Formation of food preferences in children. The promises made by the project HABEAT

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VITAGORA®
TASTE-NUTRITION-HEALTH
NETWORK INNOVATION

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Editorial

The challenge of ageing well

This objective perfectly sums up the goal that we all have at heart: to age in the best possible manner. Ageing well is also the theme of the 7th edition of the Taste-Nutrition-Health International Congress that will be held in the spring of 2012 in Dijon and which the Burgundy Franche-Comté Inter-regional Gerontology cluster (*Pôle de Gérontologie Interrégional - PGI*) has to great pleasure of co-organising with Vitagora®.

The PGI is a cluster dedicated to improving the quality of life of seniors, and our activities are oriented around two strategic lines: developing research and knowledge transfer and coordinating the network of those active in the field of gerontology. Already, several large-scale projects have been launched on cross-sector topics in relation to gerontology: home assistance, ergonomics, motor function... and nutrition. This last topic is one on which Vitagora® and its members, through various R&D projects such as Vitalim'Senior or Aupalesens, seek to better understand and anticipate the relatively little understood dietary needs of seniors.

A collaboration between players active in the area of ageing and nutrition has allowed us to launch Senior'Act, a project lead by the PGI in partnership with Vitagora®, CEPEIC, the Centre of Sciences for Taste and Food and Welience. To date, more than 20 companies have joined the action.

The aim of Senior'Act is to foster innovation within companies in order to help them to offer products or services that meet the demands and needs of seniors in the area of food and diet.

In March 2012, during the Taste-Nutrition-Health International Congress, a symposium will be organised as a part of this collective action. Here also, quite naturally, the PGI is closely involved at the side of Vitagora®. Indeed, it is only by joining forces, pooling our resources and capabilities, that we will truly be able to address the challenge of ageing well, a challenge that concerns every one of us.

Olivier Boyer
PGI Project director

Vanessa Bailly
PGI Projet Coordinator

Janny MT An SME that innovates

Created in May 2009, the company Janny MT, whose president is an agricultural engineer named Pierre Janny, offers two distinct products based on a revolutionary patented technology: equipment for storing fresh products in a controlled atmosphere, or another for airtight storage and transport. Benoît Janny, also an agricultural engineer and Managing Director, joined the company to boost the development of these two products both in terms of technology and marketing.

Today, classic cold store technologies allow us to store cherries, for example, for five to six days and apples for four to six months. However, thanks to the novel equipment developed by Pierre Janny, food producers in need of greater storage flexibility can now store cherries for up to 25 days and apples for 10 to 11 months. Janny MT's equipment can be used in several modules, each made up of a container and a patented lid using selectively permeable membranes. This equipment is thus able naturally to make use of controlled atmospheres within classic cold stores.

Benoît Janny does not hesitate to talk about "disruptive technology" in terms of the product developed by his father. *"We have democratised modified atmosphere for the whole of the agricultural sector"*, he declares, before adding, *"Technologies for modified atmosphere existed already in industry. But, up till now, they only concerned large capacity storage, in other words over 150 tonnes of fruit or vegetables. The equipment that we offer targets a different clientele, one that wishes to store food in volumes of one to 150 tonnes."* This technology offers vast storage possibilities in modified atmosphere, for fruit, vegetables, mushrooms and even flowers (tulips and roses). *"This is a product that iour ndustry has been demanding and that has been a real boost for some producers,"* he opines.

The modular equipment also offers producers a flexibility that allows them to face the inevitable peaks and troughs of productivity and to adapt their products to variable market prices where certain products, such as cherries or asparagus, can see their prices triple, or even be multiplied by more than ten in the case of fruits like blueberries.

AIRTIGHT STORAGE, A SECOND PROMISING MARKET

"We have observed that the same patented container lid without a membrane guaranteed a perfectly airtight palette case," indicates Benoît Janny. Thus, the company has targeted a second market of storage and transport solutions, an area that presents vast possibilities, especially for the food sector. *"We are offering a simpler and cleaner solution for products in brine during transport, such as olives or cherries. It is also a solution that can extend use-by dates for certain dairy products such as cheeses or yoghurts."* In this logistics industry, the modules allow the transport of materials or products safe from dust and temperature changes. It also offers an improvement in traceability.

For this company of 10 employees that manufactures and markets these two flagship products, there is still scope to gain a higher profile both in France and abroad. *"Our main goal is currently to find new commercial partners and export companies,"* indicates Benoît Janny, who reminds us that his company holds a patent in over 90 countries where it intends to develop licences or joint-ventures. Hence its membership to Vitagora®. *"We are particularly interested by the industry network of the cluster. The technological intelligence that Vitagora® offers to its members is also one of our interests,"* he explains. In addition, he does not exclude in the medium term working with other Vitagora® members, in particular research organisations, on the taste and nutritional properties of fruits and vegetables and other food products.

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3 PROJECTS ON THE SAME THEME: SENIORS

Older adults, along with children, are one of Vitagora®'s main areas of focus. The R&D project FLOUR+ is an excellent illustration. One of the first of Vitagora®'s accredited projects, FLOUR+ has targeted seniors in order to develop new bread products that meet their taste and nutrition needs. Since then, Vitagora® has collaborated on the launch of two other projects centred around the topics of seniors, VITALIM'SENIOR et AUPALESENS, and more recently is taking part in SENIOR'ACT, in partnership with the Burgundy Franche-Comté Inter-regional Gerontology cluster (*Pôle de Gérontologie Interrégional - PGI*).

"Older adults represent a consumer segment that is relatively little studied, especially where food and nutrition is concerned. This in even more the case considering that they are constantly changing: today's seniors are very different from the previous generation as will be those of the year 2050, at which time France's population of over 60's will be twice what it is today," explains Christophe Breuillet, Director of Vitagora®. It is from this observation that the project SENIOR'ACT was launched, whose goal is to assist 20 or so companies to innovate or adapt their offer of products or services the needs of seniors.

"Our goal is for food companies, especially those within the Vitagora® network, to gain a headstart in understanding the senior market segment, which has already been identified as a strong trend for the immediate future," declares Christophe Breuillet. He then reminds us that Vitagora® has recently organised a mission to the United States on the topic of seniors and preserving consumer health and wellness, and that Vitagora® is currently preparing it's 7th Taste-Nutrition-Health Congress on the theme of "The Challenge of Ageing Well". *"Our aim is to continue to cement our strategic focus on wellness, but drawing attention to seniors. It is a subject, along with children's food, in which we have long been active,"* he concludes.

AUPALESENS : IMPROVING ELDERLY NUTRITION

In line with government health objectives to prevent, diagnose and limit elderly malnutrition, the Vitagora®-accredited research project, AUPALESENS, aims to better understand the various changes that take place during the process of ageing, in particular those that can lead to the first signs of malnutrition. *"We are not dissociating the sensory and nutrition, not to mention psychosocial aspects, and this is the originality of the project,"* explains Virginie Vam Wymelbeke, a doctor of elderly nutrition at the Champamillot geriatric centre in Dijon.

During its first phase, the project has carried out a study of around 600 people in four towns – Angers, Brest, Dijon and Nantes. This study ended in June 2011. The seniors that took part in the study were classified according to their level of autonomy. *"Under 65s were the main target of the study, whatever their living conditions, either at home or institutionalised,"* she explains. *"The aim was to observe any possible specific factors in the lifestyles of this heterogeneous population that could lead to nutritional difficulties."*

The analysis of the first questionnaires is already indicating very encouraging results for the nine partners of AUPALESENS, who are already working on phase 2 and 3 of the project. Here, the goal is to improve food intake of seniors, either by optimising the food products themselves, or by allowing each senior to reappropriate his or her meal. *"We are already working with companies in order to develop prototypes of dishes able to meet the needs of this population,"* concludes Virginie Van Wymelbeke.

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SENIOR'ACT: ADAPTING COMPANIES' OFFERS TO THE NEEDS OF SENIOR

Lead by the Burgundy Franche-Comté Inter-regional Gerontology cluster (PGI), in partnership with Vitagora® and other regional organisations, SENIOR'ACT is a collective action that aims to improve our understanding of the food environment of seniors and their consumption behaviour in order to incite companies to develop and market products that better meet the needs of this population. *"It is an opportunity for companies who wish to gain access to markets that present significant interest but for which they do not necessarily know all the expectations and needs,"* indicates Claire van Overstraeten, Vitagora®'s project manager.

More than 20 companies are now partners in this project, which also involves Dijon's Centre for the Sciences of Taste and Food, Welience and CEPIEC, the regional packaging industry association. Three quarters of these companies are from the food processing sector, while the remaining quarter is from the packaging industry. *"We are convinced that the packaging and ease-of-use of a product, especially when being consumed, is very important for seniors,"* Claire van Overstraeten.

During the 16 months of the project, there will be regular scientific and technological intelligence bulletins on culinary practices, packaging and kitchen utensils. In parallel, innovation workshops and training sessions will be held, involving experts in design and marketing. *"Our ultimate aim is to help individual or collaborative projects to emerge,"* she concludes.

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VITALIM'SENIOR: FUNCTIONAL FOODS FOR SENIORS

The Vitagora®-accredited R&D project VITALIM'SENIOR is lead by the company Senoble and also involves the INSERM Lipids, Nutrition, Cancer research unit in Dijon and the SME Lara Spiral. Its objective is to develop food products (either dairy-based desserts or drinks) with health claims as regards the prevention or treatment of weight gain in seniors.

This project is organised in two stages. The first concerns a family of active ingredients that could allow the elimination of body fat that accumulates in adipose tissue. The second aims to determine if maintaining anti-oxidant activity, which slows down with ageing, can prevent weight gain in individuals from the target population.

During the second semester of 2008, the project's first studies were launched, lead by the "Lipid-transfer proteins and lipo-protein metabolism" research team, directed by Laurent Lagrost within Dijon's INSERM research unit, and carried out on mice. The one or several prototype products, developed during the second phase, should soon be studied in a clinical trial. The final phase of the project will involve the market launch of one or more of these functional food products

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Merck Médication Familiale interested by "active seniors"

Made up of billions of microorganisms that belong to more than 1000 different species, gut flora, also called intestinal microbiota, varies greatly in composition from one individual to another, even if they generally contain the same overall types of microorganisms. Appearing from birth, gut flora remains fairly stable during a person's life. However, with age and a less diversified diet gut flora can diminish or modify, creating an unbalance that can lead to lowered immunity and a weaker absorption of nutrients. *"Bion 3 senior — launched by Merck in 2002 and which associates three probiotics, vitamins and antioxidant components such as lutein, ginseng and blueberry — contributes to improving the natural defences of seniors,"* indicates Stéphanie Courau, Scientific and Clinical Manager of Merck Médication Familiale.

Today, Bion 3 is well established on the market of so-called "active seniors", a segment that is of particular interest to Merck Médication Familiale. *"In this context, we are working with Vitagora® on defining active seniors, which is not necessarily to say that they are in good health. However, this group is different from institutionalised seniors or those suffering from malnutrition, whose needs are better served by medical nutrition,"* she explains. Of course, this is a market that should only expand as the population of active seniors grows with increasing life expectancies.

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Fromagerie Milleret seeks to better understand seniors

"We can easily ascertain from published statistics that the proportion of seniors is growing. Additionally, it is a group that devotes a large part of its purchasing power to food. There is therefore a large potential that our company is interested in exploring," explains Catherine Baudier, Marketing Manager of Fromagerie Milleret. It is for this reason that the company is involved in SENIOR'ACT, the project lead by the Burgundy Franche-Comté Inter-regional Gerontology cluster (*Pôle de Gérontologie Interrégional - PGI*) in partnership with Vitagora®, and whose objective is to assist companies over a period of 16 months with the development and marketing of products that meet the demands of seniors. *"This segment are already consumers of our cheese products. That said, within the segment of seniors, there are certainly specific needs to be met that we need to define,"* she continues.

By taking part in SENIOR'ACT, Fromagerie Milleret aims to learn more about the needs of this population before launching the development of its own products. *"The first workshop allowed us to see that this type of approach should not only concern food manufacturers but retailers too, as adapting our offer should involve the product itself but also how it can be accessed on supermarket shelves,"* declares Catherine Baudier. The developments of SENIOR'ACT are indeed oriented towards seniors whose level of autonomy allows them direct acess to shopping options, hence the need to raise awareness in retailers. *"If the demand exists, it is essential to try to meet the demand with products that are adapted to this population but do not generate in seniors a feeling of exclusion. It's a difficult balancing act,"* she concludes.

Senior nutrition: much still to discover

As a student, she was interested by the human body without really wanting to study medicine, so on beginning her tertiary studies Virginie Wan Wymelbeke opted for a cursus in biochemistry with a major in nutrition. Her studies at the University of Villeneuve d'Ascq lead her to carry out a doctoral thesis at the University of Burgundy on "The role of glucose on the control of food intake in humans". By chance, this research carried out on young populations lead her to be interested in seniors, once her doctorate wascompleted and she began working at the Centre for the Sciences of Taste and Food in Dijon. Today, she is involved in three Vitagora®-accredited projects, including AUPALESENS for which she is the coordinator.

"I wanted to be a scientist. But if I had been been oriented towards elderly nutrition at the time of my doctoral studies, I'm not sure I would have accepted," recognises Virginie Van Wymelbeke. However, after several years of working within the Centre for the Sciences of Taste in Dijon, this young researcher joined forces with the late Pr. Pierre Pifitzenmeyer, who was at the time Head of Geriatrics at the Dijon University Hospital and president of the Gerontology association.

FROM AUPALESENS TO SENIOR'ACT: THE SAME OBJECTIVE

Virginie Van Wymelbeke reminds us that elderly malnutrition is not always considered as a pathology, hence a certain tendency to dismiss it as a serious subject. That said, with the support of statistics, a level of awareness is starting to emerge concerning the urgent need to look closely at the nutritional state of seniors and to reflect, in partnership with industry, on solutions that could be developed. Since its creation, Vitagora® has launched a project, FLOUR+ whose goal is to develop new bread products adapted to the tastes and nutritional needs of specific groups such as the elderly. *"We worked on this project. Last March, we launched a study of the new product in a hospital setting,"* she indicates. According to the results of this and previous studies, the first "senior bread" should be launched in the next few years.

In parallel, Virginie Van Wymelbeke coordinates AUPALESENS, another Vitagora® accredited project whose objective is to better understand the changes that take place during ageing that can lead to the first signs of malnutrition. This project is unique in that it associates the nutritional, sensory, social and psychological aspects of food and diet, too often studied in isolation. *"The first three stages of the project are underway. The first, a survey of 600 seniors, ended last June. We have begun to analyse the data, which has already suggested interesting results,"* she resumes.

AN AREA THAT IS STARTING TO DEVELOP

This Dijon-based expert in nutrition is also involved in SENIOR'ACT, the market-oriented collective action involving Vitagora®. If the nutritional state of the elderly was the main motivation for AUPALESENS and SENIOR'ACT, the latter is more focused on helping companies to develop, in the short to medium term, new products adapted to seniors' needs. *"In this context, we are carrying out an observational study of seniors over 60 living at home,"* she explains, before adding, *"There is a lot still to discover in this area and we are all delighted to see that it is is really starting to develop, especially with the added boost from cluster organisations such as Vitagora®."*

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2012 TASTE-NUTRITION-HEALTH CONGRESS

"Ageing well" as an extention to "Wellness"

The 7th edition of the Taste-Nutrition-Health International Congress, organised by Vitagora®, will be held on March 20th and 21st, 2012. This will be the opportunity for Vitagora® to reaffirm its interest in wellness, but with a specific focus on seniors. Which gives us the theme for the 2012 Congress: "The challenge of ageing well". This latest edition of the Congress has a new president in Valérie Vuillemot, Vice-president of Marketing of Seb. Under the vigilant eye of the scientific committee, lead by Lionel Brétillon of the Centre for Sciences of Taste and Food, the 2012 congress will raise the issues of age-related pathologies, but especially from the angle of prevention.

"We chose this theme for the Congress taking into account the demographic changes of developed countries that are predicted for the next few decades. Indeed, for the population of France in 2050, compared to the year 2000, the number of over 65s will have doubled, and over 75s will have tripled. Finally, the number of over 85s will be multiplied by five. There is a real need for the medical, scientific and industrial sectors to open discussions on what this demographic "shock" really means for society and heath," explains Lionel Bretillon. Taking over from Luc Pénicaud as president of the scientific committee of the Taste-Nutrition-Health Congress, Lionel Bretillon is a researcher and leader of the "Eye, nutrition and cell signalling" research team within the Centre for Sciences of Taste and Food in Dijon, and who believes that, in addition to treatment options, early prevention is essential for ensuring that ageing happens in the best possible conditions.

This Congress, as each year, will attract scientists, academics, health professionals and industry representatives, including one third from outside of France. The scientific programme will be built around four themes that will provide topics for conferences and round table debates. Of course, in line with Dijon's major research areas, the topic of ageing and loss of sensory functions is a must. *"A second topic will look into the relationship between genes and nutrients, in particular concerning the role played by lipids and proteins, a subject where there is a large amount of data already available. This is the relatively new discipline that we call nutrigenomics,"* explains Lionel Brétillon. Probiotics will also make an appearance, which also has a link to strong local capabilities, in particular within Merck Médication Familiale. Finally, this latest edition of the Congress will be a forum for discussing aspects of socio-economics in relation to food and health in order to understand, for example, how our perception of our relationship food and health can change with age, in particular following the appearance of any pathologies.

AGEING WELL: MORE THAN A CONCEPT, A REALITY

"Ageing well" interests more and more research teams and companies in France and elsewhere in the world. However, Lionel Brétillon assures us that the 2012 Congress will not be "just one more conference" on this theme. *"What is unique about the Congress, being coherent with the preoccupations of Vitagora® and its members, is that it bring the sensory to the forefront. This aspect is indeed very important for older adults and the elderly for whom loss of taste or smell, or even visual capacity, is a major concern,"* continues Lionel Bretillon. This interest is borne out by the growing involvement of Vitagora®'s member companies in innovative research projects such as AUPALESENS, VITALIM'SENIOR and, more recently, SENIOR'ACT.

"Lifestyles, likes and dislikes evolve with age. We do not cook in the same fashion at the age of 35, when our children are young and our professional activity takes up a lot of your time, compared to the age of 65 when we are often retired and can have more free time," observes Valérie Vuillemot, the new President of the Vitagora® Congress. These notions, and the expectations of wellness from consumers, have indeed begun to be taken into account in the research strategies of companies such as Seb, the multinational of which Valérie Vuillemot is the Vice-President of Marketing. This strategy of Seb is an extension of a major strategy for the company of "eating well in order to preserve one's health", an approach that has been baptised "Nutritious-Delicious". *"For us, it was a question of developing kitchen solutions, in the form of appliances or associated services, that allow consumers to reconcile taste (which is the determining factor), health (in other words the nutritional qualities of ingredients), ease of use and safety, but integrating the reduction in cognitive capacity that goes with ageing,"* she explains.

The 2012 edition of the Vitagora®'s Taste-Nutrition-Health Congress is already shaping up to be a winning vintage, in particular in so much as its theme concerns not only to the scientific community but also to companies and, more generally to society as a whole. *"Preparing and consuming a meal inevitably generates social ties at various levels. Indeed, it is these ties that give meaning and can be a positive accompaniment to ageing,"* concludes Valérie Vuillemot.

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Dominique Vuitton
An atypical career path

Many would be satisfied with the profession of surgeon specialised in hepato-gastroenterology, and with being one of the world's foremost experts in human alveolar echinococcosis, a disease that is often found in the French region of Franche-Comté, but also in China. However, Dominique Angèle Vuitton, professor emeritus in clinical immunology, is not the sort of person to set herself on an unswerving career trajectory, however successful she may be at it! Hence her 'atypical' career that has lead her to the area of allergies, in particular within the European research project PASTURE (1), stopping on the way with food safety via her involvement in the Health and Consumers department of the European Commission. All this expertise was more than enough to interest the Vitagora® cluster and in short work to involve Pr Vuitton in its programmes.

Even though her career development is unusual, a common thread is all the same discernable: her passion for research. It was thus quite natural for this female surgeon (from an era when women in this profession were still few and far between) to undertake projects in addition to her surgical activities, including a thesis on immunology that looked mainly into hepatic diseases, in particular human alveolar echinococcosis. *"Surgery introduced me to this rare disease, which is a zoonosis caused by an Echinococcus tapeworm that is mainly transmitted by dogs. Indeed, besides surgery, there were no treatments for this pathology whose main occurrences in Europe are in the French region of Franche-Comté,"* she explains. Through the development of an experimental model, epidemiological studies and development of new treatments, Dominique A. Vuitton has become one of the world's foremost experts in this disease. Besançon is also home to only World Health Organisation reference centre on the disease.

FROM FOOD SAFETY TO ALLERGIES: A NATURAL PROGRESSION

"The research that I am following today, mainly in collaboration with China (a major centre for this disease) has lead me to become interested in other zoonoses and problems of human-animal contamination," she continues. From there, the jump to food safety was a natural step for Dominique A. Vuitton, precipitated by the era of serious listeria contaminations at the beginning of the 1990s and the media storm that hit raw milk cheeses. *"It is very important to reinject a little truth into the flow of unverified information that was being bandied about,"* she says. Around the year 2000, with the support of the Gruyère and Comté interprofessional committees, she began experimental studies on humans, among healthy subjects, in order to understand the potential influence of raw milk cheese microflora on human intestinal flora, in particular following antibiotic treatment. Taken up by the professor Xavier Bertrand of the Besançon university hospital and Eric Beuvier of the INRA-URTAL (2) research unit in Poligny, this research become the Vitagora®-accredited project FROMSANTE, whose results were published in 2010.

This experience brought her back in contact with the traditional farm environment of her Franche-Comté childhood, which lead this specialist in clinical immunology to take another career turn. *"Erika von Mutius, a researcher at the university of Munich was the first to put forward the hypothesis that exposure from birth and during childhood in a rural environment could have a protective effect against allergies. This could explain why children with an urban lifestyle develop more and more allergies, in particular asthma,"* she resumes. Corroborating observations from epidemiological studies confirming this hypothesis, the European research project PASTURE was thus launched around the year 2000, a project that followed a cohort of 1000 children in five countries. Dominique A. Vuitton and the professor Jean-Charles Dalphin of the Besançon university hospital where the French coordinators. *"The aim was to confirm the protective role of a rural environment, in particular farms where animals were raised, against allergies and asthma,"* she explains.

This European project included a cohort of 200 children from Franche-Comté followed for seven years and has already confirmed the existence of protective factors, of which some have been identified. These are microorganisms found in animal housing. *"We estimate that the diet consumed by these children, but also specific odours from farms, likely play an important role. We have enormous amounts of data that we have yet to analyse. But it is an extremely promising area of study,"* she concludes.

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Sensors and food: a necessary synergy

Between Marcel Bouvet and sensors, there is already a lot of history. This began within the prestigious *Ecole Supérieur de Physique et de Chimie de la Ville de Paris* (ESPCI ParisTech) and continued at the Pierre and Marie Curie University also in Paris. More recently, he has joined the Institute of Molecular Chemistry of the University of Burgundy (ICMUB), where he leads the "Electrochemistry, Molecular Materials and Apparatus" research team. He is principally involved in research in the area of gas and chemical sensors, in particular ozone and ammonia with applications in environmental pollution. However, his recent arrival in Burgundy also corresponds to a new line of research with specific applications for the food sector.

At ESPCI, a "veritable temple to innovation" of the academic sector, Marcel Bouvet began his study of the fundamental electronic properties of certain molecules. *"At the time, we were one of the first teams in the world to design organic field effect transistors,"* he reminds us. As a chemist by training, he was initially involved in the synthesis of these molecules. This was very basic research that eventually lead to proof that it was possible to design electronic apparatus from these molecules. *"At the time of this research, we discovered quite by accident that ozone was disrupting one of our experiments. This lead us to carry out the first developments of ozone sensors,"* he explains. In two or three years, a first model was developed and tested by AIRPARIF, the network for air quality testing for the Ile-de-France region.

Subsequently, Marcel Bouvet continued his research at the Pierre and Marie Curie University, still focused on the development of ozone sensors, but also on other molecules and different systems. Once accorded a professorship at the University of Burgundy, he joined the Institute of Molecular Chemistry of the University of Burgundy (ICMUB) in 2008 where he directs a team of around 25 people, including a dozen permanent staff, working mainly but not exclusively on the development of ozone sensors. The detection of odours represents one of the promising activites of this team who began by studying ammonia, a molecule often found in landfills, but also sectors of animal farming and fertilisers. *"It is more or less the same technology as what we used for ozone. But we also use specific odour-recognising proteins that come from rats,"* he sums up.

The aim is to eventually develop applications mainly in the area of environmental pollution. But Marcel Bouvet also intends to put the expertise of his team at the disposal of the food industry. *"It is a sector that we have not yet worked with. But during meetings with Vitagora®, I learned that there are opportunities for collaborations with academic and industry players for whom we could offer solutions to certain industry problems,"* he indicates. What's more, unlike working in the French capital where researchers tend to be lost in the crowd, here in the region of Burgundy, individuals are more accessible. *"All the more so thanks to a climate of free discussion where Vitagora® openly plays its role of catalyst and coordinator. Without Vitagora®, we would never have met Absciss, an SME with whom we are collaborating on a particular sensor application, with a doctoral thesis that began in October,"* he explains.

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The project PIANO: the mysteries of Nitric Oxide

Next August, the final report of the project PIANO will be submitted. Accredited by Vitagora® and funded by the national research funding agency (*Agence Nationale de la Recherche - ANR*), this project aims to understand the molecular mechanisms whereby nitric oxide (NO) produced by plants guides cells towards appropriate responses. This goal has been largely attained by PIANO and have resulted in several major scientific advances, in particular the identification, in a physiological context, of proteins directely regulated by NO. Today, an explanation is still needed for how NO modulates the activity of certain proteins and to understand the impact of these modifications when a plant is attacked by a pathogen. These questions should be the object of a new project currently being prepared by the Dijon-based team of Professor David Wendehenne, PIANO's coordinator.

"This project has been a great adventure, and Vitagora® has been a very positive influence. This was our first project with the cluster and it has been a success", declares David Vwendehenne, director of the "Cellular and molecular signalling in defense reactions" research team within the Plant-Microbe-Environment Research Unit (INRA/CNRS/University of Burgundy) in Dijon. After running for three years, PIANO came to an end last May and has indeed resulted in important scientific advances concerning NO. The scientists involved were thus able to observe that when a plant is infected by a microorganism NO starts a specific process by which the plant reduces the amount of iron available to the pathogen. This retention of iron during interactions with microorganisms was a surprise discovery for David Wendehenne and his collaborators.

DISCOVERY OF PROTEINS REGULATED BY NO

PIANO has also resulted in the identification of genes that are directly regulated by NO in a context of iron deficiency. *"One of these genes, which codes a protein with an iron-transporter role for the plant, is positively regulated by NO. By regulating the gene in this way, NO allows the plant to better adapt itself to iron deficiency,"* he explains. But for David Wendehenne, the greatest discovery of PIANO is without a doubt the identification of proteins regulated by NO, a discovery that has allowed a better understanding of this substance and to discover some of its fonctions that no-one had suspected before now. *"The interest of these proteins is all the greater for the fact that they are associated with a primary metabolism, but also with the degradation of misfolded proteins,"* David Wendehenne explains.

The researchers are also now interested in being able to explain how NO modulates the activity of these proteins and to understand the impact of these modifications during an attack by a pathogen. *"These are important questions that we are just starting to work on, in particular with professor Hernan Francisco Terenzi who directs a laboratory specialised in the study of protein structures at the University of Sao Paolo in Brazil,"* he continues. It is in this context that an idea emerged for developing a new project aiming to study the impact of the protein structure on the physiological incidence of this response mechanism to biotic and abiotic stress. This project should involve several of PIANO's partners such as professor Alain Puppo, leader of the Legume-Rhizobium Symbiosis research team for INRA in Sophia Antipolis, and Emmanuel Baudouin, of the Cellular and Molecular Plant Physiology team at the University of Pierre and Marie Curie in Paris. *"We would also like other longtime collaborators, the laboratory of professor Hernan Francisco Terenzi and a Polish team from the Institute of Biochemistry and Biophysics in Warsaw, to join us in this next adventure,"* he indicates.

This new project could be launched as early as mid 2012, with an ANR funding submission and Vitagora® accreditation. Indeed, the end of PIANO has generated a good deal of excitement and has already lead to more than a dozen scientific publications. *"Of course, the results of the project speak for themselves, but the conference that we organised in Dijon three years ago, with the support of Vitagora®, on the subject of PIANO allowed us more international visibility,"* he claims. Let's hope for more of the same with the next project!

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SENSINMOUTH
A successful industry-research partnership

Launched at the end of 2007, the project SENSINMOUTH has just come to an end. This is a Vitagora® accredited project with national research funding, directed by Elisabeth Guichard, co-leader with Christian Salles of the "Molecular interactions, in-mouth food break down and flavour perception" research team within the Centre for Sciences of Taste and Food (CSGA) in Dijon. Its aim is to better understanding and to model the dynamic of solute release responsible for stimuli during food mastication by humans. Besides the Dijon-based research centre, this project involved three other research teams(1) and two companies, Soredab and Fromageries Bel.

"Generally speaking, this type of study is carried out on a dozen or so subjects but never on over one hundred subjects such as we have done for SENSINMOUTH," explains Elisabeth Guichard. She goes on to explain that this project that she coordinates is a positive example of a strong industry-research partnership. *"The companies were very involved by creating customised products with the specific characteristics necessary for our study,"* she adds. Soredab and Fromageries Bel were thus tasked with making products with varying compositions and textures, but always with the same concentration of the odour molecules chosen to be incorporated in the six recipes, in this case ethyl propionate and 2-nonanone.

DEVELOPMENT OF NEW METHODOLOGIES

For each of the 101 subjects of the study, the researchers put together a sort of 'profile' measuring their salivary flow at rest and after stimulation, breathing rate, masticatory efficiency and the manner of releasing aromas in the mouth during the mastication of cheese. The statistical analysis of this data allowed the researchers to select 50 subjects with standard values for each of the measured parameters, *"a group that remains representative of the overall group,"* explains Elisabeth Guichard. This reduced group then took part in the next phase of the project for which a number of new methodologies had to be developed.

First, it was necessary to develop a means of following the release of the two odour molecules in the subjects' nasal cavity during mastication. Optical sensors were used to observe the mandibular movements of the subjects. The researchers were also able to measure mouth-coating, meaning how the product spread out in the mouth, thanks to the use of fluorescent markers. In addition, swallowing was recorded using a piezoelectric transducer placed at the cricoid cartilage. Finally, with the help of the Laboratory of Rheology in Grenoble, they were albe to develop solutions for measuring the rheology of the food bolus.

Using data from previous studies, researchers in the GMPA laboratory were able to build models that they then refined using the experimental data from the 50 subjects of SENSINMOUTH, in order to explain and then predict aroma release. *"This back-and-forth allowed them to target what appeared to be the most important parameters in aroma release,"* indicates Elisabeth Guichard. The researchers also used the 'Artificial Mouth' that the CSGA developed in collaboration with the Le Creusot Technology Platform. Thanks to this masticating simulator that can be attached to a variety of equipment such as a mass spectrometer, the researchers were able to follow in real time the release of a number of aromatic components during the breakdown of the food in conditions simulating real mouth processes.

FIRST RESULTS SHOWING INTERESTING TRENDS

Today, the processing and interpretation of the large amount of data collected for SENSINMOUTH is coming to an end with the publication of two doctoral theses. *"Already, a few trends are emerging. The firmer the cheese, the more odour molecules are released thanks to a higher level of masticatory activity. Large differences are also observed between individuals, which could be explained by physiological differences. We thus observed that some parameters, which we did not necessarily prioritise at the beginning, have turned out to be very important. I'm thinking in particular of saliva, whose composition varies from one person to another and can play a major role in the dilution of the food bolus,"* concludes Elisabeth Guichard.

(1) - UMR "Génie et Microbiologie des Procédés Alimentaires" (INRA-AgroParisTech), Thiverval-Grignon
- "Déficiences, incapacités et désavantages en santé orale" (Université d'Auvergne), Clermont-Ferrand
- Laboratoire de Rhéologie (CNRS/Université de Grenoble

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Project

FORMATION OF FOOD PREFERENCES IN CHILDREN
The promises made by the project HABEAT

The first European project accredited by Vitagora®, HABEAT aims to improve understanding of the key periods and mechanisms involved in the formation of food preferences in children, from birth to two years of age. Two meetings of the 11 project partners, including the Centre for the Science of Taste and Food (*Centre des Sciences du Goût et de l'Alimentation - CSGA*) in Dijon, have already taken place to follow the studies already underway since the project launch in January 2010. Sylvie Issanchou, INRA research director and project coordinator, tells us about this ambitious project.

"HABEAT is a large-scale project that involves 10 European scientific teams in a number of areas. A third of these teams are focused on epidemiology, the other two thirds carry out the experiments," explains Sylvie Issanchou. For the epidemiology aspect of the project, researchers have already carried out a literature review and have established that there are already a number of questionnaires concerning the food behaviour of young children and the parental practices or attitudes that can influence them. A few weak spots have been identified especially concerning parents' attention to hunger and satiety signals. *"We are preparing a specific questionnaire that will address this problem,"* Sylvie Issanchou indicates. Another area that requires further work is a tool for evaluating the food preferences of children, but through a questionnaire that attempts to cover various sensory characteristics of food.

In parallel, existing data from cohorts of children from four European countries have been the subject of a first series of analyses. The aim is to observe the effects of various factors such as the length of time the child is breastfed, the age of introduction of foods other than milk into the child's diet (known as 'dietary diversification'), the age of introduction of fruit and vegetables, and the effects of the mother's education level on the consumption of fruit and vegetables at the ages of two, three or four years. *"The effects of these various factors are not significant for all the cohorts and it seems that they become less important with time. This could be linked to the fact that breastfeeding, the ages of diversification and the levels of fruit and vegetable consumption vary greatly from one country to another. However, when breastfeeding has an effect, it is always positive: the longer the child is breastfed, the more fruit and vegetables they consume. When the education level of the mother has an identifiable impact, we observe that the higher the mother's education level, the more fruit and vegetables her children consume,"* observes Sylvie Issanchou. New analyses are underway to better understand the origin of the observed differences between the countries in question.

ARTICHOKE AND SALSIFY ON THE CHILDREN'S MENU

For the experimental side, two studies have been launched, with one in Dijon and two parallel studies in England and Denmark. *"Here in Dijon, we are in charge of the youngest group of children, from the beginning of diversification, while the English and Danish teams are focusing on children between the age of 1 and 3 years,"* she explains. For each of these two studies, it has been necessary to choose a target vegetable, that is little eaten by children in the three countries, not necessarily greatly liked but neither completely rejected. In the end, artichoke and salsify were chosen. The three groups of children will have eaten artichoke at home, each in the form of a different recipe: a simple preparation for the first group, with a little added sugar in the second and with a little oil for the third. *"As the children are in a learning phase, we hope that the positive component, here sugar or oil, will be transferred to the aroma and the taste of the vegetable,"* she explains.

Another study has been set up in Dijon for about 70 children from six crèches, aged 2 to 3 years, who have consumed salsify, once again within three recipes: simple, with added salt and, finally, with a little nutmeg. The researchers estimate that the nutmeg could indeed compensate for a lower level of salt and still be appreciated. *"These experiments represent a lot of work that we have been able to carry out thanks to the cooperation of Dijon's municipal infant services. Each day, we have to go to each of the crèches, distribute the food, weigh what is served and what is left over, since acceptability is evaluated by how much is consumed, as children are too small to give their opinion,"* Sylvie Issanchou reminds us. And for each of these tasks, mountains of data are collected and need to be analysed. Finally, another study is underway, concerning the children of four Dijon schools. The aim is to observe how children regulate their food intake, either when they are given something to eat before the meal, or when attractive products are arranged within reach after the meal.

All in all, a remarkable project for which many look forward to some promising results.

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REGISTER NOW FOR THE 7TH TASTE-NUTRITION-HEALTH CONGRESS

Registrations are open for the 7th Taste-Nutrition-Health Congress organised by Vitagora®, on March 20th and 21st, 2012. Go to the website

WWW.TASTE-NUTRITION-HEALTH.COM

to find out more about the 2012 Congress' theme - The challenge of ageing well - and to register or download the full program.

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TWO SCIENTIFIC CONFERENCES, IN APRIL AND JULY 2012

The following scientific conferences will be organised in Burgundy in the months of April and July 2012.

- MATBIM, 22nd-25th April, 2012in Dijon - the 2nd International meeting on Material/Bioproduct Interactions.
  The second meeting will promote the latest findings in mass transfer mechanisms and interactions between packaging materials and food/bioproducts and the consequences on the consumer and environment safety.
  Website: www.matbim.com

- FOP 2012, 1st-5th July, 2012 in Beaune - the 2nd International Conference on Food Oral Processing - Physics, Physiology, and Psychology of Eating.
  Website: https://colloque4.inra.fr/fop

INTERNATIONAL MISSION TO SOUTH KOREA AND JAPAN IN JUNE 2012

Vitagora® will be leading a mission to South Korea and Japan in June 2012. The delegation will be composed of industry and research members of the Vitagora® network who will take part in meetings on the following mainthemes:

- Nutrition health
- Functional ingredients
- Fermented products

This mission will also be the opportunity to further contacts with Vitagora®'s local partners, theKyushu Bio Cluster Conference in Japan, and the Foodpolis cluster in South Korea.

To find out more, contact:
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