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**Authors**
Renée Michaud, Yves Pouliot, and Sophie Banville

**Contributors**
Members of the INAF Board of Directors between 2011 and 2013: André Marette, Jean-Christophe Vuillemand, Khaled Belkacemi, Émile Levy, Lucie Beaulieu, Yves Desjardins, Yvan Boutin, Sylvie Turgeon, Benoît Lamarche, and Paul Paquin

*The authors would like to thank the Université Laval administration, the management of affiliated institutions, and all the INAF partners, researchers, staff, and students who shared their constructive findings, opinions, and suggestions during the various consultation phases leading to the development of the strategic development plan.*

**Design and layout**
Isabelle Jobin, graphic designer

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A number of large academic and industrial research centers around the world are dedicated to research on food, nutrition, and health. Despite being fairly new—just over ten years old—INAF has built a solid reputation and become a player on the international stage with an integrated approach to multidisciplinary research that is unique in the field.

Making INAF an international reference in the functional foods, nutrition, and health sector was the focus of our 2005–2011 strategic development plan. During the period, INAF distinguished itself with its unique mode of operation and the quality and originality of its multidisciplinary and intersectoral research. As you will see in the following pages, we have maintained strong growth and achieved major milestones—the renewal of funding from the FRQNT strategic clusters program and the expansion of our facilities, to name a couple. In addition, as our reputation has grown, we have become an international reference in research, training, and transfer, and our performance has exceeded all expectations.

Now that the 2005–2011 plan has been implemented, we can safely say “mission accomplished”! But a strategic development plan is less an end in itself than a road map—a travel plan that sets out goals, steps to take, and a path to follow. After such an exciting journey, it will come as no surprise to learn that we are eager to continue the adventure!

Building on the momentum of the previous plan, the 2013–2017 Strategic Development Plan is an ambitious one, with its focus on development, growth, consistency, and cooperation. It will enable our actions to create a lasting impact on our sector and on the public at large, and help us take advantage of new opportunities and maintain the highest standards of excellence.

It goes without saying that this vision cannot be achieved without the unwavering support of our members and partners, with whom we will continue to Join Forces, Take Action, and Reach Out!

Happy reading!
Competition in research has never been as fierce as it is today and current funding models demand networking and the attainment of tangible benefits for society within ever-shorter timeframes.

The 2013–2017 Strategic Development Plan is an action plan aimed at providing INAF with the long-term strategies and means to carve out a place for itself in the increasingly competitive environment while meeting current research and innovation needs. The initiative is the result of a year of consultations with the Institute’s researchers, leaders, and partners, followed by a period of thinking, assessments, and prospective analysis.

Our main challenge is to secure adequate funding to remain competitive at the national and international level—a number of the means described in the plan are therefore aimed at meeting this challenge. Significant efforts will be made to further increase and diversify our sources of funding. One of the new means identified for this purpose is the creation of an INAF foundation.

Recruitment of new researchers is another major challenge—some fields of research have urgent needs that must be met quickly. We intend to tackle this challenge by setting up new chairs and capacity-building projects to help attract top talent and thereby take advantage of new research and partnership opportunities.

Lastly, we have targeted strategic partnerships with various organizations to maximize the social and economic benefits of research findings. To this end, we intend to help set up an observatory on the nutritional quality of food in Quebec and be involved in large-scale nutrition initiatives.

Through its accomplishments over the past ten years, INAF has achieved the highest standards in research and training—the largest critical mass of researchers in Canada working in agri-food, nutrition, and health; state-of-the-art facilities; a national and international network; and productive partnerships that facilitate the transfer of technology and knowledge to research users.
The approximately 80 INAF researchers and their teams of professionals and graduate students conduct fundamental, applied, and clinical research in more than 40 different scientific disciplines. Some seek to discover and identify new molecules in foods and food constituents, while others focus on processes and technologies for enhancing the nutritional value of foods. Some study in vitro and in vivo the metabolic, physiological, genetic, and epigenetic factors involved in the development or prevention of chronic diseases; others validate the health potential of diets, foods, or ingredients through clinical nutrition studies. Since its inception, INAF has built a strong culture of multidisciplinary collaboration and team projects regularly involve both biofood and health science specialists.

Each year, a total of more than 300 graduate students take advantage of the opportunity to pursue their studies in this outstanding environment. The jobs they land upon completion of their training are testament to the fact that these highly qualified individuals are ideally prepared to fill strategic positions in every sphere of the food and health sector.

INAF boasts Canada's largest team of researchers dedicated to the study of foods and their components and the role they play in nutrition, health, and the prevention of chronic diseases. Our multidisciplinary and intersectoral research program helps develop innovative nutritional approaches including foods and ingredients that are more effective in promoting health at every stage of life.

Our emphasis on transfer is reflected in the organization every year of a host of scientific and technological activities for knowledge sharing and in our support for strategic collaborations that facilitate entrepreneurship and technology transfer.

In conjunction with many partners from industry, government, socioeconomic development organizations, and public health agencies, we work to accelerate the development of innovative ingredients and foods and to find sustainable solutions to food-related problems in society.

A leader in the field, INAF enhances nutrition through science to fulfill its mission and ensure its actions lead to tangible and lasting results for the biofood sector and the health of populations.
Since INAF’s creation, the research program has had three main focuses of research, which strike a careful balance between fundamental, applied, clinical, and epidemiological research. The flexible and evolving program was designed to adapt to rapid growth in specific areas of expertise while providing for the integration of emerging fields of greatest relevance to the sector. By prioritizing these key areas, we have managed to stay the course in a field that is advancing by leaps and bounds.

INAF has gone from 60 to nearly 80 researchers with the enrolment of new members from UQAR in the marine biomass sector, from Université de Sherbrooke and Université de Montréal for research on nutrition and aging, and from Université Laval in science and engineering-related disciplines, health sciences, and social sciences. This growth has allowed us to advance research in fields where scientific issues require a resolutely interdisciplinary approach.

The presence of 11 research chairs in 2013, including five Canada chairs and six partnership chairs, is further proof of INAF’s world-class researchers and a relevant, cutting-edge program. Three of these chairs, which were set up in recent years (animal nutrition, nutrigenomics, and diabetes prevention), have helped enhance research and cement our reputation in the area of food and health.

The increase in our critical mass of researchers and the number of projects in certain sectors has recently justified the integration into the program of new themes, including the following, that will be increasingly important in the coming years:

- Nutrigenomics and epigenetics
- Cognition and aging
- Digestive processes and intestinal microbiota
- New approaches to food safety
- Eating behavior and consumption habits
- Approaches to the transfer of nutrition knowledge

The result of extensive consultations with INAF researchers and partners, our research program for the coming years and its priority areas, themes, and objectives are outlined on page 22 of this document.
FUNDING: ENOUGH TO ADVANCE, BUT MORE NEEDED TO PICK UP THE PACE

In 2011 FRQNT renewed INAF’s operating budget for six years. The Strategic Clusters Program grant and the operating budget granted by Université Laval increased by 50%. Including the funding sources for capacity-building projects and transfer activities, our total annual operating budget is now $2.4 million.¹

One of the key highlights of the 2005–2011 Development Plan was without a doubt the injection of more than $12 million to renovate our facilities and acquire new equipment. The funding came mainly from a grant from the MDEIE infrastructure development assistance program, from Université Laval, from NSERC research tool and instrument grant programs, and from other sources through in cash and in kind collaborations.

The annual budget directly earmarked for research projects has been nearly $20 million in recent years. Between 2009 and 2012, more than 330 grants and contracts supported our members’ research, for a combined total of more than $40 million. This level of funding reflects the maturity and stability of the group, which includes experienced researchers operating at maximum capacity and young researchers making steady progress in establishing their research programs.

Equally noteworthy is the nature of our research funding, which bears witness to our multidisciplinary and intersectoral nature. Although more than half of the research grants are still obtained via the competitive process from conventional funding sources in science and engineering (NSERC, FRQNT, MAPAQ) and health (CIHR, FRQS), an increasingly large proportion comes from nonconventional sources in Canada and abroad, in particular a growing number of research funds from private sources such as the major health-related foundations (heart disease, diabetes, Alzheimer’s, etc.); organizations serving specific sectors (federations), in particular the dairy sector (Novalait, Dairy Farmers of Canada); and businesses in the agrifood sector, ranging from small Québec businesses to large multinationals (Danone, Nestlé, McCormick, General Mills). More than 150 enterprises and private organizations have developed partnerships with INAF.

More than 50% of our total research funding is linked to team projects, the majority of which are interdisciplinary and bring together science and engineering researchers and health researchers. What’s more, nearly 40% of our projects involve private source funding, sometimes through contracts, but mainly through co-funding, consortiums, and partnership research projects.

The national and international recognition of our researchers has given them access to major projects and networks, including the AFM and Canadian Obesity Network centre of excellence networks, the EmbryoGENE (NSERC) strategic network, which includes nutrigenomic and epigenetic components, AAFC’s Dairy Research Cluster, and European framework programs such as the new Infogest international network.

GRADUATE TRAINING ENHANCED WITH LEADING-EDGE TOOLS

Approximately one thousand students and interns at all graduate levels have been supervised by INAF researchers since the Institute’s founding. Each year, more than 300 master’s, doctoral, and postdoctoral students carry out projects as part of the INAF scientific program under the direction of our members.

We strive to offer the highest standards of excellence in training for graduate students and interns. Our state-of-the-art facilities and dynamic, one-of-a-kind multidisciplinary environment help broaden their knowledge and better prepare them to take up the numerous challenges they will face once employed in the food and health sector.

In recognition of this excellence, INAF was awarded a prestigious Collaborative Research and Training Experience (CREATE) Program grant from NSERC. This program promotes approaches that are focused on collaboration, integration, and the major scientific challenges associated with Canadian research priorities, and helps the next generation of researchers go from the role of intern to that of productive employee in the Canadian workforce.

¹ The operating budget excludes infrastructure grants and the salaries of professors covered directly by universities and partner institutions, as well as those of professionals and students that are paid from the research budgets of professors.
As part of the CREATE grant, we set up the Food Advancement Through Science and Training (FAST) program, which aims to help trainees and postdoctoral students acquire and develop key professional skills that are complementary to their scientific skills. Offered in conjunction with the University of Manitoba and in collaboration with two major INAF partners, the Richardson Centre for Functional Foods and Nutraceuticals and the Canadian Centre for Agri-food Research in Health and Medicine, the FAST program has given rise to many training initiatives, the two most notable being an intensive summer school held in Quebec City in June 2011 and a joint symposium organized entirely by students and presented in Winnipeg in June 2012. This innovative program will help better meet the urgent need of companies and organizations in the functional food and natural health product sector for highly qualified and versatile personnel who are well equipped to handle the challenges facing this rapidly growing sector.

At the international level, the innovative Institut de Nutrition Aquitaine-Québec (INAQ) has already led to the co-supervision of several students between Université Laval and Université de Bordeaux. Since the Nutrition and Aging focus of the INAQ research program is well established, the international collaboration is set to become an ideal springboard for more joint projects, co-supervision, and student mobility in the coming years.

EXPANDED AND UPGRADED RESEARCH FACILITIES

Over the years, the group’s growth, project portfolio, and steadily growing demand for clinical studies have necessitated the implementation of a second phase of infrastructure development, barely ten years after the first ($17.3 million, 1999). In 2009, an $8.2 million grant from the Quebec government and Université Laval paved the way for the addition of new laboratories for research in nutrigenomics, cell culture, and intestinal microbiology. It also allowed us to expand the clinical investigation unit by doubling the capacity of the sampling room and metabolic kitchen and adding a densitometry room and several new nutritional assessment and testing rooms. Thanks to the expansion work completed in 2011, we now boast the largest nutrition clinical research facilities in Canada, accommodating no less than 400 voluntary participants each month.

The platforms available at INAF include several preclinical in vitro and in vivo models, significant biological material banks (lactic acid and probiotic bacterial strains, enteroviruses, plasma samples) and facilities for studying food perception and eating behavior (dining and focus group rooms). In addition, several other laboratories and specialized equipment supervised by our researchers are also available at our partner units and institutions. These include a food mycology lab, three level-2 containment labs for studying pathogenic microorganisms (food virology, meat microbiology, in vitro simulation of digestion—unique in Canada), and high-performance microscopic and medical imaging platforms.

INNOVATION SUPPORT SERVICE TRIAL

In 2009, with financial support from TRANSAQ (MAPAQ), we set up an innovation support pilot project for companies in the health food sector. Comprised of a multidisciplinary group of professionals from universities and industry, the team acts as a liaison between industry and INAF’s specialized resources to support and accelerate the innovation process at biofood companies who want to develop nutrition and health research areas for their product lines. Whether for startups, SMEs, or large companies, our team helps them conduct research and development to formulate and validate their products, while guiding them through the sometimes complex regulatory process.

By leveraging INAF’s scientific expertise, the new service provides the sector with clear benefits and helps instill a strong culture of research and innovation in Quebec companies. Through this approach, INAF has developed research projects in partnership with companies that first came to INAF for simple contractual services. As a result, some of these partners have been able to finalize the development of new products now available on the market.
PUBLIC AUTHORITIES SHOWCASE OUR EXCELLENCE

In 2007 FRQS and FRONT recognized INAF as a “joint competency group,” thereby affirming the multidisciplinary character of projects carried out at the Institute and paving the way to a major expansion strategy for our health research activities. Subsequently, landmark government policy reports in Quebec and Canada have publicly established INAF’s reputation and credibility in the areas of food and health.

In 2008, the Pronovost Commission report on the future of agriculture and agrifood clearly showed the very high priority Quebec’s senior policymakers give to the agrifood sector, in particular because of its ability to play a major role in population health. In several sections the report cited the key role played by INAF in research and knowledge transfer in the sector in Quebec. MAPAQ put nutritional quality and food safety at the top of its list of five priority research areas identified in its five-year action plan for agrifood research and innovation (2010). In addition, MDEIE’s 2010–2013 Quebec Research and Innovation Strategy mentioned that Quebec must build on its strengths, and to this end the ministry clearly identified INAF as a research powerhouse in Quebec.

Across Canada, the presence of INAF members on key Health Canada and Agriculture and Agri-Food Canada committees (trans fat, fiber, sodium, regulations, and innovation) clearly reflects the credibility we have gained with leading decision-makers with regard to major societal issues.

INTERNATIONAL POSITIONING:
GROUNDWORK LAID IN BORDEAUX

Since raising our international profile was central to the last development plan, major efforts were made to support collaborations likely to result in long-term links. A first milestone in this regard was reached in 2009 with the signing of a framework agreement between INAF (Université Laval) and Institut de recherche en nutrition humaine in Aquitaine (Université de Bordeaux) to create Institut de nutrition Aquitaine-Québec (INAQ). By joining forces, the two organizations seek to capitalize on their complementary assets and expertise to boost the spinoffs from their work on priority areas related to nutrition and aging, i.e., the prevention of neurodegenerative diseases, obesity, diabetes and its cardiometabolic complications, as well as gastrointestinal disorders. Our strategic alliance will lead to a significant increase in the co-supervision of graduate students and will facilitate the completion of major research projects involving industry, government, and socioeconomic partners.

Numerous other ongoing collaborations are giving rise to more exchanges in research and training, notably at major French research centers in Rennes and Lille, and also in some Latin American countries, including Brazil and Mexico.
BACKGROUND OF THE 2013–2017 DEVELOPMENT PLAN

Several aspects of INAF’s external environment have changed a great deal since 2005. We therefore had to reassess the environment to take into account factors likely to impact its development in the coming years.

ASSESSMENT OF THE EXTERNAL ENVIRONMENT

MAJOR CHANGES IN RESEARCH FUNDING

- Merger of the three major Fonds de recherche du Québec: Nature et technologies, Santé, Société et Culture
- Significant increase in competition for granting agency funds: several success rates are only around 10–17%
- Changes in funding approaches and research priorities at NSERC: agrifood is no longer among the priorities identified
- Changes in approaches at CIHR as well: we are seeing a trend toward overfinancing some researchers with megabudgets to the detriment of traditional or emerging sectors
- Overhaul of some federal policies (AAFC clusters), creation of niche funding consortiums (CRIBIQ, concerted actions by FRONT, MAPAQ)
- Increasing involvement of granting organizations in programs aimed at training and knowledge transfer: CREATE program at NSERC, Knowledge to Action program at CIHR
- Increase in private funding: contracts, clinical studies, shared-cost programs

PARTNERSHIP PERSPECTIVES

- Increase in the number of associations and organizations offering services in the functional food and health ingredient sector
  - Collegial transfer centers and other technology centers: Cintech, TransBIOtech, CINAQ, CDBQ, Merinov, CRBM, CEPROCQ, CNETE
  - Economic development and knowledge transfer: ACCORD clusters, CQVB, INITIA, AHIF, CRAAQ
- Proliferation of activities addressing a relatively limited clientele, resulting in some overlap of the themes covered
- Strong potential for strategic alliances and partnerships beneficial to the sector
- Need to create a dynamic of complementarity and cooperation
BACKGROUND OF THE 2013–2017 DEVELOPMENT PLAN

ASSESSMENT OF THE EXTERNAL ENVIRONMENT

CHANGES IN THE INDUSTRIAL FABRIC

- In 2007 Quebec was the second biggest producer of functional foods, behind Ontario, and the fourth biggest producer of health foods.
- Market segmentation is increasingly established by health target: bone and joint health, heart health, digestive health, diabetes prevention and management, weight management. Annual market growth in Europe and the U.S. varied between 3.6% and 6.4% between 2006 and 2010.
- The regulatory framework has been clarified both for the natural health products sector and for health claim applications for functional foods.
- Pharmaceutical companies are showing an increased interest in natural products and nutraceutical compounds.
- Small businesses are seeking to innovate as much as multinationals.
- Markets have become internationalized.
- Businesses are subject to many requirements including green and sustainable development practices.
- Vocabulary is tending to change—the dull terms “nutraceutical” and, to a lesser extent, “functional foods” are gradually disappearing because of a lack of consistency in their use, to the benefit of more inclusive terms such as “healthy ingredients and foods.”

RECOGNITION OF THE IMPACT OF NUTRITION ON HEALTH

- Consensus among government ministries and agencies in Canada and abroad
- Increase in government support for initiatives to promote health and prevent diet-related chronic diseases: Québec en Forme, Melior program, etc.
- Increase in public awareness: Défi Pierre Lavoie

PUBLIC AND MEDIA INTEREST IN FOODS: PLEASURE OR HEALTH?

- Marked public and media interest in diet; food is in the spotlight in media reports on health as well as those dealing with good living and fine dining
- Target audiences are extremely diversified and faced with a choice between eating healthy or taking supplements and vitamins.
- Information sources with highly variable credibility are highly popularized by the pervasiveness of social media.
- Difficulty for consumers in distinguishing between scientifically validated products and the often farfetched nutritional approaches that “ride the wave” and that lack a certain credibility
- Major communication issues for all stakeholders in the sector: federal and provincial governments, health professionals, and industry
BACKGROUND OF THE 2013–2017 DEVELOPMENT PLAN

INAF’s internal environment consists of its staff and the way they interact as well as their work environment, including the facilities, services, and means they have to operate and evolve. Here are some of INAF’s defining characteristics in 2013.

ASSESSMENT OF THE INTERNAL ENVIRONMENT

A NETWORK OF EFFECTIVE RESEARCHERS

- Now more than ever, INAF is a group of experienced, recognized, and internationally competitive researchers.
- There is an increase in INAF membership applications—since competition for grants is increasingly fierce, belonging to a strong critical mass is seen as a factor that improves chances for success.
- Dual membership with other centers and networks may limit the involvement of researchers in some disciplines.
- The increase in critical mass puts significant pressure on available resources.

A BROADENING MULTIDISCIPLINARY CONTEXT

- For research and transfer activities alike, the culture and dynamic of research and collaboration differs significantly between the health science, social science, natural science, and engineering sectors.
- The organizational positions and personal scientific opinions expressed by its members present a considerable public relations challenge for INAF given the number of researchers and wide range of fields of expertise (e.g., industrial issues vs. public nutrition issues).

FACILITIES AND SERVICES TO BE DEVELOPED

- INAF has one-of-a-kind facilities and equipment.
- The maintenance and replacement of equipment requires the development of specific management and supply tools and funding mechanisms.
- The professionals who manage and operate platforms play a significant role in supervising and training graduate students.
- The networking and optimal use of these facilities and equipment requires significant promotion and development inside and outside the group.
- The self-financing of platforms remains a challenge.
**BACKGROUND OF THE 2013–2017 DEVELOPMENT PLAN**

**ASSESSMENT OF THE INTERNAL ENVIRONMENT**

**SOLID FOUNDATION, SOME ASPECTS TO BE STRENGTHENED**

- Since its inception, INAF has relied on ongoing and strategic financial support from Université Laval, the Faculty of Agriculture and Food Sciences, and the Department of Food Sciences and Nutrition.
- In light of growth in the health research area, new administrative processes are required to increase the collaboration and participation of the Université Laval medicine and pharmacy faculties.
- Collaborations with the social science sector are expected to increase.
- Members of partner institutions need more support so they can get more involved in the INAF community.
- The recruitment of new researchers in strategic sectors is subject to significant administrative constraints compared to other universities or hospital research centers.
- INAF could influence these hires by setting up chairs in strategic sectors in which research needs are aligned with teaching needs.

**THE CHALLENGES OF GROWTH**

- The expertise, drive, and performance of the management team and administrative and scientific staff are recognized by the researchers and academic, government, industrial, and socioeconomic partners.
- The group’s growth brings organizational challenges and the need to equip it with new management tools and strategies.
- Operating costs (payroll, material resources, travel expenses, activities, etc.) increase each year and put significant pressure on the operating budget.
- INAF’s mode of operation and funding strategies have proven themselves and should allow it to weather the anticipated changes in research funding in Quebec and the rest of Canada.

**A STRONGER IDENTITY REQUIRES A STRONGER IMAGE**

- The Institute in general and the expertise of its members in particular are increasingly recognized by peers around the world.
- INAF members—researchers, research professionals, and students—have a strong sense of belonging.
- INAF enjoys a strong brand image in Quebec but would benefit from greater national and international visibility.
- Some researchers identify with INAF spontaneously but their many professional affiliations (university, department, chair, centre, other group) make their identification more complex.
- The name “Institute of nutraceuticals and functional foods” is restrictive and no longer reflects the reality of what INAF has become or the direction it is going in.
BACKGROUND OF THE 2013–2017 DEVELOPMENT PLAN

Our accomplishments in recent years have allowed us to build, strengthen, and develop a network that now boasts many significant achievements.

DEVELOPMENT CHALLENGES AND ISSUES

ALTHOUGH INAF HAS A SOLID FOUNDATION...

Our accomplishments in recent years have allowed us to build, strengthen, and develop a network that now boasts many significant achievements.

- The group’s operating grant will be covered by FRQNT and Université Laval until 2017.
- Research funding is supported by a large number of grants and the presence of many major projects and research chairs.
- Our researchers’ success in large national and international grant programs reflects the group’s scientific competitiveness.
- The scientific program is well defined and based on solid expertise—its research areas are supported by a vast range of scientific disciplines and it is flexible enough to foster the development of emerging sectors and integrate new ones as needed.
- The network boasts state-of-the art facilities and equipment that are among the best in Canada.
- INAF’s visibility and credibility are well established in the community—among industry and government stakeholders as well as socioeconomic development agencies.
- INAF benefits from significant support at the regional level (MAFQ, MFE, ACCORD clusters, private businesses).
- Major strategic partnerships have been maintained (TransBIOtech, CQUB) and national (Manitoba) and international (France, Brazil, Mexico) collaboration agreements have been reached.
- Even at the pilot project level, the establishment of the innovation support team has proved successful as it helps companies improve the nutrition and health aspect of their products and ensures followup at the scientific and regulatory levels.
- The many collaborations established by researchers in countries around the world, on both an individual and organizational basis, help further bolster INAF’s position internationally.
...WE ARE FACING MAJOR CHALLENGES!

To advance to the next stage in our development, we must strengthen our “growth” mode and take a stronger leadership role. Our increased power and influence in establishing research and action priorities for universities, ministries, and even granting agencies, will make it possible to recruit and hire leading experts in strategic research sectors at Université Laval and partner institutions, attract outstanding graduate students, and significantly increase our research competitiveness at the international level.

To this end, we must meet the following challenges.

- **Increase our financial capacity to**
  - support growth in multidisciplinary scientific productivity
  - support the development of international collaborations
  - recruit world-class researchers
  - increase the critical development threshold
  - ensure equipment replacement and maintenance
  - develop new platforms

- **Engage and support researchers in achieving the highest standards of productivity and excellence by**
  - offering the research and training support program
  - recruiting top graduate students
  - holding networking and scientific activities covering the diverse interests of group members

- **Raise INAF’s public profile as a credible source of dietary and health information by**
  - participating in public events
  - increasing our media presence, including taking a public stance on subjects relevant to the sector
The strategic development priorities for the coming years are aimed mainly at solidifying INAF’s growth and long-term future as a go-to organization in the food and health sector.

Our scientific program and excellence in research are the cornerstones of the 2013–2017 Development Plan—the very base of all our development initiatives and activities. The program was analyzed, reviewed, and redesigned in late 2010 for the purposes of renewing our operating grant with FRQNT. It is therefore well established and already in place for the coming years. The priority areas, themes, and specific objectives of the INAF research program are presented on page 22.

The strategic development priorities for the coming years are aimed mainly at solidifying INAF’s growth and long-term future as a go-to organization in the food and health sector.

2013–2017 DEVELOPMENT PLAN
PRESENTATION

The strategic directions consist of the following:

1. Pursuing timely and innovative research
2. Becoming a magnet for those looking to advance their training
3. Maximizing our economic and social spinoffs
4. Strengthening our strategic position both nationally and internationally
5. Supporting the organization’s growth and development

The following pages outline INAF’s vision. For each strategic direction, specific objectives have been defined, the means to meet them have been identified, and targets have been set to measure our progress and success.
INAF aspires to an internationally-recognized leadership role in the area of food, nutrition, and health research.

VISION

INAF aspires to an internationally-recognized leadership role in the area of food, nutrition, and health research.

MISSION

INAF is a group of renowned multidisciplinary scientists working together to advance knowledge about human nutrition and its impact on health.

The pillars of our mission are:

- To improve human nutrition through basic, applied, and clinical research on foods and compounds that promote health
- To contribute to the training of highly qualified personnel
- To ensure the transfer of knowledge and technology
- To support innovation in the industry and in health approaches

THE INSTITUTE’S VALUES

The four pillars of our mission are based on our core values:

- Promoting open-mindedness, creativity, and cooperation
- Sharing resources and knowledge
- Adhering to ethical and scientific rigorousness
- Pursuing excellence
- Valuing multidisciplinary and intersectoral approaches
- Acting in response to society's needs
# FIRST STRATEGIC DIRECTION - PURSUING TIMELY AND INNOVATIVE RESEARCH

## 1.1 SUPPORT THE GROWTH OF PRIORITY RESEARCH AREAS AND THE DEVELOPMENT OF EMERGING SECTORS

<table>
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<th>Objectives</th>
<th>Means and Targets</th>
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| Enhance the research program and the development directions based on the needs of society | → Set up an international scientific direction committee  
→ Periodically reassess research priorities |
| Recruit and retain top researchers in key sectors                         | → Develop strategies for recruitment and collaboration with the universities involved  
→ Obtain five new chairs in Canadian chair, super chair, and industrial chair programs within five years |

## 1.2 ENSURE ACCESS TO STATE-OF-THE-ART FACILITIES

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
</tr>
</thead>
</table>
| Ensure the optimal maintenance and renewal of facilities, equipment, and platforms | → Develop a long-term management and development plan  
→ Promote the services available internally and externally  
→ Promote the self-financing of equipment and platforms |
| Enhance the facilities                                                    | → Help renovate the food biochemistry laboratories (Paul-Comtois building)  
→ Improve the research facilities for the consumer behavior and knowledge transfer components (Services building)  
→ Develop new platforms (affiliated institutions) |

## 1.3 PROVIDE A STIMULATING RESEARCH ENVIRONMENT

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
</tr>
</thead>
</table>
| Foster team spirit, creativity, and cooperation between members in all disciplines | → Organize activities to promote exchanges and networking among researchers  
→ Offer more annual scientific activities  
→ Increase the amounts granted through the pilot project program  
→ Get administrative staff more involved in setting up capacity-building projects and identifying partners |
## SECOND STRATEGIC DIRECTION - BECOMING A MAGNET FOR THOSE LOOKING TO ADVANCE THEIR TRAINING

### 2.1 INCREASE RECRUITMENT CAPACITY AT THE GRADUATE LEVEL

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruit more master’s and doctoral students</td>
<td>→ Promote INAF among Université Laval undergraduates and in other Quebec universities</td>
</tr>
<tr>
<td>Attract top graduate students</td>
<td>→ Step up promotion of the FAST training profile and its summer school</td>
</tr>
</tbody>
</table>

### 2.2 PROVIDE DISTINCTIVE SUPERVISION

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop multidisciplinary and intersectoral projects</td>
<td>→ Increase the number of students under co-supervision</td>
</tr>
<tr>
<td>Promote the acquisition of scientific and professional skills that meet the needs of future employers in the sector</td>
<td>→ Increase student participation in scientific activities</td>
</tr>
<tr>
<td>Promote the internationalization of training</td>
<td>→ Support student mobility in research organizations in Canada and abroad</td>
</tr>
</tbody>
</table>
### THIRD STRATEGIC DIRECTION - MAXIMIZING OUR ECONOMIC AND SOCIAL SPINOFFS

#### 3.1 SUPPORT HEALTH-BASED INNOVATIONS IN THE AGRI-FOOD SECTOR

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help establish a culture of innovation focused on nutrition and health</td>
<td>➔ Reach more SMEs through partnerships with CTAC and the ACCORD clusters</td>
</tr>
<tr>
<td>on agri-food businesses</td>
<td>➔ Carry out 10 to 15 support projects per year</td>
</tr>
<tr>
<td></td>
<td>➔ Secure funding to ensure the future of the innovation support service</td>
</tr>
<tr>
<td>Support researchers in their technology and know-how transfer activities</td>
<td>➔ Collaborate with CQVB and NSERC to promote company/researcher networking</td>
</tr>
<tr>
<td></td>
<td>➔ Identify industrial and financial partners interested in investing in technology</td>
</tr>
<tr>
<td>Work more closely with CCTTs and business incubators</td>
<td>➔ Increase the number of projects carried out, notably with TransBIOtech, CINTECH,</td>
</tr>
<tr>
<td></td>
<td>CDBQ, Merinov, and AG-Bio Centre</td>
</tr>
</tbody>
</table>

#### 3.2 AFFIRM INAF’S ROLE AS A REFERENCE AMONG PROFESSIONALS, INDUSTRY, AND THE GENERAL PUBLIC

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set up an observatory on the evolving nutritional value of food in Quebec</td>
<td>➔ In conjunction with CTAC, motivate sectoral and financial partners with a view to implementing the project</td>
</tr>
<tr>
<td>Promote INAF’s expertise and achievements among target clienteles</td>
<td>➔ Highlight INAF projects in trade media</td>
</tr>
<tr>
<td>Increase public awareness of Clinique Nutrition Santé (the nutrition and health clinic)</td>
<td>➔ Expand services&lt;br&gt; ➔ Improve communication tools</td>
</tr>
</tbody>
</table>
## 4.1 Raise the Profile of INAF and Its Members

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
</tr>
</thead>
</table>
| Increase the organization's visibility | → Standardize the identification of researchers and students in scientific publications and communications  
→ Encourage members to participate in international committees, symposiums, seminars, and congresses |
| Help organize major congresses in INAF’s fields of excellence | → Help researchers organize international events  
→ Collaborate with INITIA, AHIF, AQIA, CQVB, and other organizations to organize activities that showcase INAF and its members |

## 4.2 Take a Strong Leadership Role in the Sector

<table>
<thead>
<tr>
<th>Objectives</th>
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</thead>
</table>
| Expand the scope and enhance the reputation of the BÉNÉFIQ event and the summer school | → Secure funding to ensure the event’s organization every two years  
→ Increase the number of national and international participants  
→ Increase the number of exhibitors at BÉNÉFIQ |
| Influence the establishment of university, government, and funding agency research priorities, measures, and programs | → Draft opinion pieces, briefs, and recommendations on emerging themes, strategic dossiers, and sectoral development issues |
| Actively participate in discussions for developing programs and policies in the agri-food and health sectors | → Encourage members to participate on strategic committees |
## FOURTH STRATEGIC DIRECTION - STRENGTHENING OUR STRATEGIC POSITION BOTH NATIONALLY AND INTERNATIONALLY (SUITE)

### 4.3 STEP UP THE DEVELOPMENT OF NATIONAL AND INTERNATIONAL COLLABORATIONS

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
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</thead>
</table>
| Take national leadership in key fields | → Strengthen collaborations with the University of Manitoba through the FAST program  
→ Step up collaborations in nutrition through large-scale multicentric studies  
→ Take leadership in a national epigenetics network |
| Consolidate INAQ activities and accelerate its development¹ | → Identify long-term funding sources  
→ Promote INAQ among researchers, students, regional partners, and industry |
| Form and strengthen strategic partnerships with targeted international organizations | → Strengthen ties with France (STLO-Rennes, IFREMER-Nantes, Univ. de Lille), the Netherlands (TNO, Maastricht Institute), the U.S., Mexico, and Brazil |

¹. INAQ’s development plan is an integral part of the overall 2013–2017 Alliance Bordeaux-Laval development plan.
### 5.1 DIVERSIFY AND INCREASE FUNDING SOURCES

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means and Targets</th>
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</thead>
</table>
| Set up an INAF foundation                      | → Establish a funding strategy focused on corporate and individual donations, as well as fundraising events  
|                                                | → Achieve $1 million in capitalized funds within five years                         |
| Create a scholarship fund for students         | → Achieve an annual budget of $50,000/year                                         |
| Increase the funding from granting agencies    | → Improve the success rate of researchers in conventional programs                 |
|                                                | → Develop and secure one or two major projects or national or international networks |
| Increase the contribution of partner universities | → Increase the operating budget granted by Université Laval                       |
|                                                | → Involve partner universities financially (U. de Montréal, U. de Sherbrooke, UQAR) |

### 5.2 IMPROVE ORGANIZATIONAL DEVELOPMENT TOOLS

<table>
<thead>
<tr>
<th>Objectives</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Refresh INAF’s image and implement a consistent visual identity platform</td>
<td>→ Revamp the website and communication tools</td>
</tr>
<tr>
<td></td>
<td>→ Encourage members to use the corporate signature</td>
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<td>Update administrative mechanisms, policies, and management tools</td>
<td>→ Review the policy on enrolment and membership renewal</td>
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<td>→ Improve policies and procedures: management of rooms and facilities, health and safety policy, orientation policy, etc.</td>
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<tr>
<td></td>
<td>→ Set up a researcher and employee recognition program</td>
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**THEME 1 - SUBTHEMES AND SPECIFIC OBJECTIVES**

**IDENTIFICATION, CHARACTERIZATION, AND FUNCTION OF BIOMOLECULES**

*Coordinator: Jean-Christophe Vuillemaud, Ph.D.*

A number of bioactive components—proteins, peptides, lipids, polysaccharides, phytochemical compounds, lactic acid bacteria, and probiotics—are responsible for the beneficial health effects of food. The work under this research theme focuses on 1) isolating bioactive molecules and their coproducts from terrestrial and marine plants, animals, and bacteria; 2) characterizing these bioactive molecules and microorganisms at the molecular and functional levels; and 3) understanding the relationship between the biomolecules’ structure and function as well as the mechanism of action underlying their physiological activity.

### 1.1 MICROORGANISMS OF NUTRITIONAL INTEREST

- Identify and isolate new microorganisms (probiotics, lactic acid bacteria, yeasts, and molds) that manufacture/degrade biomolecules for use in new food matrices
- Characterize their metabolites (bacteriocins, organic acids, exopolysaccharides, aromatic compounds) and understand their mechanism of action
- Develop new methods of detecting and measuring the survival and activity of microorganisms of nutritional interest
- Explore the beneficial role of probiotics and their metabolites in healthy humans and in monogenic and polygenic disorders (obesity, inflammatory bowel disease)

### 1.2 BIOLOGICALLY ACTIVE PROTEINS AND PEPTIDES

- Identify, characterize (structure vs. function, biological activity, mechanisms of action), and develop new sources of bioactive peptides from food
- Evaluate the effect of gastrointestinal digestion on the molecules’ structural integrity and biological activity
- Assess the capacity of certain products of protein digestion to activate or inhibit digestive enzymes in order to better understand their digestibility and the speed at which they transit the gastrointestinal tract
- Evaluate the tendency of certain peptides to form nanofibers and hydrogels with a view to developing new natural-source food matrices

### 1.3 PHYTOCHEMICAL COMPOUNDS

- Develop pre- and post-harvest methods of improving the nutritional value and antioxidant capacity of plant products
- Characterize the structure vs. function relationship of bioactive phytochemical compounds and the metabolic fluxes in fruits and vegetables leading to the production of bioactive secondary metabolites during storage
- Characterize the bioavailability and transport mechanisms of polyphenols in the intestine and their role in inflammatory bowel disease
- Develop baseline proteomic tools to monitor metabolic changes and the compositional authenticity of new and existing plant products

### 1.4 LIPID COMPOUNDS

- Study how the quality and bioefficacy of omega-3 fatty acids depends on their source
- Optimize dairy cow diets to enhance the nutritional and organoleptic properties of milk
- Identify new animal, plant, and marine sources of functional lipids
- Characterize the properties of conjugated linolenic acids (CLnA), unconventional fatty acids (e.g., branched), and other isomers of conjugated linoleic acids
THEME 2 - SUBTHEMES AND SPECIFIC OBJECTIVES

TECHNOLOGIES AND PROCESSES FOR FOOD MATRICES AND FUNCTIONAL FOODS

Coordinator: Khaled Belkacemi, Ph.D.

The main scientific challenges in this area are to optimize the quality, efficacy, and safety of bioactive molecules and develop new functional food concepts. The work under this research theme focuses on 1) developing new technological strategies for producing, extracting, and concentrating bioactive molecules and incorporating them into food matrices; 2) studying food matrices effect on the stability, bioactivity, and beneficial health effects of bioactive molecules; 3) developing new matrices to protect, transport, and release fragile biomolecules; 4) validating the impact of new technological processes on microbial quality and food safety; and 5) formulating new lines of functional beverages and foods.

2.1 TECHNOLOGICAL STRATEGIES: EXTRACTION, FRACTIONATION, AND PURIFICATION OF BIOACTIVE COMPOUNDS

- Develop membrane fractionation methods for bioactive molecules, combining several separation factors (pressure, conventional and pulsed electric fields, and addition of ligands)
- Develop new approaches to improve the performance of extraction and drying processes and thus the quality of the finished product
- Develop molecular tools for de novo synthesis of bioactive peptides and proteins (e.g., ovokinin) in plants
- Develop fractionation methods for omega-3s (DHA and EPA) extracted from fish oil

2.2 QUALITY, BIOAVAILABILITY, AND STABILITY OF BIOACTIVE COMPOUNDS

- Study the effect of packaging/storage of fresh products on the duration of biomolecules’ biological activity
- Study the effect of various processes on the activity of biomolecules in processed foods
- Study the effect of gastrointestinal digestion on the activity of bioactive extracts
- Develop metabolic and cellular engineering approaches to in situ protection of bioactive peptides and proteins in plant products

2.3 BIOPROTECTION AND NEW FOOD MATRICES

- Develop food-based matrices composed of proteins, polysaccharides, and lipids to stabilize bioactive molecules during processing and transit through the gastrointestinal system
- Evaluate the effect of the structural organization (including texture and viscosity) of food systems on bioactive molecules’ bioavailability and resistance to gastrointestinal digestion

2.4 FORMULATION OF FUNCTIONAL FOODS

- Assess the relation between type of dairy product (milk, cheese, yogurt) and milk protein digestibility, bioactive peptide release, and the products’ nutritional properties
- Reduce salt, sugar, and saturated fat content of food using new formulation approaches
- Enhance the nutritional value and organoleptic quality of functional foods through the addition of innovative ingredients
- Examine the impact of sodium salt substitutes on physicochemical properties (diffusion coefficients, sorption equilibrium, glass transition temperature, etc.) related to the drying, maturation, and storage of functional foods
- Develop food concepts adapted to specific health conditions (celiac disease, obesity, diabetes)

2.5 MICROBIOLOGICAL QUALITY AND FOOD SAFETY

- Evaluate the potential of natural antimicrobial biomolecules (peptides, spice extracts, etc.) and new nanostructures (e.g., metal oxides) as natural food preservatives
- Examine the effect of reducing salt (sodium) in foods on the growth and activity of food pathogens
- Develop methods of detecting, reducing, and inhibiting bacterial and viral pathogens in foods
- Predict food safety problems by examining the transcriptome and epigenome of organisms generated by assisted reproductive techniques in animal production
- Characterize harmful compounds caused by the deterioration of food (e.g., cooking oils)
THEME 3 - SUBTHEMES AND SPECIFIC OBJECTIVES

NUTRITION AND HEALTH

Coordinator: Émile Levy, M.D., Ph.D.

INAF draws on expertise in developing and validating preclinical and clinical nutrigenomic and behavioral studies in humans. Using an integrated approach, the work under this research theme focuses on 1) demonstrating the effect of functional bio-molecules on metabolism, immunity, and inflammatory conditions that lead to chronic disease; 2) studying the role of bioactive ingredients and health foods in preventing cardiovascular disease, obesity, Type 2 diabetes, gastrointestinal disorders, cognitive decline, and other aging-related disorders; 3) relating individuals’ genetic makeup, response to diet, and predisposition to certain metabolic illnesses with a view to prevention; and 4) understanding food behavior and studying key success factors associated with improved food habits.

3.1 SCREENING AND PRECLINICAL IDENTIFICATION OF MOLECULES LIKELY TO BE BENEFICIAL TO HEALTH

- Determine the development potential of natural source bio-molecules using cell and animal models
- Determine biomolecules’ mechanisms of action at the molecular and cellular levels
- Develop in vitro and in vivo methods for measuring the expression of certain cytokines in cells and tissues of various organs (spleen, liver, and intestine)
- Evaluate the anti-inflammatory, hypolipidemic, and therapeutic effects of omega-3s
- Characterize the in vivo effects of fish protein on inflammation and tissue regeneration following muscle injury

3.2 CLINICAL VALIDATION OF THE ROLE OF FUNCTIONAL FOODS IN DISEASE PREVENTION AND HEALTH

- Generate new clinical data on the effect of consuming healthy ingredients and functional foods
  a) on health,
  b) on potential interactions between functional foods and natural health products, and
  c) on the role of marine proteins in preventing metabolic syndrome.
- Identify new specific and nonspecific risk factor biomarkers
- Evaluate the role of berry extracts in the prevention of diabetes and cardiovascular disease
- Conduct an epidemiological study on the effects of functional foods on the metabolic health of male vs. female Quebecers
- Study the effect of psychosocial factors on food behavior, weight management, and risk factors for metabolic illnesses
- Study the influence of labeling, logos, and health claims on food consumption and weight management
- Develop decision-making tools for health professionals and consumers to promote the adoption of nutritional approaches based on scientific evidence

3.4 NUTRIGENOMICS

- Study the genetic and molecular bases of
  a) how individuals vary in terms of lipoprotein metabolism and response to nutritional treatments, and
  b) obesity and risk factors for cardiovascular disease and metabolic syndrome.
- Evaluate the effect of polymorphisms and the predictive value of certain genotypes on the response to nutritional treatments
- Identify the protein and gene expression signatures of inflammatory and metabolic components related to metabolic syndrome and their modulation by bioactive molecules during a therapeutic response
- Study the effect of nutritional interventions and components on levels of gene expression/methylation

3.5 NUTRITION AND HEALTH AT VARIOUS LIFE STAGES

- Study the effect of nutrition on fertility, reproduction, and embryonic development (epigenetic transmission of nutritional effects)
- Study the role of functional foods in the treatment of diabetes in pregnant women
- Study the role of natural health products and various nutritional approaches on hormone metabolism and management of menopausal symptoms
- Measure the potential benefits of vitamins, omega-3 fatty acids, and functional foods for seniors
- Study the effect of fish protein consumption on fertility disorders in women
ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAFC</td>
<td>Agriculture and Agri-Food Canada</td>
</tr>
<tr>
<td>ACCORD</td>
<td>Action concertée de coopération régionale de développement (Clusters)</td>
</tr>
<tr>
<td>AFM</td>
<td>Advanced Foods and Materials Canada</td>
</tr>
<tr>
<td>AHIF</td>
<td>Association for Health Ingredients in Food</td>
</tr>
<tr>
<td>AQIA</td>
<td>Quebec Association for Food Protection</td>
</tr>
<tr>
<td>CCTT</td>
<td>Collegial Technology Transfer Centers</td>
</tr>
<tr>
<td>CDBQ</td>
<td>Centre de développement bioalimentaire du Québec</td>
</tr>
<tr>
<td>CEPROCQ</td>
<td>Centre d’études des procédés chimiques du Québec</td>
</tr>
<tr>
<td>CIHR</td>
<td>Canadian Institutes of Health Research</td>
</tr>
<tr>
<td>CINAQ</td>
<td>Centre d’innovation sur la nutrition et les aliments du Québec</td>
</tr>
<tr>
<td>CNETE</td>
<td>National Center for Electrochemistry and Environmental Technologies</td>
</tr>
<tr>
<td>CQVB</td>
<td>Centre québécois de valorisation des biotechnologies</td>
</tr>
<tr>
<td>CRAAQ</td>
<td>Centre de référence en agriculture et agroalimentaire du Québec</td>
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<tr>
<td>CRBM</td>
<td>Marine Biotechnology Research Centre</td>
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<tr>
<td>CREATE</td>
<td>Collaborative Research and Training Experience program</td>
</tr>
<tr>
<td>CRIBIQ</td>
<td>Consortium de recherche et innovations en bioprocédés industriels au Québec</td>
</tr>
<tr>
<td>CTAC</td>
<td>Conseil de la transformation agroalimentaire et des produits de consommation</td>
</tr>
<tr>
<td>FAST</td>
<td>Food Advancement through Science and Training</td>
</tr>
<tr>
<td>FRQNT</td>
<td>Fonds de recherche du Québec – Nature et Technologies</td>
</tr>
<tr>
<td>FRQS</td>
<td>Fonds de recherche du Québec – Santé</td>
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<tr>
<td>INAQ</td>
<td>Institut de nutrition Aquitaine-Québec</td>
</tr>
<tr>
<td>MAPAQ</td>
<td>Ministère de l’Agriculture, des Pêcheries et de l’Alimentation du Québec</td>
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<tr>
<td>MDEIE</td>
<td>Ministère du Développement économique, de l’Innovation et de l’Exportation</td>
</tr>
<tr>
<td>MFE</td>
<td>Ministère des Finances et de l’Économie</td>
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<tr>
<td>NSERC</td>
<td>Natural Sciences and Engineering Research Council</td>
</tr>
<tr>
<td>TRANSANQ</td>
<td>Transformation alimentaire Québec</td>
</tr>
<tr>
<td>UQAR</td>
<td>Université du Québec à Rimouski</td>
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INAF IS PROUD TO COUNT EXPERTS FROM THE FOLLOWING UNIVERSITIES AND RESEARCH CENTERS AMONG ITS MEMBERS: