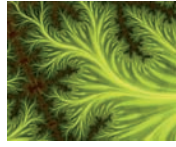


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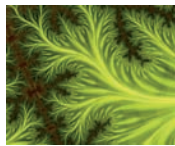
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biennial report
2008-09



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2008-09

foreword



Manuela Juárez
Director IMDEA Food Institute

Madrid, April 2010



The Madrid Institute for Advanced Studies in Food (IMDEA Food Institute) is a food science research institution created by the Madrid Regional Government in coordination with universities, research centres of Madrid and enterprises. Constituted as a non-profit organisation in November 2006 within the framework of the IV Regional Plan for Scientific Research and Technological Innovation (IV PRICIT), it is conceived structurally and legally with a view to bringing research into society.

The Madrid Region has traditionally possessed considerable potential for food research. However, the presence of some of the lines of research with the most promising future on the international scene is still slight in Madrid's regional Science & Technology System. Moreover, there is still not enough transfer of R&D results to society. The principal aim of IMDEA Food Institute is therefore to carry out research of excellence in the field of food from a multidisciplinary perspective, addressing new lines and prioritizing all avenues that can lead to scientific advances for industry and society.

The period 2008-2009 has seen the conclusion of agreements with the Universidad Autónoma de Madrid, the Universidad Politécnica de Madrid and the Universidad Complutense de Madrid intended to enhance the capacities of IMDEA Food Institute. A Scientific Council has been set up with researchers of international prestige, and some of the leading enterprises in the food sector have been brought onto the Board of Trustees.

The period covered by this report embraces the start-up of scientific activity at IMDEA Food Institute. When the first researchers were recruited, they began working as partners in various prominent research consortia in the field of food and health and competing to secure public funds.

In 2008 IMDEA Food Institute set up its R&D laboratory on the Cantoblanco Campus, thanks to support from the Universidad Autónoma de Madrid. That is where it currently carries out its research, awarding priority to projects bearing on food & health in view of the scientific, economic and social importance of that relationship.

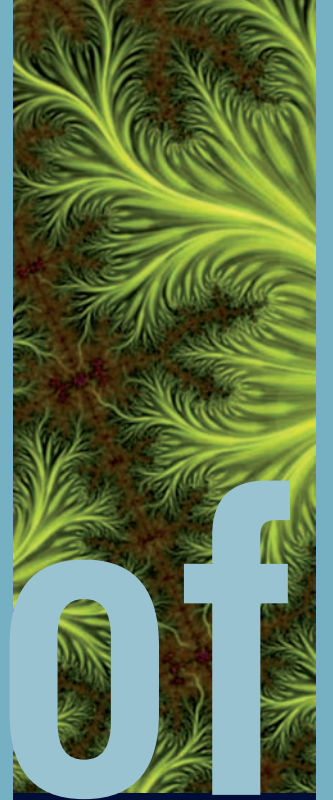
The Institute has nine researchers: three senior researchers, two senior assistant researchers, one postdoctoral researcher, one predoctoral researcher and one senior technician, with additional input from an associate senior researcher of acknowledged international prestige in the field of nutritional genomics.

In the period 2008-2009, IMDEA Food Institute secured almost 1 Million euros for R&D activities and has also participated in a Programme of activities for R&D groups run by the Madrid Region with over 800,000 euros in funding, and in a Consolidar-Ingenuo Programme with approximately 6 million euros in funding.

We aim to recruit researchers of the greatest possible international prestige to try and reach the highest levels in food research and, as one of the goals of the Institute, to present to society advances in our understanding of the relationship between health and food.

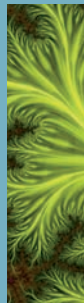


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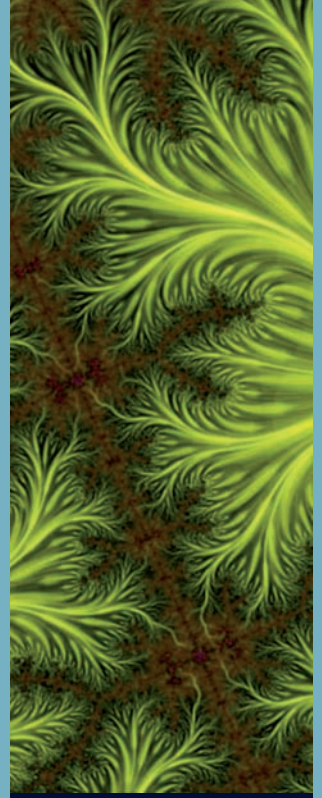
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**general
presentation**

1



The IMDEA Food Institute is a non-profit independent research institution created by the Madrid Regional Government, Spain, in November 2006 for the purpose of promoting appropriate research, technological development and innovation capabilities, in the field of Food Science in order to:

1. Undertake science research of international excellence addressing and driven by the real needs of society, with special emphasis on improving the technological level and competitiveness of enterprises in the Madrid Region.
2. Create a working framework that will facilitate the recruitment of researchers of international prestige, using or creating the necessary infrastructures and facilities to carry out competitive research that will assure results in the medium to long term.
3. Contribute to the training of researchers and technical personnel on a collaborative basis.

Originally conceived with the aim of conducting research of utility in various different food-related areas—food&health, food quality and food safety—IMDEA Food Institute's Scientific Council decided to start focusing the Institute's activity on Nutritional Genomics, an area that is relatively underdeveloped in the Spanish scientific community but is now part of programmes in the leading food research centres worldwide. Following the guidelines laid down by the Scientific Council, the Institute has been recruiting researchers specializing in this kind of research, and a number of projects are now in progress.

Food&health is an area of paramount interest to the international scientific community today; it is also an object of interest to the food industry and a matter of concern for the public at large. However, current approaches to the issue as yet pay very little attention to the genomic bases of the problem, while it has now been shown that there are major differences in the response to diet between individuals. In order to tackle the subject properly it is necessary to create adequate structures as regards specialized research personnel, and adequate infrastructures with which to undertake advanced research into gene-nutrient interactions.

The following lines of research were pursued in 2008-2009:

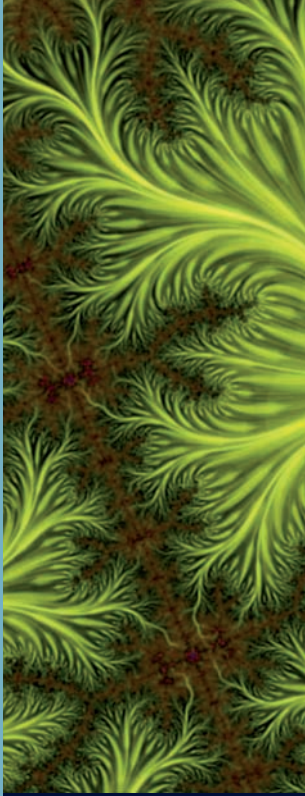
- Genomic bases of the healthy effects of food (Nutritional Genomics)
- Design and development of Functional Foods



Initially these lines specifically target “Effects on cardiovascular health and related metabolic disorders”. However, in the near future this orientation will be extended to take in the study of chronic disorders in general.

In one of the preferential lines of action within the context of its objectives, IMDEA Food Institute is working to create a Nutritigenetic Platform as an advanced tool to assist R&D groups at research centres and enterprises to conduct genetically-based dietary intervention studies. Conceived as a cohort platform, it will have banks of biological samples for food-related biomedical research and studies on biomarkers to help understand the effect of food products on the human organism, through both nutrigenomics and nutritigenetic research.





2

governing bodies and functional structure

- 2.1. **Board of Trustees [11]**
- 2.2. **Scientific Council [12]**
- 2.3. **Delegated Commission [13]**
- 2.4. **Executive Board [13]**
- 2.5. **Research Units [14]**

The organizational and functional structure of the IMDEA Food Institute is summarized in the diagram below with indication of its main bodies and units.

The main governing body of the Institute is a Board of Trustees constituted by representatives of the Madrid Regional Government (4), Madrid public universities (3), the Spanish National Research Council (CSIC), internationally renowned scientists in food science (4) and industrial enterprises (4), together with independent experts (2).

The Institute carries out its scientific research activity directed by its own management team, assisted by the program coordinator, and advised by a scientific committee of recognized international prestige, the Scientific Council.

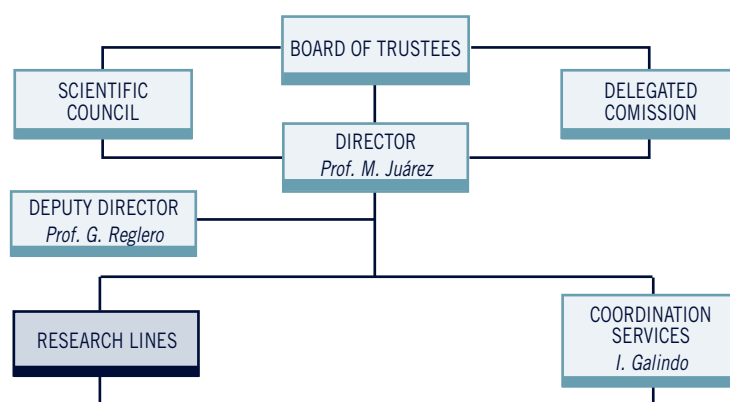


Figure 1. Management structure of IMDEA Food Institute



2.1. Board of Trustees

The Board of Trustees of the IMDEA Food Institute is its supreme governing, representative and administrative body. The Board is responsible for fulfilment of the Foundation's objectives, for administering the property and rights that constitute its assets, and maintaining their yield and utility. Since its creation, the meetings of the Board of Trustees are held twice a year.

President of the Foundation

Prof. José M^a Ordovas

*Director of Nutrition and Genomics Laboratory
JM-USDA-HNRCA Tufts University
Boston, USA*

Vice-Chairman of the Foundation

Excma. Sra. D^a. Lucía Figar de Lacalle

*Regional Minister of Education,
Comunidad de Madrid, Spain*

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Excma. Sra. D^a. Lucía Figar de Lacalle

*Regional Minister of Education,
Comunidad de Madrid, Spain*

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Ilmo. Sr. D. Federico Ramos de Armas

General Director of the Environment, Comunidad de Madrid, Spain

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Coordinator of the Food Science and Technology Area, IF-CSIC, Spain

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Prof. Jesús Vázquez Minguela

Professor, Universidad Politécnica de Madrid, Spain

Scientific Trustees

Prof. Michael Heinrich

Head of Centre for Pharmacognosy and Phytotherapy, The School of Pharmacy, University of London, UK

Prof. Jean Louis Sebedio

UMR- INRA. Université d'Auvergne, Institute de Nutrition Humaine, Clermont-Ferrand, France

Dr. Fabrizio Arigoni

Head of Nestlé Research Tokyo, Graduate School of Agricultural and Life Sciences, The University of Tokyo, Japan

Dr. Vincent Steinmetz

Director of the Agence pour la Recherche et l'Innovation en Champagne-Ardenne (CARINNA), Reims, France

Expert Trustees

Mr. Daniel de la Sota Rius

Director of the Innovation and New Technologies Department, CEIM, Madrid Business Confederation-CEOE, Madrid, Spain

Dr. Jorge Jordana Buttica de Pozas

General Secretary FIAB-Spanish Federation of Food and Beverages Industry, Madrid, Spain

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Director of Research and Development, Madrid, Spain

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Dr. Marco Antonio Delgado

Director of Research and Development, Madrid, Spain

Secretary

Mr. Alejandro Blázquez



2.2. Scientific Council

The Scientific Council is a consolidated body within the Foundation with the task of advising on and analysing research programmes that the Institute may take on, and evaluating candidates for recruiting of researchers of different levels to carry on the research lines.

The IMDEA Food Institute Scientific Council is composed of researchers of recognized international prestige in areas relevant to the Institute.

Scientific Council

Prof. José M^a Ordovas

Director of Nutrition and Genomics Laboratory, JM-USDA-HNRCA Tufts University Boston, USA

Prof. Michael Heinrich

Head of Centre for Pharmacognosy and Phytotherapy, The School of Pharmacy, University of London, UK

Prof. Jean Louis Sebedio

UMR- INRA. Université d'Auvergne, Institute de Nutrition Humaine, Clermont-Ferrand, France

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Dr. Vincent Steinmetz

Director of the Agence pour la Recherche et l'Innovation en Champagne-Ardenne (CARINNA), Reims, France

Prof. Andreu Palou

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Prof. M^a Carmen Dobarganes

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Professor, Universidad de Lérida, Lérida, Spain

Prof. Francisco Tomás-Barberán

*Research Professor
Centre for Soil Science and Applied Biology of the Segura (CEBAS-CSIC), Murcia, Spain*

Dr. Gloria López-Gálvez

Scientific Officer, European Food Safety Authority (EFSA), Parma, Italy





2.3. Delegate Commission

All the powers of the Board of Trustees are delegated to the Foundation's Delegate Commission, with the exception of approval of the action plan, budgets, annual accounts amendment of statutes, mergers, liquidation, extinction and any acts requiring the authorization of the Protectorate. Also, they may not elect or dismiss any trustee or appoint officers of the Board, elect or dismiss the Director, or take any decision having to do with the Scientific Council, or grant powers of attorney or general delegations. They may appoint and dismiss the Foundation's Manager and Deputy Director at the proposal of the Director.

President

Ilmo. Sr. D. Jon Juaristi Linacero

Member

Ilmo. Sr. D. Federico Ramos de Armas

Member

Mr. Daniel de la Sota

Secretary

Mr. Julián García Pareja

2.4. Executive Board

The executive board is composed of the Director, the Deputy Director and the Program Coordinator. The Executive Board is responsible for managing and dealing with the main business administration and scientific activities of the whole Institute, except those decisions taken by or shared with the Board of Trustees.

Director

Prof. Manuela Juárez Iglesias

Represents the institution in dealings with third parties. Proposes and carries out initiatives to promote and manage research, negotiates agreements and alliances with third parties. The Director of the IMDEA Food Institute also optimizes and allocates economic and human resources and infrastructures.

Deputy Director

Prof. Guillermo Reglero Rada

Assists the Director in her duties and reports directly to her. The Deputy Director is chosen at the proposal of the Director from among persons of recognised prestige in



the field of interest to the Institute. If the Director is absent, the Deputy Director substitutes for her functions.

Program Coordinator

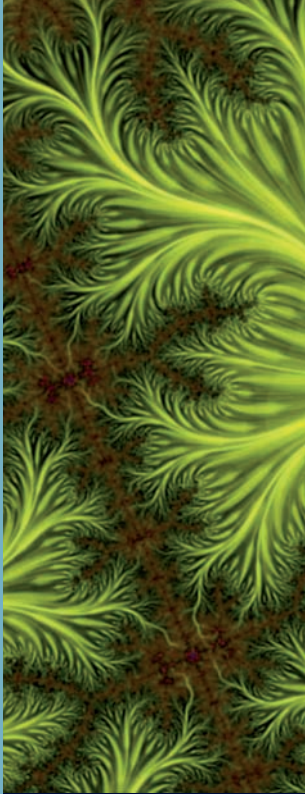
Ms. Inmaculada Galindo Fernández

Responsible for management coordination of the different programmes carried on at the Institute: programmes in the economic-financial area, programmes in the human resources area, programmes in the R&D area, etc.

2.5. Research Units

The researchers and scientists are structured in Research Units defined according to their expertise and specialization.





3

research lines

- 3.1. RESEARCH LINE 1. Genomic bases of the healthy effects of food (Nutritional Genomics) [16]
- 3.2. RESEARCH LINE 2. Design and development of Functional Foods [19]
- 3.3. RESEARCH UNIT. Nutrigenetics Platform [22]

IMDEA Food Institute carries out its work in a context of transferable multidisciplinary research of excellence. On the basis of an analysis and diagnosis of the actual environment in which the Institute operates today, in this period activity has been focused on the strategic research area of Food & Health as it relates to “effects on chronic diseases and related metabolic disorders”, in the following two lines of research.

- Research Line 1-Genomic bases of the healthy effects of food (Nutritional Genomics).
- Research Line 2 -Design and development of Functional Foods.
- The Institute also runs a horizontal Research Unit: “Nutrigenetics Platform”.

3.1. RESEARCH LINE 1

Genomic bases of the healthy effects of food (Nutritional Genomics)

Dietary prevention or mitigation of major chronic diseases such as obesity, diabetes, cardiovascular disorders or cancer may benefit strongly from knowledge of the human genome and the consequent emergence and application of genomics. The new techniques that are being developed and the knowledge emerging from genome studies are revolutionizing the process of identifying genes involved in different prevalent diseases. In this sense, it is well known that most cases of obesity, cardiovascular disorders (CVD), diabetes or cancer are caused by the interaction between genes and environmental factors, diet being the most prevalent of them. However, the specific molecular basis of these chronic diseases still remains unclear.

The presence of common events in these major chronic diseases has been extensively reported. Such results have led to the development of the «common disease/common variant hypothesis», which states that chronic diseases are caused by sets of gene variants that collectively contribute to disease initiation and development. One of these shared events for the chronic diseases mentioned above is the presence of alterations of lipid metabolism and closely-related signaling pathways, highlighting the importance of studying the differential metabolic statuses of the population sectors that develop these diseases. In addition, the influence of determined nutrients in lipid metabolism is well known, suggesting an essential role for nutrient-gene interactions in this area.

The objective of our Nutritional Genomics line of research is the interface between the nutritional environment and cellular and genetic processes, with the goal of arriving at a genetic understanding of how certain nutrients and bioactive components of foods affect the balance between health and disease by altering the expression of an individual's genetic profile. Among the different signalling pathways and specific processes that are being included in the study, we are placing special emphasis on the global analysis of the expression profile of genes that codify for enzymes of lipid metabolism, including absorption and transport of nutrients, lipid catabolism, biosynthesis and beta-oxi-

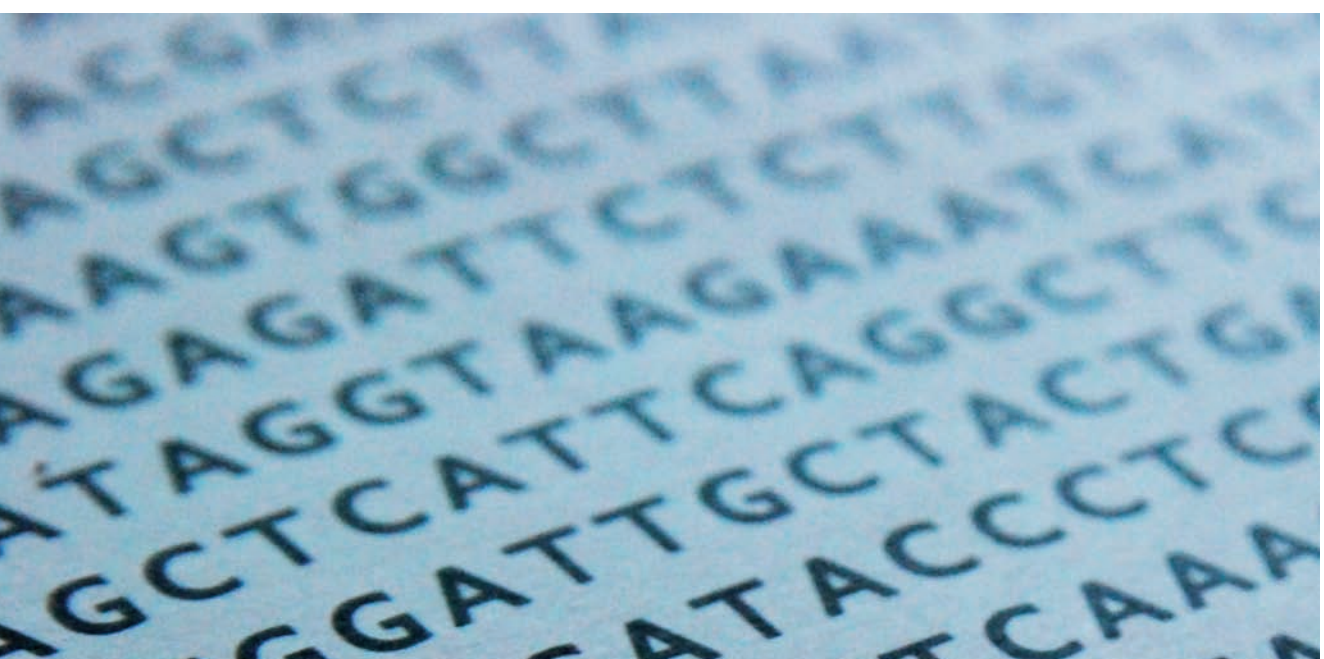


dation of fatty acids, ketogenesis, phospholipid metabolism, biosynthesis of bile acids and perioxomal lipid metabolism, with the ultimate aim of identifying a metabolic-related gene expression signature useful for identification of new nutritional markers for cancer, cardiovascular pathologies, obesity and diabetes.

Two different programmes are being developed within this research line to study in depth the interactions between nutrients and genes, focusing mainly on cancer, CVD, obesity, and the relationship between them:

- One is the Nutrigenetic Programme, whose main goal is to examine whether genetic variants can predict individual response to dietary components that alter cancer, CVD or obesity processes and modify individual susceptibility to their development. Experiments are being conducted to address two main objectives:
 - Determination of the dependence of an individual's genetic makeup on the influence of diet in the balance between health and disease. Once the pathways, enzymes and probes that will provide a proper global view of the process of interest have been determined, the latest technology will be used for genotyping and allelic discrimination of different populations.
 - Understanding the reason why in certain individuals diet can be a serious risk factor for developing of disease. Different case-control association studies will be performed as a first approach to this issue.

Individual genetic variations in functional SNPs and haplotype blocks appear to contribute to the varied biologic responses to dietary interventions. However, recent studies incorporating findings from the Human Genome and HapMap Projects have revealed disparities in human responses to bioactive food components in terms of modifying dis-



ease risks, which may be explained by Individual genetic differences. Thus, it is important to provide mechanistic support for the notion that specific genetic variations may be critical in predicting both beneficial and harmful effects of dietary components in the risk of developing or promoting chronic diseases.

- The Nutrigenomic Programme addresses the following areas of research:
 - Analysis of how certain nutrients and components of foods affect the human genome, altering gene expression or structure, with a beneficial effect on human health. Several bioactive food components can modify transcription, expression, and regulation of genetic targets that are known to influence different disease-related signaling pathways that determine the development or the aggressiveness of the disease, as well as the detoxification of harmful compounds such as carcinogens. Various projects are in progress in this area, mainly focusing on the activity and action mechanism of different natural antioxidants and phytochemicals. Various experimental approaches are being pursued, including genomic studies, in vitro assays with different human cell systems, and in vivo experiments using animal models.
 - Identification of diet-regulated genes and interconnections among them ones that play a role in the onset, incidence, progression, and/or severity of the above mentioned chronic diseases. This approach focuses on analysis of the expression of a group of candidate genes. Once the pathways, enzymes and probes that will provide a proper global view of the process of interest including lipid metabolism are determined, the latest technology will be used for relative quantification of gene expression between people with disease and healthy controls. Statistical analysis will provide the value of the selected diet-regulated genes as new biomarkers of the disease with relevance in the clinical setting.

Finally, both programmes converge in the conduct of pilot dietary intervention studies based on the knowledge of specific genotypes and phenotypes and nutritional status and requirements, focusing on the prevention, mitigation, cure or improvement of the response to treatments of patients with chronic diseases. Thus, this research line focuses on the development of individualized, targeted nutrition with the aim of devising prevention strategies that can reduce the risk of cancer, CVD or obesity in genetically susceptible individuals and mitigate or improve the management of patients with these diseases based on individual genetics. Bioactive food components in dietary interventions may include essential nutrients and non-nutrients found in foods. This approach includes the identification of new biological markers in the development of these diseases by different gene expression analysis, as well as dietary intervention studies using cell culture and animal models. The information generated from such research could serve as the basis for exploratory pilot clinical studies in humans.





Scientists:

Prof. Dolores Corella Piquer

Associated Senior Researcher. Head of Nutritional Genomics. Head of the Nutrigenetics program

Dr. Ana Ramírez de Molina

Senior Researcher. Head of Nutritional Genomics. Head of the Nutrigenomics program

Dr. Arantxa Rodríguez Casado

Senior Assistant Researcher

Marta González Castejón

Predoctoral Researcher

Dr. Susana Molina Arranz

Postdoctoral Researcher, Senior Laboratory Technician

Isabel Espinosa Salinas

Senior Technician, Nutritionist/Dietician

3.2. RESEARCH LINE 2

Design and development of Functional Foods

The objective of this line is to develop and apply advanced technologies and methodologies to produce new ingredients of utility for the design of effective functional foods, taking the genetic aspect into account, i.e. the consequences of the way that variations in each individual's genome may be related to differences in response to various bioactive food ingredients.

The intention is to work for the wellbeing of the population by promoting improved health through the development of effective, safe functional foods as a nutritional tool to help achieve healthy diets. It is also intended to contribute to the economic development of the Madrid region by developing high value-added products for the food industry to help them become more competitive and profitable.

The idea of improving health, and even preventing serious disorders, through diet is a very attractive one. Over 20 years ago the governments of developed countries like Japan began to see functional foods as a means to reducing public health costs. The FOSHU regulation is now fully operational there. The European Union began to take official notice of functional foods in the mid-1990s with the FUFOSSE Strategic Action, part of the Fourth FP, which established a definition and laid down the bases for such products. Since then scientific programmes and work on standardization and legislation have been ongoing.





Functional foods appeared in the Spanish food market in 2000 with something of a bang, lagging a little behind the international trend. The first products to appear were vitamin- and mineral-enriched beverages; then came the addition of fibre, calcium and active lactic bacteria strains, and more recently the addition of polyunsaturates, phytosterols, peptides, etc. to dairy and meat products.

There is no question about the utility of ameliorating serious disorders through diet, but it must have a solid and demonstrable scientific basis. That is a requirement of the European Union Regulation on Nutrition and Health Claims made on Foods, which came into force not long ago and is still at the stage of drafting implementing legislation and definition of assessment methods and tools. It regulates the design, production and marketing of functional foods. This regulation offers the food industry an opportunity to market products with a demonstrable ability to prevent or ameliorate disorders subject to validation by the European Food Safety Agency (EFSA).

Heart and circulatory disorders cause 1.9 million deaths a year in the European Union. That is approximately half of all deaths occurring in the European countries. They lead to numerous premature deaths and are also a heavy burden on the European economy given the high cost and long duration of care.

The causes of this group of disorders are multifactorial, but the most important risk factors are cardiovascular (CVRF). Some of these factors, such as sex and age, are immutable, but others like diet, where the effects on blood pressure, high cholesterol or diabetes, can respond to intervention.

The development of new foods and new food ingredients with heart-healthy effects requires a multi-disciplinary approach within an integrated project that takes account of the latest advances in human genome research and new research tools, for instance nutrigenomics, transcriptomics, proteomics and metabolomics.

This programme proposes a study of new bioactive ingredients. optimization of production procedures, determination of their chemical composition and evaluation of their



bioavailability, their potential biological activity in vitro and in cell cultures, their toxicological safety and their healthy effects in experimental animals and in nutrigenetic dietary intervention assays in humans. The possible avenues of research are legion: considerable attention continues to be paid to addition of probiotics to foods, and examples of products that could fall within this line of research include lipids structured with better nutritional properties, alteration of lipids through enzymatic reactions, enrichment of dairy products with bioactive lipids using natural processes, prebiotic carbohydrates, proteins that exert physiological effects on the organism, whether directly or via in vivo enzymatic hydrolysis (i.e. during gastrointestinal digestion), or antioxidant products with various physiological effects.

This line of research will be pursued by means of the following activities:

- 1 Development of procedures to achieve bioactive ingredients for heart-healthy functional foods, using advanced chemical, enzymatic, extraction, fractionation and purification technologies with which to produce safe, highly active products.

The following beneficial biological activities are pursued: antihypertensive, antioxidant, reduction of lipid peroxidation in vivo and neutralization of free radicals, modulation of inflammation mediators, immunostimulation, cholesterol reduction and balancing of the plasma lipid profile.

- 2 Evaluation of the benefit/risk ratio of functional ingredients using in vitro procedures, with cell cultures and assays on experimental animals.
- 3 Performance of studies to produce as much scientific evidence as possible on the heart-healthy effect of the target functional products on humans, also taking into account the variations in the genome of each individual.



Scientists:

Prof. Manuela Juárez Iglesias
Senior Researcher. Head of Functional Foods

Prof. Guillermo Reglero Rada
Senior Researcher

Dr. Arantxa Rodríguez Casado
Senior Assistant Researcher

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Senior Assistant Researcher

Marta González Castejón
Predoctoral Researcher

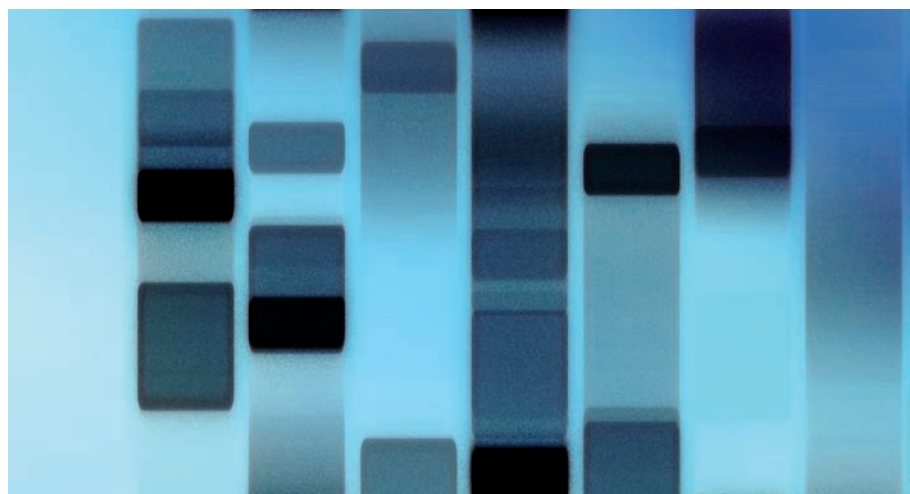


3.3. RESEARCH UNIT. Nutrigenetics Platform Platform for Genetics-based Dietary Intervention Studies

An understanding of the human genome and variations in its key candidate genes may be of very great help in deciphering the molecular mechanisms that determine the inter-individual response to diet and thus generating a series of biomarkers through which to determine precisely the effects of foods on the human organism. At IMDEA-Food we therefore believe that at this time the scientific community must acquire the necessary tools to undertake the requisite R&D with this new approach.

The Platform for Genetics-based Dietary Intervention Studies (INTERDIETGEN) was conceived as a major, high-level scientific tool to assist in examining how the genomes of individuals interact with the foods in their diets and these interact in turn with the genome, in order to determine the benefits or risks of given nutrients and food ingredients for individual health. It is intended for use in basic or applied research on gene-diet interactions, in the fields of nutrigenetics or nutrigenomics alike. This is a stable platform based on volunteer cohorts from the general population or groups in different physiological situations. Each cohort is composed of a large number of individuals with genetic characteristics that are known as regards polymorphisms in candidate genes associated with chronic non-transmissible diseases and the possible response to diet. If the platform is to work effectively, thousands of volunteers are required, organized in centrally-managed cohorts. A university campus like the one at Cantoblanco is therefore a particularly suitable setting in that every day there are over thirty thousand people aged from 17 to 70 who are particularly willing to comprehend and become involved in activities related to scientific development.

IMDEA-Food proposes to advertise for volunteers, with the authorization of the Universidad Autónoma de Madrid and subject to the rules of their Ethics Committee. The genomic DNA of each participant will be isolated by standard procedures from peripheral venous blood; DNA quality and concentration will be checked and stored, and polymorphisms of interest will be analysed by high-performance genotyping. Individuals will also be carefully characterized in terms of ambient factors (food, tobacco and alcohol consump-



tion, exercise, stress, dietary habits, socio-economic status etc.), and also subjected to phenotyping for the principal anthropometric variables, arterial blood pressure and other clinical parameters. Blood sampling and conventional clinical analysis will be performed by the UAM's medical service. Genotyping, anthropomorphic measurements and cohort management will be performed by IMDEA-Food. Once the cohorts are made up, the platform will be run in such a way as to provide a service to the local, national and international scientific community in the field of food and health, and also to enterprises in the same field that need to demonstrate health benefits of functional foods, nutritional supplements or drugs.

At this moment there is no tool for food/health research like this Platform which once fully operational will be able to serve Spanish and foreign research groups working in the field of nutritional genomics. The platform can also serve enterprises in the food sector that wish to carry out the dietary intervention studies necessary to develop products or to obtain approval of nutrition or health claims for food products from the European Food Safety Authority, US authorities or other countries like Japan which specifically regulate this issue.



Scientists:

Prof. Guillermo Reglero Rada

Senior Researcher. Head of the Nutrigenetics Platform Research Unit

Dr. Dolores Corella Piquer

Associated Senior Researcher

Dr. Ana Ramírez de Molina

Senior Researcher

Dr. Susana Molina Arranz

Postdoctoral Researcher, Senior Laboratory Technician

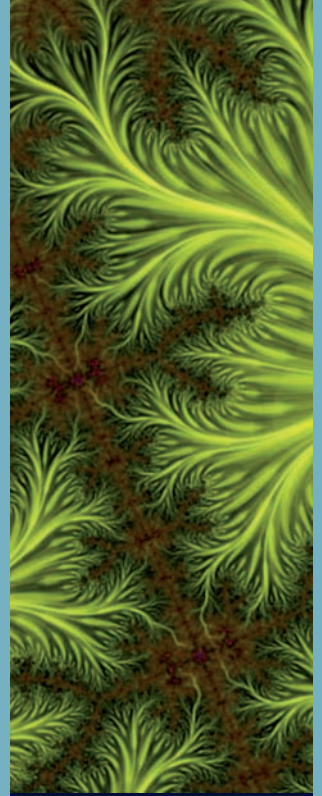
Isabel Espinosa Salinas

Senior Technician, Nutritionist/Dietician



scientists

4



scientists



Prof. Manuela Juárez

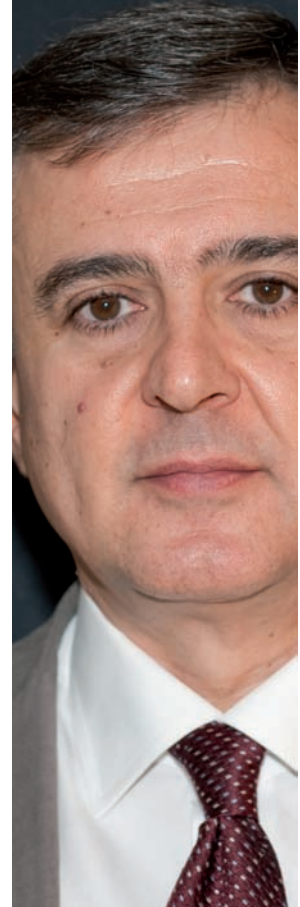
Director
Research Professor

Manuela Juárez Iglesias is PhD Chemistry. She is Research Professor in the Spanish Council for Scientific Research (Instituto del Frío-CSIC). She leads the research group of dairy products bioactive lipids. Her Scientific Contributions includes more than two hundred papers in scientific journals, monographic or chapter of books and the participation in patents in Food Science and Technology Area. She has succeeded Award of research in Food Science and Technology of the Foundation CEOE, 1996, Honour Medal to the Invention from the Foundation García Cabrerizo, 2006, Award from Dairy Industrial Federation on diffusion of the healthful properties of dairy products and International Prize Hipócrates of Medical Research on Human Nutrition in 2009. She has occupied the charge of Director of the Instituto del Frío, Manager of the Area of Science and Food technology of the National Plan of R&DT, the coordination of the Food Technology Area of the National Agency of Evaluation and Prospective, General Assistant director of Programación, Seguimiento y Documentación Científica of CSIC and Vice- President of Scientific and Technological Research of CSIC. She is Director of IMDEA Food Institute, Vice- President of the Singular Science and Technology Infrastructures Scientific Committee (MICINN) and Member of the Spanish Scientific Committee Food Safety Authority.

Prof. Guillermo Reglero

Deputy Director
Professor

Guillermo J. Reglero-Rada is PhD in Chemical Sciences. From 1999 he is Full Professor of Food Technology of the Universidad Autónoma de Madrid. Before he was Senior Researcher of the Consejo Superior de Investigaciones Científicas (CSIC). He directs a research team in Food Science and Technology that is employed on obtaining food functional ingredients with projects of funding both public and private. This line of investigation includes the development of extraction processes, fractionation and purification by means of the technology of supercritical fluids and the chemical and functional characterization of natural products with biological activities of food interest. He is author of 130 publications of international impact and of several transferred patents. In 2001 he received the Prize «Archer Daniels» granted by the American Oil Chemists Society. Between 2002 and 2006 he has been Manager of the Area of Science and Food technology of the National Plan of R&DT.





Prof. Dolores Corella
Associate Senior
Researcher

Dolores Corella Piquer, PhD in Pharmacy and Bsc in Food Science and Technology, is a Full Professor of Preventive Medicine and Public Health at the University of Valencia. Since 1998 she has been Director of the Genetic and Molecular Epidemiology Research Unit. She focuses on the study of genetic determinants of disease and has developed research methodology for analyzing gene-environment interactions, both for monogenic and complex multigenic diseases. Within the gene-environment interaction study, gene-diet interactions have constituted an important research line giving rise to the development of Nutritional Genomics.

Since 2003, Dr. Corella has participated in the PREDIMED Study (PREvención con DIEta MEDiterránea) and from 2006, in the CIBER on Physiopathology of Obesity and Nutrition, taking part in various studies centered on the analysis of obesity risk factors, both genetic and environmental, as well as the impact of gene-diet interactions.

She has directed more than 30 research projects related to cardiovascular genomics and various Doctoral Theses in this area. She has more than 130 articles published in prestigious international journals in the fields of genomics, nutritional genomics, obesity and cardiovascular diseases, and has been quoted many times.

Her research group also took part in the INBIOMED network. Current-

ly she is collaborating with the COMBIOMED network. Dr. Corella is one of the pioneers in the development of nutritional genomics in Spain, and together with Dr Ordovás, Director of the Nutrition and Genomics Laboratory, Human Nutrition Research Center, Boston, USA, published the first works on gene-diet interactions, which have already become classics in this new discipline.

senior researcher

Dr. Ana Ramírez de Molina
Senior Researcher

Ana Ramírez de Molina, PhD in Biochemistry and Molecular Biology and Bsc in Chemistry (Biochemistry), has pursued her scientific career in the field of lipid metabolism and its relationship with the molecular and cellular biology of cancer. Her PhD Thesis was cited as outstanding by the Autonomía University in 2002 for her work on the alterations of the lipid metabolism performed at the "Instituto de Investigaciones Biomédicas (CSIC)" under the supervision of Prof. Juan Carlos Lacal. She stayed as a postdoctoral student with Professor Paul Workman, Head of the Cancer Research UK Centre for Therapeutics, and worked as a postdoctoral

researcher in the Translational Oncology Division of CSIC-UAM-Hospital La Paz for three years. In 2005 and 2006 she worked as an associate researcher at the Molecular Pathology Division of the Sloan Kettering Cancer Center (New York) under the supervision of Prof. Carlos Cordon-Cardó, and afterwards she worked as the Deputy Scientific Director of TCD Pharma, a CSIC spin-off company focusing on the development of new tumoral markers and cancer therapies. On 2007 she became Director of Research and Innovation at TCD Pharma, focusing on the development of a diagnostic platform based on tumoral genomics and coordination of the preclinical development of new antitumoral drugs focused on the lipid metabolism, where she had been working till she joined IMDEA

Food in 2009. In the last 7 years she supervised two PhD Thesis, published more than 25 articles in prestigious international journals in the field, and is co-inventor of 8 patents in different phases of exploitation by a biotechnology company.



Dr. Arantxa Rodríguez Casado
Senior Assistant
Researcher

Arantxa Rodríguez Casado, PhD in chemistry (Universidad Complutense de Madrid, 1998), has pursued research in the field of Biophysics, studying different aspects of molecular biological systems. She has focused on the connection between the structure of biomolecules - proteins, nucleic acids, lipids - and their functionality, with the ultimate goal of understanding the complex mechanisms of interaction between them.

In the Food field, she has worked on two applied research lines: Conservation and Quality, and Restructured Foods in collaboration with Professor Mercedes Careche (Instituto del

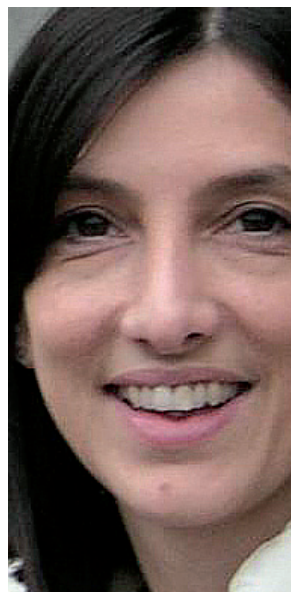
Frio - CSIC), developing new methodologies for identification of defects in food, and studying the correlation between rheological properties and structural aspects of new functional foods.

She worked as a research associate for more than three years in the Department of Cell Biology and Biophysics, School of Biological Sciences at the University of Missouri-Kansas City (MO, USA) under the supervision of Professor George Thomas, on the study of structural proteins. Then she worked for almost two years at the Birkbeck College, University of London, in the group of Professor Helen Seibil dealing with the 3D reconstruction of proteins by electron microscopy (TEM and SEM) and digital image processing, with particular focus on the mor-

phology of biomolecules. She also has worked in the Biomedicine field at the Institute of Structure of Matter - CSIC collaborating with Dr. Pedro Carmona and with Professor Adolfo Toledano (Instituto Cajal - CSIC), in early diagnosis of neurodegenerative diseases by vibrational microspectroscopy, and also in characterizing specific structures in nucleic acid triple helices, with the focus on gene therapy. All these years dedicated to this work are reflected in 30 publications with a high impact factor in her research field.



assistant senior researcher



Dr. Lorena Betancor
Senior Assistant Researcher

Dr. Lorena Betancor graduated as a Bsc in Biochemistry at the Universidad de la Republica (Montevideo, Uruguay). She obtained a PhD in Molecular Biology at the Autonoma University in Madrid working under the guidance of Prof. JM Guisan at the Institute of Catalysis and Petrochemistry (CSIC). There she specialized in enzyme technology particularly in developing strategies for the immobilization and stabilization of enzymes of biotechnological interest (e.g food industry, fine chemistry, pharmaceuticals). Upon completion of her PhD, she worked as a post doc at Georgia Institute of Technology where she explored the enzymology and molecular biology of nitroreductases and

mutases. She deepened her knowledge in enzyme immobilization using novel nano structured materials as supports and applying them in the design of in vitro biocatalytic reactions for cofactor regeneration and microfluidics. Between 2006 and 2009 she joined Prof. Peter Leadlay's group at the University of Cambridge as a post doctoral fellow from the Spanish Ministry of Science and Education. There Dr. Betancor developed new strategies for the expression and purification of multienzymatic systems and explored the use of polyketide synthases in vitro applying her expertise in enzyme immobilization. She joined IMDEA-FOOD in February 2009 as a "Ramón y Cajal" researcher to work in functional foods and nutrigenomics. She is co author of more than 40 papers in international peer-reviewed journals, 6 book chapters and 4 patents

and has been invited to review areas of enzyme immobilization and biocatalysis by relevant biotechnological review journals (Trends in Biotechnology, Biotechnology and Genetic Engineering Reviews).

Research Interests

During her pre and post doctoral research Dr. Betancor has explored almost all the fields related to enzyme technology: expression, purification, immobilization-stabilization of enzymes and application of immobilized preparation to biocatalytic processes and biosensors. Now, a new challenge will be taken by working towards the production of new functional ingredients for the food industry and the design of improved ways of obtaining additives of known value for the human health.



predoctoral & postdoctoral researcher



Susana Molina

Postdoctoral Researcher,
Senior Laboratory Technician

Susana Molina Arranz, PhD in Molecular Biology Autonomía University of Madrid (2005), pursued her PhD studies in the group of Prof. Luis Carrasco at the “Centro de Biología Molecular Severo Ochoa” (CSIC-UAM). During these years she worked on viral RNA translation, specializing in techniques such as viral infections, radioactive labellings, western blotting, cloning and protein purifications. In the same group she worked as a postdoctoral researcher on analysis of the ethiology of several human diseases, studying the implication of a fungal. In this work she participated in the development of methods to determine the presence of yeasts in human samples, including antibodies recognizing different yeast antigens or detection of fungal DNA by RT-PCR. In 2007 she joined Dr. Juan M. Torres’ group at “Centro de Investigación en Sanidad Animal” (INIA), where she collaborated in different projects on prion diseases and their strain barriers. Between 2008 and 2009 she was in the group of Fernando Valdivieso at the “Centro de Biología Molecular Severo Ochoa” (CSIC-UAM), where she started working as a technician generating biological tools for therapeutic investigation of Alzheimer Disease.

Marta González

Predoctoral Researcher

Marta González Castejón graduated in Biology at the Universidad Autónoma de Madrid in 2007.

During her final year she did her Graduating Dissertation at the Department of Biology of UAM, working on the construction and analysis of mutant bacteria strains. Thanks to this project and her course subjects she is familiar with techniques of molecular biology and genomics.

In March 2009 she joined IMDEA Food, having obtained a Madrid Region Research Staff Support Contract for completion of her doctoral thesis on the topic “New functional ingredients that affect the expression of genes involved in development of obesity and metabolic syndrome”, directed by Dr. Arantxa Rodríguez Casado, and she is currently taking a Master’s degree course in Nutrition and Health at the Universidad Complutense de Madrid.



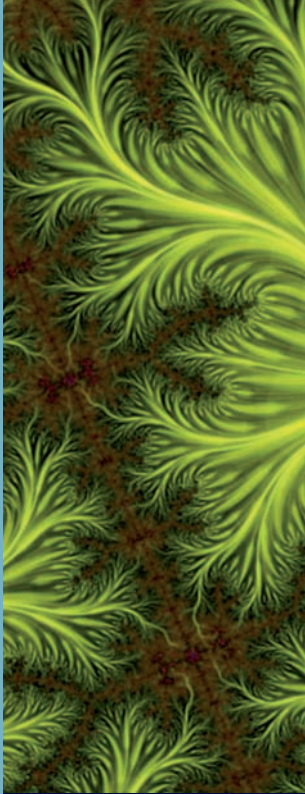
senior technician

M^a Isabel Espinosa

Senior Technician,
Nutritionist/Dietician

M^a Isabel Espinosa, BSc in Food Science and Technology (UAM) and with a Degree in Human Nutrition and Dietetics (UAM), has worked in the Endocrinology and Nutrition department at La Paz and Puerta de Hierro Hospitals in the Comunidad de Madrid. In 2008 she collaborated in developing a nutrition and health programme for the Mahou-San Miguel group in Madrid, Barcelona, Lerida, Tenerife, Málaga, Burgos and Gualdalajara. She has experience in anthropometric assessment, in nutritional control and development of catering menus, and in dietary consultation and monitoring. During the last two years she has been imparting specialized seminars and conferences in nutrition and food technology. She has published several articles in the field for the general public, and she has also experience in updating quality control systems (ISO9001/ 00, ISO 14001/04 and EMAS regulation 7617/2001).





5 scientific infrastructures

- 5.1. **Definitive headquartes** [30]
- 5.2. **Temporary facilities** [32]
- 5.3. **Provisional administration offices** [32]
- 5.4. **Scientific infrastructures** [32]

5.1. Definitive headquartes

The Institute will be located on the Cantoblanco Campus on land ceded by the Universidad Autónoma de Madrid near the UAM-CSIC Institute for Food Science Research “CIAL”, the “Severo Ochoa” Molecular Biology Centre and the CLAID Building in the Madrid Science Park.

There, the Institute will be able to take advantage of synergies with the research and scientific services centres on the Cantoblanco University Campus an essential consideration for a centre devoted to targeted basic research, applied research and transfer of research results.

The end result is a high-level food R&D environment, especially appropriate for the transfer of the results of IMDEA Food’s research in association with the Madrid Science Park, which can support the numerous food research groups in the Region, serve as an international scientific benchmark and attract new innovative enterprises that require its services.

The land covers an area of 4200 m², with room for 7000 m² of floor space and a plan area of 2000 m², a maximum of 6 storeys and 70 parking spaces.

The Institute’s strategic plan conceives of a modular development in phases.

Phase I

This phase of the project covers all the requirements and contingencies for IMDEA Food Institute to commence operations for a period of five years. In this first phase the building will include complete architectural preparation of the entire habitable area of the building, including the basement, which will house the general facilities, function hall and covered car park. The building will have two separate but linked areas for laboratories and for common areas and offices.



The laboratory area will occupy two floors totalling 530 m², with five 50m² laboratories each. There will also be auxiliary laboratories and a service area on each floor for cold rooms, freezer cabinets, scales, etc., thus constituting a working area that meets all space and functionality requirements.

The office area will occupy five floors, for Management and Administration and meeting rooms and another three for offices. The spatial distribution is designed with personal development in mind, open-plan to give a sense of space, visibility and communicability between research groups, facilitating teamwork, interpersonal communication and a measure of privacy without loss of the visual contact, all essential to proper performance of the various activities that will be going on in the building—research, administration / management and institutional activities.

Phase II

In this phase it is planned to complete the building, making up a total floor area of 6517 m².



5.2. Temporary facilities

In the interim, IMDEA Food Institute is developing its activity in temporary facilities. The Universidad Autónoma de Madrid has provided IMDEA Food Institute with spaces on Cantoblanco Campus for the development of the research line on which its activity is focused sharing one laboratory and the Pilot Plant in the Science Faculty's Food Technology building, plus an office area that has been remodelled.



5.3. Provisional administration offices

The provisional headquarters for management and administration are located in a space assigned to this purpose by Universidad Autónoma de Madrid on the Campus of Cantoblanco at the Pavillion C building, with an area around 30 m² with access to common services of the building (a meeting room, a Function Hall, etc.).

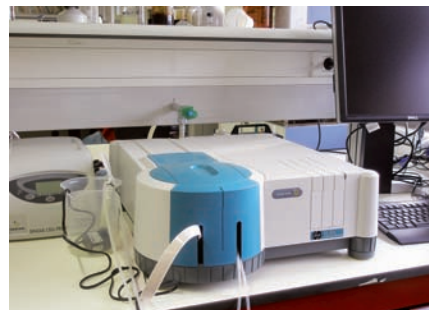
5.4. Scientific infrastructures

IMDEA Food Institute has been fitted out for research in Line 1 Food & Health, with the following advanced scientific and technical equipment:

- High-productivity, high-performance Genotyping and Gene Expression Platform:
 - TaqMan® OpenArray™ Genotyping System (Applied Biosystem).
 - 7900HT Fast Real Time PCR System with a block of 96 wells and a block of 384 wells, user-changeable (Applied Biosystems).



- The laboratory also has instruments for monitoring assays:
 - Series 1200 (Agilent) gradient HPLC system.
 - UV/Vis-CARY-50 Bio (Varian) spectrophotometer.



- In addition, there are conventional apparatuses for isolation of ingredients and other small items of instrumental equipment.



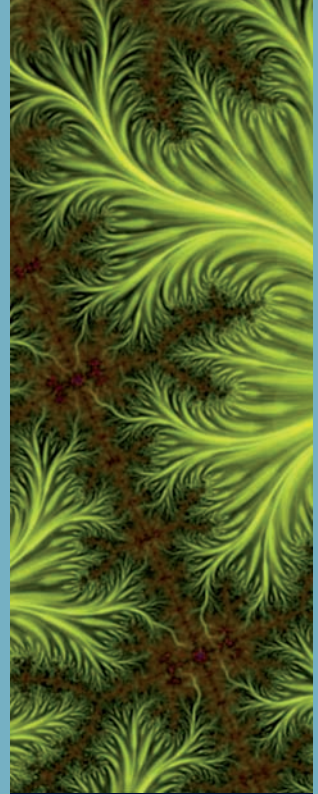
To finance the Definition Phase of the New Building and Advanced Equipment, a reimbursable interest-free loan on the basis of the project submitted to the Ministry of Science and Innovation for the call 2008 for aids of the National Sub-programme of Scientific and Technological Initiatives in Science and Technology Parks (BOE nº 94 of 18 April 2008 ORDEN PRE/1083/2008 of 11 April).

This loan is part of a cooperation agreement concluded on 30 December 2008 between the Madrid Region Government and the Spanish Ministry of Science and Innovation, to grant 423,082 Euros to IMDEA Food Institute through Madrid Science Park Foundation.

research projects

6

- 6.1. **Competitive research projects [35]**
- 6.2. **Contracts with Companies [40]**
- 6.3. **Research Grants [40]**



6.1. Competitive research projects

DIETCAN

Investigational Nutrigenetic Studies for Cancer Prevention

Alterations in lipid metabolism in cancer: influence of diet ingredients on development, onset and/or progress of the disease

IP: Dr. Ana Ramírez de Molina

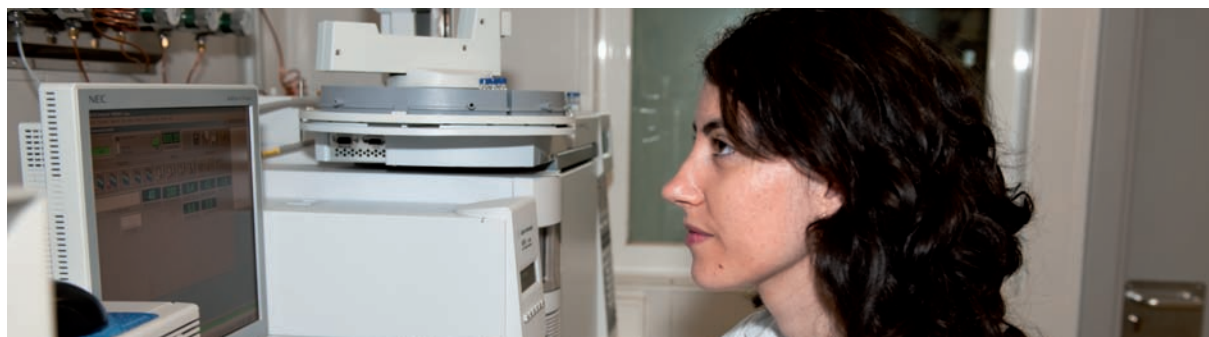
Funding: Fundación Mapfre

Duration: 2009-2011

This research line is focused on using information on individual genetic variations to stimulate pilot dietary intervention studies. The main goal is to examine whether genetic variants can predict individual responses to dietary components that alter cancer processes and modify individual susceptibility to cancer. These studies will allow for personalization of cancer preventive dietary strategies to reduce cancer risk or to improve responses to anticancer treatment in genetically susceptible individuals.

Bioactive food components and genes that determine human cancer risk. Several bioactive food components can modify transcription, expression, and regulation of genetic targets that are known to influence different cancer-related signaling pathways that determine the aggressiveness of the disease or the detoxification of carcinogens. On the other hand, individual genetic variants may influence carcinogenesis at multiple levels. Furthermore, individuals carrying some genetic variants also appear responsive to the effects of some bioactive food components.

This research line focuses on the development of individualized, targeted nutrition with the aim of establishing prevention strategies that can reduce cancer risk in genetically susceptible humans, or improving the management of patients with this disease based on individual genetics. Bioactive food components in dietary interventions may include essential nutrients and non-nutrients found in foods. This approach includes the identification of new biological markers in cancer developed by different gene expression analysis, as well as dietary intervention studies using cell culture and animal models. The information generated from such investigations might serve as the basis for exploratory pilot clinical studies in humans.



DIETGEN

Gene-nutrient interactions: Study of the potential beneficial effect of dietary incorporation of rosemary extracts on the development of colon cancer

Funding: IMDEA Food Institute/Spanish Ministry of Science and Innovation (Requested)

IP: Dr. Ana Ramírez de Molina

Duration: 2009-2013

Carnosic acid extracted from rosemary is a powerful natural antioxidant, recognized as safe by the EFSA. Its capacity to alleviate cell damage caused by oxidative stress and additional evidence such as its regulatory action on lipid metabolism, or detoxifying enzymes like GST, suggest that this component of rosemary has a beneficial effect on human carcinogenesis. Promising results have recently been reported in leukemia cells, indicating that as a dietary component this ingredient could have beneficial effects on cancer. However, additional studies are needed to confirm and analyse the clinical importance of these preliminary findings and look more closely into the mechanics of this effect.

This project proposes separation and isolation of carnosic acid by supercritical chromatography as a potential functional ingredient of rosemary for future foods if the EFSA regulations are further developed, or as nutraceuticals and/or nutritional supplements affecting the development, course and treatment of colon cancer. It is proposed to elucidate the mechanics of this effect by means of various gene expression studies in human tumor cells treated with this ingredient, and also in samples from patients with colon cancer, in whom it is proposed to study the expression of carnosic acid-target genes, as well as other related genes bearing on the response to nutritional components. This study should lead to the identification of new genes associated with the development of colon cancer which could be readily modulated by diet and which might play a fundamental role in the onset, incidence, progress, severity and/or treatment of this disease.

FITOGEN

Functional Ingredients derived from phytochemicals that influence genetic mechanisms implicated in the development of multigenic disorders (obesity and metabolic syndrome)

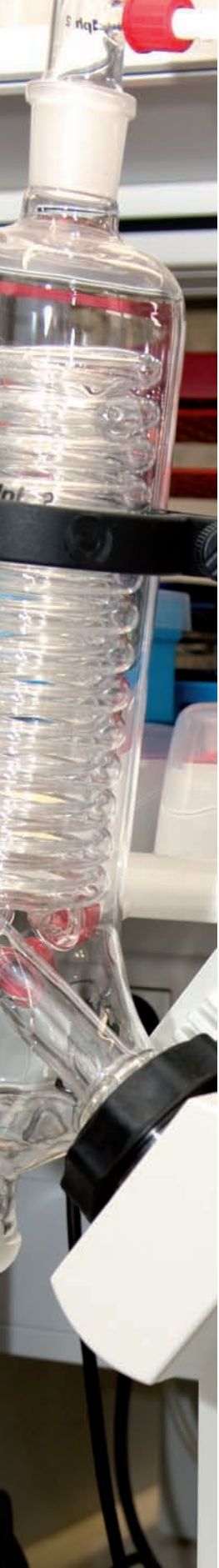
IP: Dr. Arantxa Rodríguez Casado

Funding: Madrid Region. Grant for Recruitment of Research Support Personnel (CPI/0631/2008)

Duration: 2009-2012

This research project seeks to establish connections between certain aspects of genomics in the control of multigenic disorders and the healthy effects of certain phytochemicals





when included in the diet. The research line considers certain phytochemicals found in dandelion (*Taraxacum officinale*) with properties that suggest they are a potential source of functional ingredients for the treatment and prevention of metabolic disorders in that they positively and simultaneously regulate several genetic/molecular mechanisms implicated in the development of obesity and metabolic complications deriving from it (diabetes, high blood pressure and high cholesterol). Dandelion is highly antioxidant thanks to high concentrations of carotenoids, flavonoids coumarin derivatives, and it is also strongly anti-inflammatory, reducing the levels of pro-inflammatory markers associated with the development of obesity (IL-6 and TNF- α), as well as being effective in the regulation of NO and COX-2 production. As an effective regulator of insulin secretion it is anti-hyperglucemic and hence a good option for prevention of complications in diabetes. The triterpenes and phytosterols that it contains reduce the risk of thromboembolism. Its vitamin A catalyses hepatic metabolism and activates the expression of uncoupling proteins (UCP) and hepatic genes implicated in the development of obesity. Lactones from the sesquiterpene in the leaf extracts reduce total cholesterol and triglyceride levels in serum and hepatic tissues and raise the HDL-cholesterol level.

REDUCOL

Intelligent design of cholesterol-reducing foods according to the consumer's gene profile

IP: Dr. Arantxa Rodríguez Casado

Funding: IMDEA Food Institute/Spanish Ministry of Science and Innovation (Requested)

Duration: 2009-2013

This line is oriented towards the development of functional foods capable of effectively reducing serum cholesterol levels by acting simultaneously on two levels:

- 1** Acting on endogenous cholesterol synthesis and on its haemo-entero-hepatic cycle. It is proposed at once to use active products found in foods that can inhibit the cholesterol biosynthesis pathway and to modify hepatic circulating cholesterol by means of receptor modulation.
- 2** Hindering cholesterol absorption by displacement of mixed micelles, sequestration of biliary acids during intestinal digestion to prevent re-absorption, inhibition of pancreatic lipase and modulation of the enterocyte proteins responsible for cholesterol absorption.

The experimental approaches that are required to implement this line include:

- a)** In vitro digestion model systems to determine bioaccessibility.
- b)** Model systems of cellular absorption via Caco2, to determine bioavailability.



- c) Advanced LC/CG-MS analytical techniques to identify the behaviour of the active principles and the derived metabolites.
- d) Expression of genes implicated in cholesterol homeostasis to determine the effect of different foods and active molecules.
- e) Genotyping of populations to adjust the design of foods to different genetic profiles.

NUTRIGEN

Design and Validation of Active Ingredients for the Development of Functional Foods (ALIBIRD S2009/AGR1469)

Madrid Region consortium comprising 14 R&D groups. IMDEA Food is responsible for “analysis of the effects of bioactive ingredients, with special emphasis on benefits for cardiovascular health and the behaviour and effects of those bioactive compounds”.

IP: Dr. Ana Ramírez de Molina

Funding: Madrid Region. (S2009/AGR-1469)

Duration: 2009-2013

The role of IMDEA Food Institute is to study the heart-healthy effect of target functional foods (antioxidants, microbial enzymes, structured and functional lipids, bioactive peptides, prebiotics and probiotics) in humans, taking into account the variations in individual genomes. This activity will consist fundamentally in studies of cohorts with particular genetic traits. According to the strategy laid down in the Consortium’s Work Plan, coordinated by Prof. Guillermo Reglero Rada, the groups will study procedures for producing one or two products of each type—i.e. ten in all. These will be evaluated in terms of industrial feasibility and will be subjected chemical and biological characterization. Following this process it is hoped that at least three of the ingredients will be sufficiently viable for getting into the next step of the project, in which they will be assessed for safety and put through pre-clinical (toxicology and efficacy) and nutrigenetic clinical studies.

OBESIKIT

Detection of enzymatic markers by oriented antibody immobilization

IP: Dr. Lorena Betancor (in collaboration with the University of the Republic, Uruguay)

Funding: IMDEA Food Institute

Duration: 2009-2014

The aim is to develop a novel methodology for detection in blood of tiny variations in the activity of reporter enzymes as means of determining whether a nutrient or set of nutrients could affect the risk of obesity in a particular person. To that end it is proposed to



develop functionalized magnetic particles with antibodies against aspartate aminotransferase and alanine aminotransferase, two hepatic enzymes commonly associated with obesity. Thus, using an economical, simple but highly sensitive enzymatic method, it should be possible to achieve early detection of individuals in whom it would be easier to observe changes in their transcriptome by means of microarrays and to conduct comparative nutrigenomic studies with hyposensitive individuals.

FUN-C-FOOD

New ingredients and functional foods to improve health

Coordinating centre: CSIC- Center of Soil Science and Applied Biology

Programme INGENIO-CONSOLIDER

Funding: Spanish Ministry of Science and Innovation

Duration: 2007-2011

Research programme aimed at producing and characterizing new bioactive food ingredients and applying them to the development of new functional foods, backed up by studies of bioavailability, biological activity and food safety.

This research programme explores the relationship between foods and health, in particular with regard to functional foods and bioactive food ingredients. The programme also proposes to include new food ingredient production technologies for the formulation of functional foods, for advanced bioanalysis (including both comprehensive chemical and functional characterization), evaluation of biological activity, bioavailability and metabolization, and a study of possible benefits and risks for human health. New functional foods will be developed with one or more added functional ingredients, which will be assayed for efficacy and possible toxicological risks. The programme also includes research activities that take advantage of the latest scientific tools in the field of genomics, transcriptomics, proteomics, metabolomics, metabonomics and nutrigenomics. This will be the first initiative to integrate food science and omic methods in Spain.



6.2. Contracts with Companies

CENIT-PRONAS

Nutrition intervention studies for the analysis of diet-gene interactions within the framework of the CENIT Project for “the development of a new generation of functional foods with special emphasis on obesity prevention”

IP: Prof. Dolores Corella

Funding: PULEVA BIOTECH, S.A. /Spanish Ministry of Science and Innovation – CDTI

Duration: 2009-2012

6.3. Research Grants

Programme: Ramón y Cajal (2007-01920)

Dr. Arantxa Rodríguez Casado

Title: Infrared and Raman spectroscopies of biological substances (proteins, lipids, nucleic acids, polysaccharides)

Funding: Spanish Ministry of Science and Innovation

Duration: 2008 – 2012

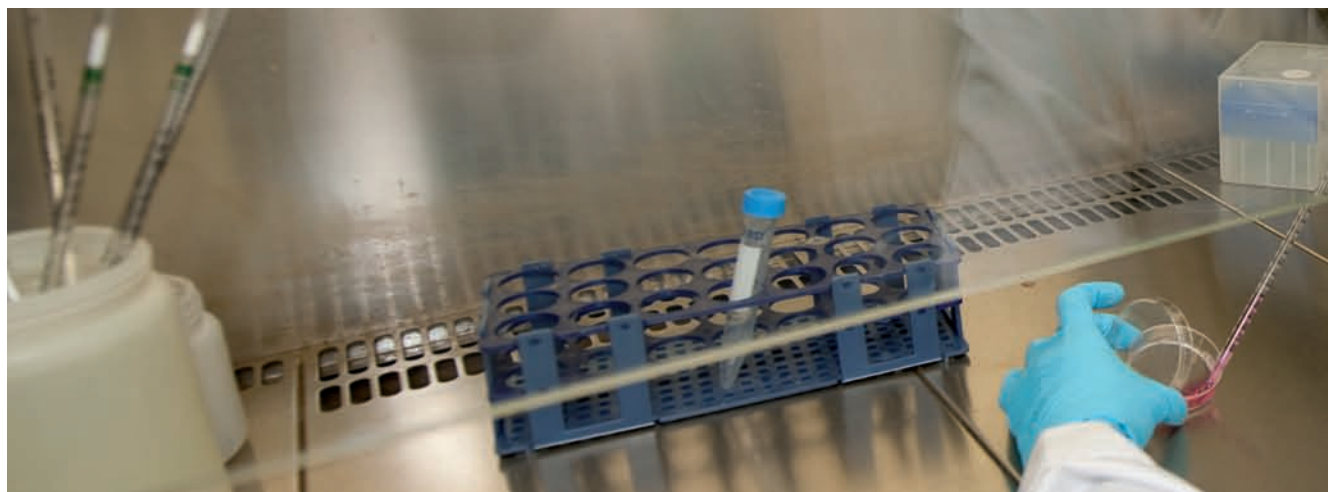
Programme: Ramón y Cajal (RYC2008-03734)

Dr. Ana Ramírez de Molina

Title: Alterations of lipid metabolism in cancer: towards a personalized diagnosis and therapy

Funding: Spanish Ministry of Science and Innovation

Duration: 2009-2014



Programme: Ramón y Cajal (RYC2008-03732)

Dr. Lorena Betancor Dutrenit

Title: Preparation of functional food ingredients using immobilized enzymes

Funding: Spanish Ministry of Science and Innovation

Duration: 2009-2014

CPI/0631/2008

Contract for the support of research staff

Marta González Castejón

Funding: Comunidad de Madrid

Duration: 2009-2012

Grant Agreement nº 229599

“Marie Curie” AMAROUT Europe

Funding: European Commission. VII R&TD Framework Program

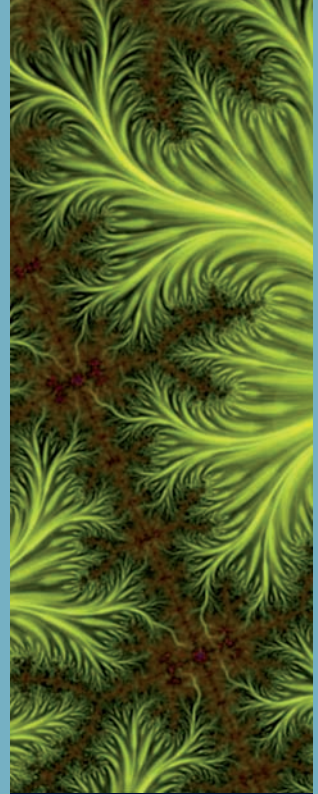
Duration: 2009-2012



scientific results

7

- 7.1. Publications [43]
- 7.2. Books and chapters of books [48]
- 7.3. Theses directed or in progress [48]
- 7.4. Awards [48]



publications

08

7.1. Publications

Listed below are the scientific contributions published in international media by IMDEA Food Institute researchers. The Institute became operational in 2008 and therefore many of these contributions began as collaborations and projects with other institutions.

2008

1. Luna, P., Bach, A., **Juárez, M.** y De La Fuente, M.A. Influence of diets rich in flax seed and sunflower oil on the fatty acid composition of ewes' milk fat especially on the content of conjugated linoleic acid, n-3 and n-6 fatty acids. *International Dairy Journal*, 18, 99-107 (2008).
2. Luna, P., Bach, A., **Juárez, M.** y De La Fuente, M.A. Effect of a Diet Enriched in Linseed and Sunflower Oil on Goats Milk Fatty Acid. Composition and CLA Isomer Profile. *Journal of Dairy Science*, 91, 20-28 (2008).
3. Gómez-Cortés, P., Hervás, G., Mantecón, A.R., **Juárez, M.**, De La Fuente, M.A., Frutos, P. Milk Production, CLA Content and *In Vitro* Ruminal Fermentation in Response to High Levels of Soybean Oil in Dairy Ewe Diet. *Journal of Dairy Science*, 91, 1560-1569, (2008).
4. Hervás, G., Luna, P., Mantecón, A.R., Castañares, N., De La Fuente, M.A., **Juárez, M.** y Frutos, P. Effect of sunflower oil in the diet of sheep on milk production, fatty acid profile and rumen fermentation. *Journal of Dairy Research*, 7, 399-405 (2008).
5. Gómez-Cortés, P., Frutos, P., Mantecón, A.R., **Juárez, M.**, De La Fuente, M.A. y Hervás, G. Addition of olive oil to dairy ewe diet: effect on milk fatty acid profile and animal performance. *Journal of Dairy Science*, 91, 3119-3127 (2008).
5. Luna, P.; **Juárez, M.**; De La Fuente, M.A. Gas chromatography and silver-ion high-performance liquid chromatography analysis of conjugated linoleic acid isomers in free fatty acid for using sulphuric acid in methanol as catalyst. *Journal of Chromatography A*, 1204, 110-113 (2008).
6. A. Anadón, M.R. Martínez- Larrañaga, M. A. Martínez, I. Ares, M. R. García-Risco, F. J. Señoráns, **G. Reglero.** Acute Oral Safety Study of Rosemary Extracts in Rats. *Journal of Food Protection* 71, 790-794 (2008).
7. Fornari, T, Vázquez, L, Torres CF, Ibáñez E, Señoráns, FJ, Reglero G. Countercurrent supercritical fluid extraction of different lipid-type materials: Experimental and thermodynamic modeling. *Journal of Supercritical Fluids* 45 (2), 206-212 (2008).
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09

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books and chapters of books

7.2. Books and chapters of books

Juárez, M. and Fontecha, J. (2009). Componentes Bioactivos de la Grasa Láctea
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De La Fuente, M.A. y **Juárez, M.** (2009). Chapter 10: Fatty acids. En: *Handbook of Dairy Foods Analysis*. Ed.: F. Toldrá y L. M.L. Nollet, CRC Press, Boca Ratón, Estados Unidos. ISBN 1420046314.

De La Fuente, M.A., **Juárez, M.** y Fontecha, J. (2009). Chapter 8: Triacylglycerides. In: *Handbook of Dairy Foods Analysis*. Ed.: F. Toldrá y L. M.L. Nollet, CRC Press, Boca Ratón, Estados Unidos. ISBN 1420046314.

Recio, I. De La Fuente M.A., **Juárez, M.** y Ramos, M. (2009). Chapter 4: Bioactive components of sheep milk. In: *Bioactive components in milk and dairy products*. Ed: Y.W. Park, Wiley-Blackwell Publisher, Ames, Estados Unidos. ISBN 9780813819822.

7.3. Theses directed or in progress

Title: Combinatory 5-Fluoracyl and cis-platinum treatment with choline kinase alpha inhibitors as a new alternative for cancer therapy.

PhD student: Ana de la Cueva Herrera

Directors: Ana Ramírez de Molina (IMDEA Alimentación) and Juan Carlos Lacal (CSIC)

Start date: December 2007

Title: Influence of new functional ingredients in the expression of genes related to obesity and metabolic syndrome.

PhD student: Marta González Castejón

Director: M^a Aránzazu Rodríguez Casado

Start date: March 2009

Title: Improvement of the healthy fatty acid profile of ovine milk lactic acid by diet supplementation with different lipid sources.

Doctorand: Pilar Gómez Cortés.

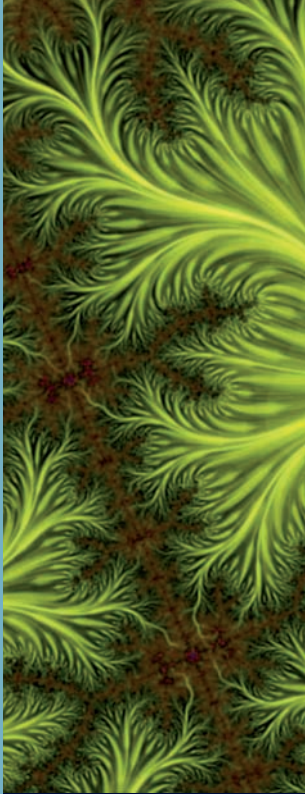
Director: M. Juárez y M. A. de la Fuente

Start date: September 2006

7.4. Awards

M. Juárez. International Hippocrates Award for Medical Research on Human Nutrition. 2009





8

dissemination activities

- 8.1. Organization of conferences and seminars [50]
- 8.2. Invited conferences, courses and seminars [51]

IMDEA Food Institute has taken part in national and international science fairs and dissemination events, including the following:

8.1. Organization of conferences and seminars

2008

9th Madrid Science Fair 2008:

Stand “IMDEAs por un tubo”

IMDEA Food was present along with all the other IMDEAs that comprise the Network of Madrid Institutes of Advanced Studies at the Ninth Madrid Science Fair, with a stand captioned “IMDEAs por un tubo”

Venue and date: IFEMA, Madrid Fair (Spain), 24 - 27 April 2008

The Fair was a perfect setting for IMDEA Food to bring research and science closer to the public through a number of thematic workshops related to the Institute’s strategic areas:

Workshop 1. «Functional foods: Probiotics»

Workshop 2. «Good and bad microorganisms»

Workshop 3. «The nutrition of the future: functional foods-nutritional genomics»



Workshop: Genomic bases of the healthy effects of functional foods. Effects on Cardiovascular Health and Related Metabolic Disorders.

Venue and date: Pavilion C- University Campus of Cantoblanco, Madrid (Spain), 21 November 2008

The IMDEA Food Institute took part in the VIII Madrid Science Week 2008 with the aim of encouraging public participation in issues relating to science and technology.

The aim of the workshop was to debate activity relating to the design and development of functional foods and the genomic bases of the beneficial effects of these foods on cardiovascular health and related metabolic disorders. This is one of the priority research lines being pursued by the Institute.

2009

Workshop: Applications of nutritional genomics platform to the research on food–health relationship

Venue and date: Pavilion C- University Campus of Cantoblanco, Madrid (Spain), 20 November 2009

In the framework of IX Madrid Science Week 2009, IMDEA FOOD organized a Seminar focused on new strategies of advanced instrumental techniques for genotyping and gene expression applied to research on the genomic bases of the health effects of foods on cardiovascular health and related metabolic disorders.



8.2. Invited conferences, courses and seminars

The list includes invited lectures and conferences in courses, masters, technical seminars and workshops given by researchers of the IMDEA Food Institute.

2008

1. III Congress of Public Health of the City of Madrid. "Building a Healthy Madrid". Madrid + Health

Conference: Evaluation of health claims on food

Speaker: Juárez, M

Venue and date: Hotel Melia Castilla, Madrid (Spain), January 2008

Organizer: Ayuntamiento de Madrid

2. Science and Technology Forum Madrid+d 2008. Food technologies and natural resources Forum

Science-Business Day. Food Quality and Safety.

Title session: Presentation of the IMDEA Food Insitute

Speaker: Juárez, M

Venue and date: Universidad Complutense de Madrid (Spain), 18 April 2008

Organizer: OTRI – UCM

3. Science and Technology Forum Madrid+d 2008. Food technologies and natural resources Forum

Conference on Functional Foods: New trends in nutrition and health

Title session: Round Table - Innovative projects and new developments of functional components: approaches from science and industry

Speaker: Juárez, M

Venue and date: Universidad Autónoma de Madrid (Spain), 23 April 2008

Organizer: OTRI-UAM and Madri+d Foundation

4. Cultural Events Instituto Cervantes (London) "Healthy Food"

Lecture: Foods with health benefits

Speaker: Juárez, M

Venue and date: Instituto Cervantes London (U.K.), 30 September 2008

Organizer: Instituto Cervantes Londres and CSIC

5. Workshop: Women in the XXI century

Conference: Functional foods. Present and future

Speaker: Juárez, M

Venue and date: Cartagena (Spain), 9 October 2008

Organizer: Universidad Politécnica de Cartagena

6. Seminar: Functional foods. Impact of regulations 107/2008 and 109/2008

Conference: Potential impact on health of different functional ingredients

Speaker: Juárez, M

Venue and date: Madrid (Spain), 5 November 2008

Organizer: Asociación de la Prensa de Madrid

7. XII Scientific Meeting of the Spanish Nutrition Society "Food and Physical Activity. The necessary balance"

Fifth International Meeting "Food and Nutrition in the 21st century"

Closing Conference: Nutrigenomics

Speaker: Ordovas, J

Venue and date: Baiona, Pontevedra (Spain), 13 -15 November 2008

Organizer: SEN and ASGAEDA

8. II International Congress on Olive Oil and Health (CIAS 2008)

Conference: Moderated the sixth symposium on «The Mediterranean Diet and Cardiovascular Epidemiology».

Speaker: Ordovas, J

Venue and date: Jaen and Cordoba (Spain), 20 - 22 November 2008

Organizer: Junta de Andalucía, the county councils of Jaen and Cordoba, CEAS and CITOLIVA Foundation



2009

1. XI National Congress of the Spanish Nutrition Society. Achievements and challenges in food: innovation and consumers

Conference: New developments in functional foods

Speaker: Juárez, M

Venue and date: Sitges(Spain), 11 – 13 June 2009

Organizer: Spanish Nutrition Society (SEN)

2. XV Meeting of the Spanish Society of Analytical Chemistry

Conference: Functional foods. Lipids. Analytical Challenges

Speaker: Juárez, M

Venue and date: San Sebastián (Spain), 19-21 July 2009

Organizer: Spanish Society of Analytical Chemistry

3. School of Nutrition «Francisco Grande Covián”. Nutrition and Health.

Title: Developments in functional foods

Speaker: Juárez, M

Venue and date: Santander (Spain), 27-31 July 2009

Organizer: Universidad Internacional Menéndez Pelayo

4. Summer Courses at the Universidad Internacional de Andalucía

Module: Food and Health

Speaker: Juárez, M

Venue and date: Sevilla (Spain), 7 - 11 September 2009

Organizer: Universidad Internacional de Andalucía

5. Official International Master in Animal Nutrition (2nd edition)

Speaker: Juárez, M

Venue and date: Zaragoza (Spain), 5 October 2009 - 11 June 2010

Organizer: Instituto Agronómico Mediterráneo de Zaragoza (IAMZ) - Centro Internacional de Altos Estudios Agronómicos Mediterráneos (CIHEAM), Universidad de Zaragoza (UZ) and Fundación Española para el Desarrollo de la Nutrición Animal (FEDNA)

6. Conference on Technology Transfer at CPHI WORLDWIDE- MADRID BIOPHARMA 2009

Title: Technological offer published in an online catalogue

Venue and date: IFEMA, Madrid Fair (Spain), 14 October 2009

Organizer: Madrid Science Park-Enterprise Europe Network madri+d in collaboration with the Association of Spanish Science and Technology Parks (APTE).

7. IX Congreso Nacional de Industrias Alimentarias-CONIA 2009

Speaker: Reglero, G

Venue and date: Universidad Nacional de San Agustín de Arequipa (Perú), 16-21 November 2009

Organizer: Universidad Nacional de San Agustín de Arequipa

8. Science-Business Mini-Forum “Advanced technologies applied to the agri-food industry

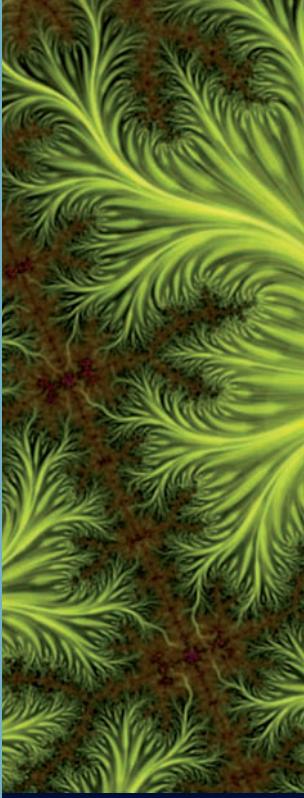
Round table: BUSINESS INNOVATION: Fostering R&D via aggregate business demand

Moderator: Juárez, M

Venue and date: Universidad Politécnica de Madrid (Spain), 27 November 2009

Organizer: Universidad Politécnica de Madrid





9

strategic alliances

IMDEA Food Institute is strongly committed with and actively participating in national and international forums, networking, panel discussions in science and innovation, through the establishing of strategic alliances with public and private entities.

Cooperation Agreement with Universidad Autónoma de Madrid

On 18 February 2008 a Framework Cooperation Agreement was concluded between the Universidad Autónoma de Madrid and IMDEA Food Institute with the aim of facilitating cooperation in research and technology development activities (R&D&I activities) and training of researchers, to regulating the use of shared spaces and equipment and cooperation between personnel of both institutions.

Association Agreement with Madrid Science Park

On 9 June 2008 a General Association Agreement was concluded with Madrid Science Park for cooperation between the Park and IMDEA Food Institute, with the aim of making the most of the advantages that such an association offers in terms of R&D&I activities, and more specifically in the activities and services that characterize it as a site and agent of innovation, in addition to providing cooperative access to the network of parks in Madrid and Spain and allied agents.

Collaboration with the CLUSTERS of the Madrid Region

Clusters are groups of enterprises, generally belonging to the same economic sector, which share experiences and good practices and coordinate to achieve the most favourable competitive framework for the pursuit of their activities, through the introduction of new technologies and innovation in products, processes and techniques.

There have been two meetings with the Clusters of the Madrid Region, a general one and another specific one with the Biotechnology Cluster.

Cooperation with the UAM on the nutrigenomics platform

The first steps have been taken to conclude a Specific Agreement with Universidad Autónoma de Madrid (UAM) for the establishment of a nutrigenomics platform. It has been presented to the UAM Ethics Committee.

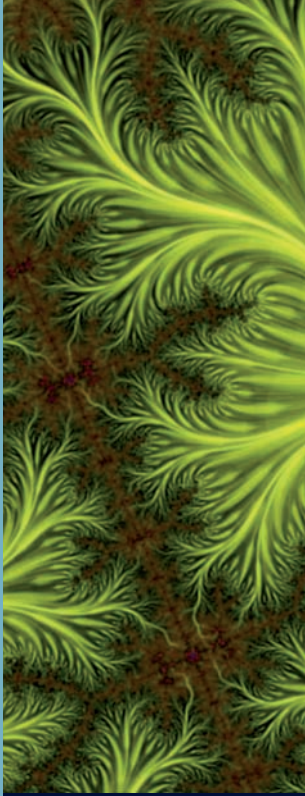
Cooperation Agreement with Tufts University. Boston (USA)

The first steps have been taken to conclude a Cooperation Agreement between Tufts University, Boston (USA) and IMDEA Food Institute to promote areas of interest in teaching and research at both institutions, and to promote greater understanding in either institution of the related economic, cultural and social issues.

International Campus of Excellence UAM+CSIC

IMDEA Food Institute has joined the International Campus of Excellence UAM+CSIC, which was awarded International Campus of Excellence status by the Spanish Ministries of Education and Science and Innovation on 26 November 2009.





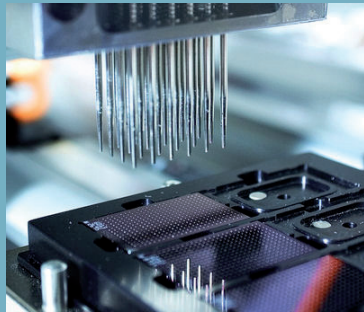
10

scientific highlights

- 10.1. **Nutritional Genomics: a new approach for understanding and improving human health [56]**
- 10.2. **Diet, lipid metabolism and cancer: a multidisciplinary research approach [58]**
- 10.3. **Highlights in cardiovascular disorders [60]**

nutritional

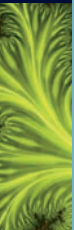
Nutritional Genomics: a new approach for understanding and improving human health



The more probable causes of cardiovascular disease, cancer, obesity, diabetes and other chronic diseases, can be found by analyzing the outcomes of genome and environment interactions, where environment is mainly represented by diet and lifestyle. Thanks to recent advances in knowledge of the whole human genome, a new field has emerged that can analyze the effect of food intake on the human genome: Nutritional Genomics.

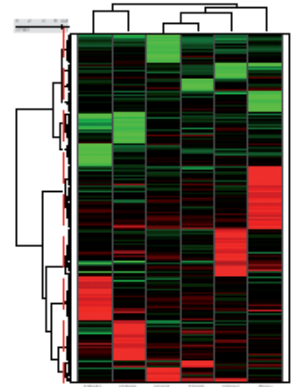
Nutritional genomics is focused on the analysis of how bioactive substances or nutrients affect the balance between health and disease due to particular interactions with individual genomes. This approach allows the identification of healthy nutrients and the mechanics of their beneficial effect through modulation of the human genome, making it possible to identify new genes (biomarkers) regulated by substances in diet with an essential role in the onset, incidence, progression or treatment of the disease. In addition, Nutritional Genomics provides a means of understanding the modulation of the response to diet by an individual's genetic profile, followed by nutritional intervention studies focused on the development of an individualized nutrition for the prevention, mitigation or improvement of the quality of life of patients with chronic diseases. The ultimate goal of Nutritional Genomics is, then, to find an optimum dietary regimen for a given individual taking account not only of nutritional needs but also of the genetic profile in order to prevent the onset of different diseases, or to manage them more effectively in a clinical setting.

The emerging field of Nutritional Genomics, which aims to identify the genetic factors that influence the body's response to diet and studies the way in which the bioactive constituents of food affect gene expression, is therefore an interdisciplinary area of strategic importance for improving human health and well-being the world over. Nutritional Genomics



genomics

applies the sciences of genomics, transcriptomics, proteomics, and metabolomics to human nutrition in order to understand the relationship between nutrition and health. Nutritional Genomics is a new science defined as the application of high-throughput genomic tools in nutrition research. Therefore, one of the essential tools of Nutritional Genomics is gene expression profiling (transcriptome level), but also similar approaches have to be used for the analysis of protein expression (proteome level) and for the determination of metabolic metabolites (metabolome level), and from there integrated analysis.



At IMDEA Food Institute we are using this multidisciplinary approach to investigate the influence of diet and individual genetic variation as risk factors for health disparities in populations. Certain genotypes are more severely affected by specific types of dietary factors than other genotypes. We are using genomics (with the latest technologies in the field such as the ABI PRISM 7900HT sequence detection system and the taqman OpenArray genotyping platform), which will be further integrated with proteomic and metabolomic analysis in order to identify and characterize genes regulated by different bioactive constituents in foods and gene-subsets that influence the balance between health and disease, in an effort to identify causative genes and new biomarkers. The ultimate aim is to palliate and/or prevent chronic diseases.

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diet, lipid

Diet, lipid metabolism and cancer: a multidisciplinary research approach

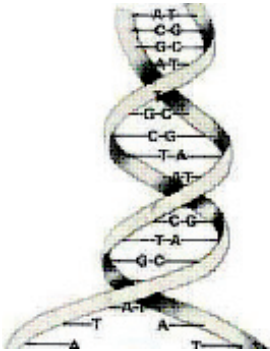
Colorectal cancer is one of the most common cancers worldwide, and the number of new cases annually, approximately equal for men and women, keeps on increasing. Though significant advances have been made in recent years, challenges and opportunities remain. Several environmental factors can interact at all stages of carcinogenesis. Lately the balance between genetic predisposition and these factors, including nutritional components and lifestyle, determines individual susceptibility and response to development of colorectal cancer. In the past few years, several studies have demonstrated the influence of diet in the risk of developing colon cancer due to diet-driven modulation of our genes and our colonic microflora. In general, though it is difficult to provide quantitative estimates of the overall risks of developing cancers, it has recently been estimated that 35 percent of cancer deaths may be related to dietary factors. A comprehensive worldwide report entitled Food, Nutrition, Physical Activity and the Prevention of Cancer, in a Global Perspective, compiled by World Cancer Research Fund and the American Institute for Cancer Research, reports that studies conducted over the years have shown a strong correlation between diet and cancer. A large proportion of cancers (80-90%) are caused by environmental factors, and of these, 30-40% are directly linked to diet.

According to the reports, a high intake of total fat is significantly associated with an increase in colorectal cancer risk. Lipids are a broad group of molecules which include fats, waxes, sterols, fat-soluble vitamins (such as vitamin D), monoglycerides, diglycerides, phospholipids and others, whose main biological functions are energy storage and acting as structural components of cell membranes. However, in the past few years an important role for lipids has emerged as signalling molecules. In this connection it was recently demonstrated that alterations in lipid metabolism are related to the development, progression and response to treatment of different types of cancer including colorectal cancer. It was also recently demonstrated that enzymes of the lipid metabolism constitute new prognostic factors and effective therapeutic targets for anticancer treatment. And again, various studies have demonstrated that weight gain and obesity are associated with health risks such as cardiovascular disease, diabetes and cancer.

and cancer



metabolism



At IMDEA Food Institute we are working on a new research line to provide state-of-the-art advances in critical areas of relevance to cancer development and prevention: regulation of the genome that focuses mainly on lipid metabolism, genetics of susceptibility, mouse models, advances in diagnostics, and clinical trials/experimental therapeutics. The biochemical mechanistic connection between the risk of development of cardiovascular disease, obesity and cancer is also being investigated to provide new clues to the genomic interconnection of these chronic diseases. In addition, we are analyzing the chemopreventative, anticarcinogenic and detoxifying activity of different nutrients, as well as potential mechanisms for protection against this disease using different approaches and validation strategies.

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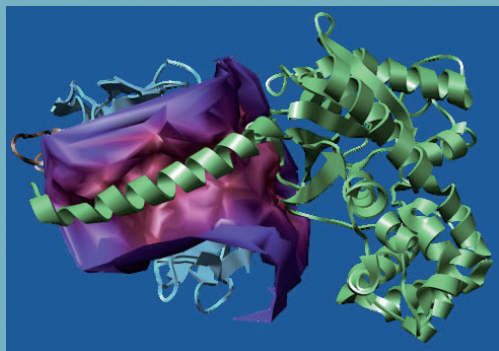


highlights in cardio

Genomics research in cardiovascular diseases

Cardiovascular diseases are a heterogeneous group of disorders of the circulatory apparatus in which major genetic and environmental influences have been identified. The relative weight of each of these factors has yet to be quantified exactly, as there are manifold interactions among them which are still largely unknown. Moreover, little is also known of the role of classic environmental factors (diet, exercise, stress, etc), and the principal genetic factors have not been identified. In the coming years it will therefore be necessary to look more closely at the principal genes associated with cardiovascular diseases, and how they are modulated by the environment.

In order to investigate the principal genes implicated in cardiovascular diseases a proper classification by phenotype is necessary, in respect of both final phenotypes (ischaemic cardiopathy, ischaemic cerebrovascular diseases, haemorrhagic cerebrovascular disease, venous thrombosis, etc), and intermediate phenotypes. Intermediate phenotypes are in principle easier to investigate since they are susceptible of a more specific approach than the more complex final phenotype. The main intermediate phenotypes that have been investigated are plasmatic concentrations of lipids and lipoproteins, arterial blood pressure and glucaemia. Along with these, other new phenotypes are being incorporated, with the emphasis on markers of oxidative stress, endothelial damage and the new characterization of metabolites in different biological samples through new advances in proteomics and metabolomics. The goals of IMDEA Food institute include the study of these new markers in different biological samples and investigation of the principal genes implicated in inter-individual variation and possible diet-driven modulation.



With the advances achieved in phenotypic characterization of various intermediate and final phenotypes of cardiovascular disease, combined with the revolution in genotyping techniques using high-performance genotyping chips to conduct complete genome studies of varying density (100K, 500K, 1000K, etc), it is now possible to use a new approach

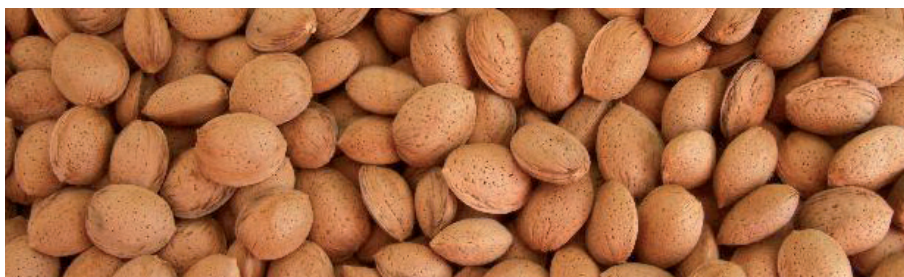


vascular disorders

to the discovery of new genes implicated in cardiovascular diseases. The last few years have seen a progression from the search for candidate genes based on protein functionality to “genome-wide association studies” (GWAs), which have made it possible through statistical tests to identify new loci associated with the different phenotypes of interest. IMDEA researchers have taken part in some of these GWAs, cooperating in the discovery of new loci associated with lipid metabolism, including two loci associated with LDL-cholesterol concentrations (1p13 near CELSR2, PSRC1 and SORT1; and 19p13 near CILP2 and PBX4), a locus with HDL-cholesterol (1q42 at GALNT2) and 5 loci with triglycerides (7q11 near TBL2 and MLXIPL, 8q24 near TRIB1, 1q42 at GALNT2, 19p13 near CILP2 and PBX4 and 1p31 near ANGPTL3). These recently-discovered require more detailed studies of the genes possibly implicated and their functional variants, and lastly the main gene-environment interactions. This line of functional characterization is also considered very important at IMDEA Food Institute, in addition to participation in future GWAs and specific direct sequencings of selected samples.

Gene-environment interactions in cardiovascular diseases

Research into new genetic variants associated with different intermediate and final cardiovascular disease phenotypes requires a simultaneous study of the principal gene-environment interactions. One of the most important environmental factors is diet. However, because of its extreme complexity diet has been the least effectively investigated factor owing to the difficulty of finding validated instruments with which to measure diet in large groups of individuals with sufficient validity and precision. IMDEA Food Institute is specializing in the most rigorous study of diet, to which end is developing a line for the design and validation of dietary questionnaires, at the same time working on the use of computer tools to improve management and quantification of actual diets. In parallel to the dietary study, IMDEA Food Institute is also working to develop valid instruments for standardised measurement of other environmental factors such as exercise,



stress, etc. All this is in response to the recommendations made by the PhenX project in the USA, which stressed the need for standardisation in the measurement of environmental exposures and phenotypes, as essential in order to be able to integrate the results of the different studies.

Once the instruments for measuring environmental exposures have characterized and a rigorous methodology has been established for genetic analyses using different genotyping platforms on which IMDEA Food Institute researchers are working, our studies will be concentrating on population surveys. To that end sampling protocols, recruiting techniques, measurement standards, data management, integrated storage platforms, various kinds of data analysis, etc. are being optimized. All this will make it possible to undertake studies of gene-environment interactions in the principal phenotypes of interest.



Cardiovascular nutrigenomics

The tools that have been designed for phenotypic characterization and for genetic and environmental determinations, especially regarding diet, will enable IMDEA Food Institute's researchers to conduct nutrigenomic studies with a maximum of methodological rigour and to investigate the influence of both dietary patterns and specific components of diet on intermediate or final phenotypes of cardiovascular disease in large-scale studies of population cohorts. One area of particular current interest is the effects of the Mediterranean diet, particularly of olive oil, nuts, pulses, fruit and vegetables, on lipid phenotypes and inflammation markers. Also, the latest discoveries regarding the protective role of coffee and cacao against diabetes and cardiovascular diseases in the American population require research among the Spanish Mediterranean population, in studies that include the principal regulating genes.

In addition to the observation studies on large cohorts, it is vital to conduct nutritional intervention studies on humans with the main components of the diet whose effects it is proposed to investigate. These compounds may be functional foods that can usefully be developed for the food industry to help improve cardiovascular health. Within this innovative, leading-edge line, IMDEA Food Institute is also making a special effort



to include the element of genetic variability so as to better approximate inter-individual variability as a means to optimizing personalized diets.

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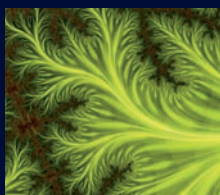


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