineering	Improved packaging for exportation of fresh fish fillets	M.Sc.	University of Iceland
Etienne Gernez	Hronn Olina Jorundsdottir	Environmental Science	An assessment of the environmental impact of cargo transport by road and sea in Iceland	M.Sc.	University of Akureyri
Hrolfur Sigurdsson	Franklin Georgsson	Food Science	Systematic analyses of analytical data from quality control of drinking water	M.Sc.	University of Iceland

All amounts in Euros					
	2007	**2008**	**2009**	**2010**	**2011**
Revenue	5.554.325	6.295.039	7.226.272	7.525.742	7.822.068
Expenses	5.487.062	6.365.503	7.076.195	7.401.018	7.810.552
Profit	57.727	118.547	186.726	110.940	30.608
Fixed Assets	654.522	1.254.848	1.423.518	1.086.279	943.372
Current Assets	2.609.685	2.429.075	2.219.150	2.602.913	3.418.455
Total Assets	3.264.207	3.683.923	3.642.669	3.689.193	4.361.828
Equity	1.061.922	1.144.875	1.331.601	1.471.799	1.497.355
Liabilities	2.202.285	2.539.048	2.311.068	2.217.393	2.864.473
Total Liabilities adn Equity	3.264.207	3.683.923	3.642.669	3.689.193	4.361.828

Grouping of Revenues

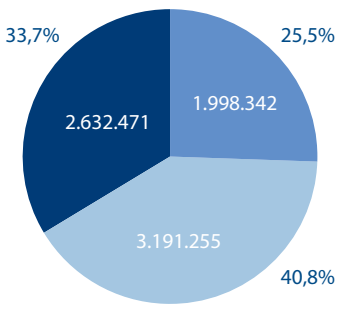
All amounts in Euros



- Service Agreement with The Ministry of Fisheries and Agriculture
- Domestic Funds
- Domestic Companies
- Public Sources
- Foreign Funds
- Foreign Companies

Main Classification of Revenues

All amounts in Euros



- Self-Acquisitioned Revenues
- Collaboration Projects and Funds
- Service Agreement with The Ministry of Fisheries and Agriculture

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