



The home straight for HabEat, Vitagora®'s first European project

Sylvie Issanchou

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IN THIS ISSUE

Sustainable food systems: Vitagora® brings together a vast and unique potential

Developing innovative agricultural systems that allow us to use only small quantities of chemicals is one of the major issues of today's agriculture. Hence the research programs that are currently being carried out that aim to reconcile ecology and agriculture in order to move towards more sustainable production methods. To get there, Vitagora®'s partners have at their disposal a number of unique trump cards, starting with GenoSol, a project recently granted funding by the French government. This platform is all at once a tool for the conservation of soils and their biodiversity, a technical platform for the standardisation of molecular tools and, finally, a data base for managing all the samples and data and for developing the first reference tool for soil biodiversity., a first of its kind. Another tool is the High Speed Phenotyping Platform (Plateforme de Phénotypage Haut Débit – PPHD) that the Agroecology joint research unit of the University of Burgundy, INRA, CNRS and AgroSup Dijon opened on July 6th 2012. The platform contains high-tech equipment unequalled in the world since it will allow researchers, with the help of video cameras using various wavelengths, to follow the development, both above and below ground, of plants placed in highly controlled, fluctuating environmental conditions and stresses.

However, sustainable food, although necessarily predicated on a base of sustainable agriculture, requires a vast range of capabilities and expertise, notably at the intersection of numerous scientific disciplines concerning the optimisation of industrial processes, or, at the other end of the chain, the knowledge of dietary behaviours and home cooking methods, that necessary

final step before the food reaches our plates. Food that we should be able to consume with enjoyment, safe in the knowledge that it can serve to maintain our health and wellness, while also corresponding to our tastes and preferences.

To support this vision that takes sustainable agriculture to its logical conclusion, the capabilities of the Vitagora® network are put to good use, of which a few examples are to be found in this issue of VitaNews International. Industry efficiency is to be improved via the projet Ecosec, which seeks to use humidity as a tool to control microorganisms and thus reduce the impact of cleaning techniques in industrial conditions. The research carried out by Vitagora® teams on fat metabolism and methods to counteract cognitive deficits linked to Alzheimer's may also soon find consumer applications that could offer solutions to large scale health problems that we face. And the children of HabEat contribute vital data to understanding how and why our food preferences develop.

Finally, the group SEB, always at the forefront of industry innovation, seeks to marry new technologies to human experience in the form of a powerful digital platform to support home cooking activities. Who knows, maybe the young children currently taking part in the HabEat programme will find it completely normal to log online with their new generation Actifry and find the latest recipe tailored to their specific tastes and nutritional needs. We can't wait to find out!

Pierre Guez
President of Vitagora®

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ECOSEC: a project contributing to sustainable food systems

Reduce the environmental impact of hygiene operations in food processing factories by an optimised use of dehumidified air: this is the main aim of the Vitagora®-accredited project, **Ecosec**. Benefitting from national research funding for the Sustainable Food Systems program, this project has a consortium of seven partners, including three companies. One of the partners, the PAM joint research unit (1), directed by **Patrick Gervais**, houses a number of scientists interested in the effects of environmental disturbances on the survival of microorganisms, whether pathogenic or beneficial to humans.

A microorganism grows in an environment that contains water and the necessary nutritional elements. If this environment becomes dry and hot, the microorganisms will naturally dehydrate. But, contrary to other living organisms, it will survive these extreme conditions, often over very long periods. "Over the years, PAM research unit has acquired a nationally renowned expertise in the area of the mechanisms used by microorganisms to survive in extreme environments," recalls Laurent Beney, associate professor within this unit. Hence the fact that PAM has accepted the request of ANSES (2), the French national agency of health, safety and environment, to become one of the seven partners of the project Ecosec, whose research program began at the beginning of 2013. Of course, collaborating with private companies is an established pattern for PAM's scientists. "We do indeed carry out basic research, but we are systematically alert to potential developments with industry applications," explains Laurent Beney.

THREE THESES, INCLUDING TWO FOR PAM

Today, if the temperature in food factories is well controlled, this is not necessarily the case for the relative air humidity. "By effectively controlling

humidity, we can potentially limit microorganism activity," underlines Laurent Beney, underlining the importance of the project Ecosec. This project is coordinated by Brigitte Carpentier of ANSES and involves three other French laboratories: the food safety unit of ANSES in Maisons-Alfort, the refrigerated process engineering unit of IRSTA (3) in Antony, and the Microbiology laboratory of INRA Theix. The program aims to reduce the environmental impact of hygiene operations in food processing factories, through the use of maximising air dehumidification. Over three years, with the help of equipment that can mimic the fluctuations in the relative air humidity and their own specialised reactors, the scientists at UMR PAM will be studying specific pathogenic bacteria, *Listeria monocytogenes*, in order to observe how it survives in various levels of ambient humidity. Three theses will be carried out for this project, one of which will be directed by PAM personnel, the second co-directed by INRA Theix's laboratory of microbiology. "Starting from basic scientific knowledge that we and our partners have acquired on a small scale, we will define specific conditions that could be generated on a larger scale in food-processing factories. This will be a boost for controlling dangerous bacteria," he explains. Among the project partners is naturally an equipment manufacturer who offers humidity control solutions, and a food manufacturer who can test these solutions in an industrial setting.

Of course, the results of Ecosec are all the more hotly awaited for being in line with the theme of sustainable food, which is strongly supported by Vitagora®. "By controlling the variable of humidity, manufacturers will be able to reduce the use of detergents that have always been necessary for cleaning surfaces in contact with food products," concludes Laurent Beney.

Contact
Laurent Beney
Email: lbene@u-bourgogne.fr

(1) Procédés Alimentaires et Microbiologiques - Food and microbiological processes (AgroSup Dijon/University of Burgundy)
(2) Agence nationale de sécurité sanitaire, de l'alimentation, de l'environnement et du travail
(3) Institut national de Recherche en Sciences et Technologies pour l'Environnement et l'Agriculture

Vectorisation of vitamin E in the brain: THE FIRST RESULTS OF LIPSTIC!



This January, *Neuropsychopharmacology*, the US journal that addresses fundamental and clinical research work at the crossroads of the fields of the brain, behaviour and therapies, published a paper called *Increased Amyloid- β Peptide-Induced Memory Deficits in Phospholipid Transfer Protein (PLTP) Gene Knockout Mice*. The findings of this remarkable research show that lipoproteins can nano-vectorise and release natural compounds such as vitamin E in the brain, thus enabling a passage through the brain blood barrier. The results were obtained during research conducted by the **Laboratory of Excellence (LabEx) LipSTIC (1)**. The Laboratory was set up under the *Investissements d'Avenir* program and brings together three French innovation clusters (Vitagora®, Eurobiomed and Medicen) and 23 research teams. The University of Burgundy and the University of Franche-Comté are also among the partners in the laboratory.

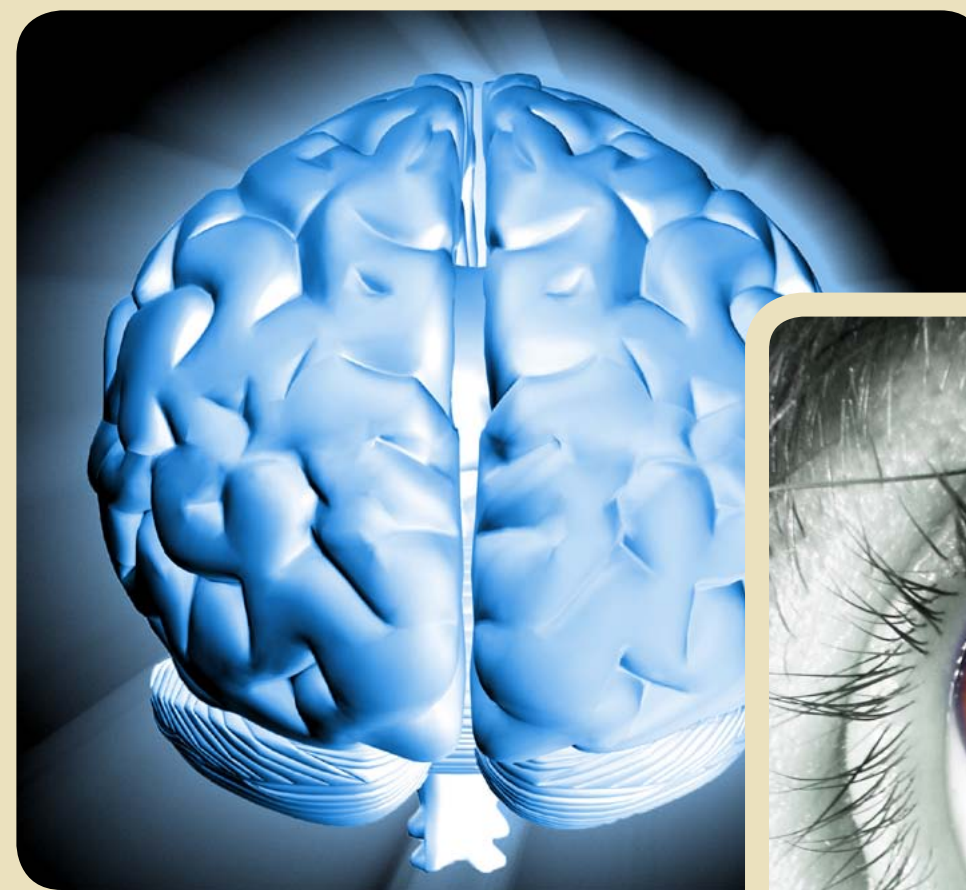
"Several years ago, Dijon's "Lipid, Nutrition, Cancer" joint Research Unit that I now direct demonstrated that the protein PLTP, coded by a gene, enabled a liposoluble antioxidant, for example, vitamin E, to enter the brain," recalls Laurent Lagrost. The researchers then observed that invalidating the gene coding for the protein caused a drop of roughly 35% in the amount of vitamin E in the brain. They also noted cognitive deficits, mainly in the so-called "PLTP-Knockout" mice. The researchers at LabEX LisSTIC then took the mouse model and tested it in the context of Alzheimer's Disease and the deposit of the Beta Amyloid peptide. The "Molecular Mechanisms in Neurodegenerative Dementia" Joint Research Unit in Montpellier, working with Amylgen, a Montpellier based company that develops models of neurodegenerative diseases in rodents - both also partners in the LlipSTIC laboratory -, injected a fragment of the peptide into the mouse model. "They managed to mimic certain symptoms of Alzheimer's disease," explains Laurent Lagrost. The scientists then observed an acceleration of the cognitive deficits in the mice and in particular a worsening of short term memory and an increase in oxidative stress, with increased deposits of the Beta Amyloid peptide. However, by giving the mice vitamin E supplements, they were able to counteract, at least partially, the observed cognitive deficits.

"Their collaborative work is outstanding, perfectly illustrating the strength of a LabEx such as LipSTIC,

where each partner provides its expertise to answer a relevant question in a satisfactory manner," Laurent Lagrost exclaims. Their findings are especially encouraging as vitamin E also plays a role in the retina. Research is thus ongoing regarding the retinal barrier, in collaboration with Lionel Bretillon who is joint head of the "Eye, Nutrition and Cell Signalling" team at the Dijon-based Centre for the Sciences

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of Taste and Food (CSGA). Aside from what researchers may eventually observe in the retina and how it works, LipSTIC results have already had repercussions, specifically with the "Epithelial Functions and Dysfunction team" at the University of Franche-Comté that is seeking to optimise how epithelial barriers work, or



to facilitate drug delivery, thus clearing the way for innovative therapeutic strategies.

Laurent Lagrost speaks of other research conducted with BioProtein Technologies, a company specialised in producing recombinant vaccines for therapeutic use in the milk of transgenic rabbits. Based in Jouy-en-Josas near Paris, it is also a partner of the LipSTIC consortium. "We are convinced that PLTP, like other proteins, could be an asset for therapies. This explains our idea of producing human PLTP in large amounts and using it as a therapeutic protein because of its capacity to make vitamin E enter organs," he summarises. A patent has already been filed in France and has recently been extended internationally. "All these collaborative ventures evidence strong coherence," he adds. He is particularly satisfied as the study, published in *Neuropsychopharmacology* this January, demonstrates a link between oxidative stress and neurodegenerative diseases, an idea that has been defended for several years by Michel Prost, the founder of Lara-Spiral, a Dijon based company and one of the first to join the Vitagora® cluster. "Until

now, most studies have shown that the development of Alzheimer's also sees an increase of oxidative stress in the brain. Our results now demonstrate that a lower vitamin E (an antioxidant) level in the brain leads to rise in the incidence and the progression of neurodegenerative diseases. The causal link is reversed," he concludes.

Contact
Laurent Lagrost
Email: laurent.lagrost@u-bourgogne.fr

[1] Created on January 1, 2007 and renewed for another five years in January 2007, UMR 866 Lipids, Nutrition & Health (LNC) joint research unit is the outcome of a determination to provide a backbone facility for the skills and expertise of several Dijon based research facilities. Today the team brings together more than 200 people broken down into nine teams, of which 4 are involved in cancer research and the 4 others are focused on lipid metabolism, nutrition and cardiovascular diseases. The ninth team mainly deals with clinical epidemiology, with a focus on cancer.

Open Food System: SEB dives into Digital Kitchens



Imagining and designing third generation cooking solutions. This is the aim of **Open Food System**. Accredited by six French clusters, including Vitagora®, this joint research program initiated and coordinated by SEB, involves 26 partners for a total of 150 collaborators, including 30 to 50 people within SEB's R&D division. With a budget of 21 million Euros, including national funding, Open Food System was officially launched at the end of 2012.

The Open Food System project will be given the green light exactly sixty years after the launch of the Supercocotte, the first French pressure cooker that made the SEB Group's reputation. In 1953, the appliance came onto the market with its own recipe book. *"The Cocotte-minute (steam pressure cooker) was essentially the outcome of very smart marketing, which explains its huge success that was not only due to the appliance itself but also to the recipe book, which has since become a reference book providing users and generations of cooks with a method for good healthy cooking everyday,"* explains Kevin Camphuis who heads SEB's Digital Workshop. Indeed, the approach combining hardware and software, the same approach that is now being rolled out by the Open Food System project, was already an instinct of the French industry operator half a century ago. Proof that the world leader of small appliances, whose adventure began in the heart of Burgundy, has always maintained an ability to innovate with the methods and tools of its time. It probably also explains why it was able, once again, to embark on a radical new path today.

A DIGITAL PLATFORM AT THE CENTRE OF THE PROJECT

"When your name is SEB and you're a kitchen expert whose products can be found in kitchens worldwide, you naturally begin to think about what our supply and our solutions will be 5 to 10 years from now. The solutions will have to involve the convergence of hardware and software," Kevin Camphuis said. Answering these questions is daily fare at the Digital Workshop that is tasked to support corporate marketing and research teams in their development of tomorrow's solutions that will incorporate digital technologies. This type of

focus-workshop is not new at SEB, there are actually two others focused on design and cooking aspects. However, the Digital Workshop that its manager defines as *"a virtual spin-off of SEB"* is somewhat of an exception as the dedicated team works on very new topics for the Group, such as mobile applications, smart appliances and web platforms.

...No fewer than 6 clusters and 26 partners are involved in the Open Food System project....



This was the background for the creation of the Open Food System, which has a special angle given its scope and topics. Indeed, no fewer than 26 teams backed by six clusters are involved *"so they can offer our users our appliances as well as a digital platform where they can find all the contents and services that will improve their kitchen every day,"* he sums up. This means bringing together the skills and expertise of many partners to design and develop the platform. Protocols, software function data formats and different Internet platforms, which can collect and analyse all the contents, will have to be designed. *"It is called an intelligent platform because it will understand the contents its hosts, especially recipes, but also the users using them. It will also be able to analyse information input by the connected appliances, to offer unique services that will make cooking easier,"* exclaimed Kevin Camphuis.

However, numerous challenges will have to be met upstream if the perfect marriage between hardware and software is to succeed. For instance, an oven that can understand what is happening during cooking on its own would have to be designed. This obviously involves knowing how to analyse data with relevant indicators and specific sensors. The software platform will have to be able to recognise, understand, analyse or even translate all types of contents. After crossing the data with the information from the appliances, it will have to offer users special customised services. This explains why SEB is marshalling its research and development teams. *"Open Food System will focus on defining platform tools. Only later will we provide testers as well as our partners with a toolbox that they can use to offer and develop the innovative tools and services for tomorrow's kitchen."* So, several prototype platforms called 'Lab Cook', enhanced with improvements as the projects advances, will be made available

to all the partners (i.e. companies, developers, startups, laboratories) who would like to develop and test their own tools or services. There is thus a double virtuous effect in the joint multidisciplinary research program as it brings together expert partners for the joint design of an unmatched digital platform and promotes partners' innovation, independent of the project.

WEDDING TECHNOLOGIES TO HUMAN SCIENCES

The most amazing feature of the 'technological' program is certainly the fact that more than half of the players come from the world of human sciences. Kevin Camphuis recalls that developing technologies is not enough; they must be 'human'. *"Partners will be able to provide a knowledge content and then use the platform to enhance their own understanding of human behaviours toward new technologies, thus clearing the way for user appropriation of the technologies,"* he explains. However, this is not really a new situation for SEB, a company that has long been working with specialists in these scientific fields. On the other hand, it will have to learn to dialogue with its partners that are specialists in software technologies or in Web users' behaviours. *"Our competitive world has exploded over the past ten years. Today, SEB has to deal with agribusiness companies that are adopting new approaches and startups that are developing new concepts, and companies in electronics and in Information and Communication Technologies (ICT)."* So, clearly the Open Food System project, probably the largest research program on kitchen and cooking to date, whose first results will be coming in 2013, is very important.

Contact
Kevin Camphuis
Email: kcamphuis@groupe-seb.com

(1) Agrimip Innovation, Aquimer, Cap Digital, Imaginove, Microtechniques, Vitagora®

The home straight for HabEat, Vitagora®'s first European project



Ongoing for the last four years, HabEat is now entering its final year. Funded by the 7th Framework program, the aim of this project is to improve understanding of the **key periods and mechanisms in the formation of dietary preferences in children**, from birth to the age of five years old. The first of its type to receive Vitagora® accreditation, HabEat involves 11 European partners, including three French structures. The project is coordinated by Sylvie Issanchou, an INRA research director and leader of the "Development and dynamic of food preferences and behaviours" team at the Centre for the Sciences of Taste and Food (CSGA) in Dijon. Here, she sums up the latest advances of the project.

"All our studies have confirmed that for a child to appreciate a vegetable, he must eat it often, and in a fairly basic form. The key to success is repetition," explains Sylvie Issanchou. A first conclusion on which parents of young children can meditate when they notice that a food is not to the taste of their child after three or four tries and thus decide to no longer offer the food. This is a behaviour to avoid that Andrea Maier, a doctoral student at the CSGA, had already observed a few years ago during surveys carried out for her thesis co-directed by Sylvie Issanchou and Benoist Schaal. This first result, one of a number already obtained or soon to be obtained from the various European teams taking part in HabEat, perfectly illustrates the importance of such a project: beyond collecting data and generating scientific knowledge, HabEat will lead to a number of recommendations destined for child care professionals, paediatricians and those in charge of public policy on nutrition, not to mention the food industry. "They are becoming more and more attentive to our research and our conclusions," underlines Sylvie Issanchou.

If HabEat is strongly oriented towards the appreciation of vegetables by young children, Dijon-based researchers are also interested in the manner in which children ages 3 to 5 regulate their food intake. Carried out during lunchtimes of a school cafeteria, a first protocol has consisted of giving these children a small chocolate brioche 30 minutes before their meal and observing if this intake is taken into account for by lowering their intake during the meal. In other words, if a child eats a snack before the meal, we expect him

to eat less during the meal. "Indeed, the children ate less. But, on average, they only reduced their main intake by half the calories represented by the chocolate brioche, thus eating more than they would have without the snack," indicates Sylvie Issanchou. This observation is especially surprising considering the scientific literature in this field and the Dijon-based researchers were indeed expecting a better compensation among the children studied, especially very young children.

... HabEat will lead to a number of recommendations destined for child care professionals, paediatricians and those in charge of public policy on nutrition, not to mention the food industry...

For the second protocol, called "Eating in the absence of hunger", children were allowed to choose what they wanted from a box full of chocolates, sweet and savoury cakes as well as strawberries and cherry tomatoes. Although some did not touch the box, and others ate a large amount, the average intake was the equivalent of 25% of the energy intake of their meal. However, they were supposed not to be hungry. "This research is especially interesting compared to other studies in scientific literature for the fact that we had a large number of children aged 3-5 years old at our disposal and, in parallel to the observations of the children, we asked parents to fill in questionnaires aiming to learn about their practices regarding the diet of their child," explains Sylvie Issanchou. They were thus able to see that for parents using food to regulate the emotions of their child or as a reward, the children ate more in the absence of hunger.

THE CHALLENGE OF TRANSPOSING TESTS FROM ONE COUNTRY TO ANOTHER

Some studies carried out within the HabEat project have lead to researchers developing tests intended to evaluate the dietary preferences of children as regards foods with specific sensory characteristics. One of these was developed in France and, if perfectly effective among cohorts of French children, proved difficult to transpose to the projects of other partner countries such as Portugal or Greece. "For a French child, a Camembert as a certain significance, but this is not necessarily the case for his Portuguese or Greek equivalent. We had to ask our colleagues in the two other countries to find equivalents,

which was not easy, or even impossible in case of cheeses," explains Sylvie Issanchou.

The wider range of food eaten in France means that it is indeed not easy to impose a standard test in all European countries. "This is why a cross-cultural approach is both important and an added difficulty. Our tools needed to undergo a number of adaptations," she reminds us.

Contact
Sylvie Issanchou
Email: sylvie.issanchou@dijon.inra.fr



EMAC : a benchmark for Vitagora® accredited projects



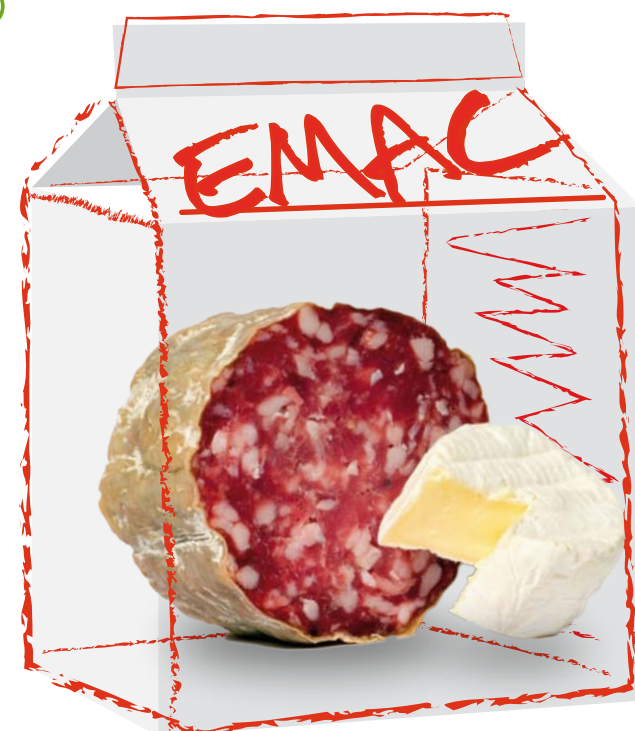
EMAC is fast approaching its conclusion. The final report is currently being written. Accredited by three French clusters, including Vitagora®, and lead by the Dijon-based SME, **Salaisons Sabatier**, this project has led to the development of several **active packaging solutions** containing various concentrations of active molecules. This packaging aims to better preserve the taste properties of dairy and cooked meat products for periods of up to 20 days. Already undergoing small scale testing, EMAC's prototypes will be finalized at the end of 2013 and will be on the market for 2014. A chance to look back over this project's history that makes it a benchmark for the type of projects lead by the Vitagora® team.

Every project often begins with an encounter. In the case of EMAC (from the French, EMBallages ACTifs – active packaging), it was when Gérard Mougin, the creator of AFT Plasturgie, a small business set up in Fontaine Les Dijon, met the team at the Vitagora® cluster. In a study that his business had just completed jointly with Welience, researchers observed that agro-sourced compounds from hemp incorporated into plastics had sorption and desorption properties. A series of tests where bactericides or aromas, which had previously been introduced into the plastics, were salted out, prompted the business to file a patent. The logical next step was to put together a project to use the active plastics and increase the shelf life of some foodstuffs. They took the step eagerly as the Lactalis Group had just put its flavour-preserving bell jar for Président camembert on the market, with its micro-aerated permeable membrane that solved odour issues while ensuring the quality of the product for a given time. Indeed, this was the first attempt at active packaging.

With AFT Plasturgie, Welience and Lactalis, the basic ingredients for project building were gradually coming together around the idea of designing active packaging for the food-processing industry. However, an actual project still had to be constructed around the idea, and with a solid grounding in terms of R&D and financing. For the project to work, its initiators, especially Vitagora®, had to together organisations that were not used to collaborating. «All these players had to be united and some had to be convinced of the expediency of participating in the project,» said Agathe

Penant, the engineer in charge of projects at the Vitagora® cluster. One of the roles of Vitagora® was to get competing small businesses such as Chazal and Salaisons Sabatier to work together for the project and work with a large industrial group such as Lactalis from different industry sectors, and with plastic processing small businesses and research laboratories. «Most of them had never been involved in a collaborative project. So, we had to provide them with support for this approach, an especially important move as EMAC was one of Vitagora®'s first projects to receive funding from the FUI (French government agency funding industrial R&D projects),» she explains.

“... We are involved in the project every step of the way, with support to project setup, partner and financing search, and development of the projects and its outcomes with financiers...”



A VERY SATISFYING PROJECT

In the end, putting together and launching a project such as EMAC is somewhat like offering a handful of people, admittedly with solid skills but from different fields and environments, to get aboard a sail boat in order to meet the challenge of a race. Indeed, the Vitagora® team took on the challenge to steer the boat into a safe harbor by accompanying the crew during the entire crossing. The work was carried out in the wings, so obviously it never made the front page of the media. However, without it, the project would never have succeeded or even got off the ground, according to the participants. “We did not take part in the R&D side. They are the ones with the required skills and know-how. On the other hand, we are involved in the project every step of the way, with support to project setup, partner and financing search, and development of the projects and its outcomes with financiers,” remarks Agathe Penant. The long-term project ended successfully with scientific and technological results that can only encourage EMAC participants to continue the adventure, perhaps as another collaborative venture, who knows?

Three prototype active packagings have already been tested at Welience. Various foodstuffs in a number of types of active packaging, produced on a small scale, were also tested by the personnel of Lactalis, Chazal and Salaisons Sabatier. They examined everything from the outside aspect of the product before and after opening, to taste and texture in the mouth. Others tests still have to be done and the packaging has to receive final approval in terms of industrial production and price so that active packaging of this type can be on the market in 2014. “It is a very satisfying conclusion for a project like EMAC when the initial objectives are met,” reflects Agathe Penant. That said, the real satisfaction has been to see the consortium function smoothly with successful collaborations that will no doubt continue beyond the scope of the initial funding. “For us, this is one of the criteria of success of a project,” she concludes.

Contact
Agathe Penant
Email: agathe.penant@vitagora.com

(1) Accredited by the IAR (Industries & Agro-Resources), Plastipolis and Vitagora® clusters, EMAC comprises:

- 3 industrial groups: Lactalis, Plastilax and Wipak

- 3 small businesses Chazal, Salaisons Sabatier and AFT Plasturgie

- 5 laboratories: UMR PAM, Procédés Alimentaires et Microbiologiques (AgroSup Dijon/University of Burgundy), UMR ICMUB, Institut de Chimie Moléculaire de l'Université de Bourgogne (CNRS/University of Burgundy), Centre de Valorisation des Glucides (CVG), Welience Agroalimentaire et Bioindustriel, Laboratoire d'Etudes des Matériaux Polymères d'Emballage (LEMPE) of the ESIEC of Reims and Welience

SENSOFAT and HumanFATaste

Fat: is there a sixth taste?



Dijon has always had a long relationship with gastronomy and research into the sciences of taste at an international level. With cutting edge research being carried out, in particular within the Centre for the Sciences of Taste and Food (Centre des Sciences du Goût et de l'Alimentation – CSGA), the question of a possible 6th taste is being closely studied. In any case, **can we really call fat a taste?** The most recent scientific research, especially that carried out by the team of **Professor Philippe Besnard**, suggests that the oral perception fat is through texture and odour but gustation is also very important in determining a spontaneous preference for fats to be observed in both humans and mice.

Philippe Besnard, director of the NUTox team (Physiology of Nutrition and Toxicology) within the "Lipids, Nutrition, Cancer" joint research unit (1), has a long history with lipids. He crossed their path by chance, as his background was mainly in endocrinology and molecular biology. "I was recruited as associate teacher by an ENSBANA (now AgroSup Dijon) laboratory that worked on the intestinal absorption of lipids," he recalls. As a consequence, he began studying the genes coding for

lipid transporters in the intestine. At the time only studied by a mere handful of researchers worldwide, this topic led Pr Besnard and his colleagues to the gradual discovery that lipid-receptors can also be found in the taste buds of mice. "We were lucky to discover the CD36 receptor in taste buds. The protein was an interesting target that was the springboard for an adventure that continues to this day," the Dijon based academic explained.

Over the past decade since that discovery, the research of Philippe Besnard and his team have made other advances, during various projects accredited by Vitagora®. For example, SENSOFAT whose purpose was to understand how the Fatty Acid Transporter protein CD36 worked on the tongue and in the intestine. The research showed the the protein plays an essential role in the taste perception of foods on the taste buds. The research also suggests that CD36 may play a role of fat sensor in the intestine. Furthermore, findings by other teams have shown that CD36 can also be found in the hypothalamus where there may also be a lipid sensor system, according to Philippe Besnard. Does this really mean that the taste of fat is now a reality and that we can safely talk about a

"... All the required theoretical conditions for designating the oral-sensory perception of lipids - I'm not saying taste - are virtually there ..."

sixth taste? "It exists as a kind of continuum along an oral-intestinal-hypothalamus axis where the same type of receptors can be found. However, while their operating mechanisms are similar, the physiological consequences they cause are different depending on their location," sums up the scientist.

Well then, can we finally talk about the taste of fat? "All the required theoretical conditions for designating the oral-sensory perception of lipids - I'm not saying taste - are virtually there," explained Philippe Besnard. He explains that unlike the primary five tastes - sweetness, saltiness, sourness, bitterness and umami - fat does not seem easily perceptible as a unique sensation in humans. Take saltiness, sweetness and umami - they bring pleasure to the people tasting them. On the other hand, sourness and bitterness trigger wariness. So, what about fat? Philippe Besnard believes that, "the taste of fat could be an unconscious oral-detection system enabling a person to select foods, not based on a specific primary sensation, but on their energy density." He recalls that since humans evolved several million years ago, they have experienced a situation of food insecurity. However, the fact of having a system that, once a food is put in the mouth, would allow humans to orient their choices according the energy density provided by the food, could represent an evolutionary advantage that would be found in different animal species. In the current situation and at least in developed countries, the hypothesis may explain why obesity keeps growing. The "taste of fat" still has surprises in store for Philippe Besnard and will continue to pique his curiosity during new projects such as SENSOFAT 2, which has been accredited by Vitagora®, and has just got off the ground.

Contact
Philippe Besnard
Email: p.besnard@agrosupdijon.fr

VITAGORA®: A FACILITATING SYSTEM FOR RESEARCH

SENSOFAT, HumanFATaste, SENSOFAT 2. Over the last few years, for three of the projects carried out by his team, Philippe Besnard has called on Vitagora®, which he describes as a "facilitating system". All began in 2007, with the launch of SENSOFAT, a nationally-funded basic research program involving five scientific teams. The aim was to understand the function of the protein CD36 on the tongue, the intestine and within the hypothalamus in the brain. Fascinating research and surprising results on the existence of detection methods of dietary fats, in particular long chain fatty acids within the oral cavity, in the intestine and by the central nervous system, which have provided data for the publication of four theses and more than a dozen scientific articles, including one in Nature.

Halfway through this first project, Philippe Besnard started on a second, called "HumanFATaste", in reference to the Fatty Acid Transporter (FAT), CD36. Developed in partnership with the French national dairy industry association and the Burgundy Regional Council, this project has been lead by the team of Sylvie Issanchou within the CSGA in Dijon, and that of Bruno Vergès, of the "Lipids, Nutrition, Cancer" joint research unit. One of the aims is to understand if the system of oro-sensory perception of dietary lipids can be regulated, or deregulated, during obesity. "We are at the point of publishing an article that shows that we can indeed observe an impact of obesity on oro-sensory perception of lipids," Philippe Besnard indicates.

Finally, SENSOFAT 2 has been launched in November 2011, also with national research funding, and follows on the path forged by its predecessor. Lead by the "Intestinal risk factors, diabetes and dyslipidemia" research unit in Toulouse, this program aims in particular to discover the role and impact of microbiota, in both the gut and the mouth, on the oro-sensory perception of lipids. It also aims to determine the respective roles of lipid receptors other than CD36 on the tongue. A thesis on this subject has just been launched.

(1) UMR 866 (INSERM, University of Burgundy/AgroSup Dijon)

PHILIPPE CAYOT

An atypical scientist at AgroSup Dijon

After spending a year working as senior advisor to Cargill R&D Europe in Vilvorde near Brussels, Belgium, advising the US group about different scientific avenues for future developments, Professor Philippe Cayot has returned to AgroSup Dijon in October 2012. He calls the break in his teaching and research career “an enriching experience” where the focus has been on the quality of human relations. The atypical academic has since returned to the lecture halls where he gives classes. At the same time the researcher, who had been working on proteins and their technical aptitudes until now, will continue his studies of oxidative processes and antioxidants.

“I am an industry researcher who works at the university,” says Philippe Cayot with a smile. Indeed, he considers that his profile is more like a corporate researcher’s profile, undoubtedly because he was trained as an engineer, graduating from the very school where he now teaches. “Many of my colleagues conduct research with the aim of understanding and developing very advanced knowledge. I’m more of a jack-of-all-trades. I want to understand but for the purpose of developing an application. I can’t help thinking about what it could be used for,” he adds. Naturally, his relations with industry began very early, right after he defended a thesis in electrochemistry at the University of Burgundy. Philippe Cayot’s first job was working for a consortium of dairy industries called Arilait-Recherche. However, problems in the private sector put a stop to hiring, so he decided to sit for an examination to become a teacher-researcher, first at the University Institute of Technology of Bourg-en-Bresse, an offsite unit of the University of Lyons, and several years later at AgroSup Dijon where he later became a tenured teacher.

For years, this academic has carried out tasks meeting the wide range of requests from his colleagues. “We all tend to be stretched in all directions,” he observes. Indeed, between giving classes, conducting research, supervising theses and coordinating projects with industry operators such as Nestlé or Danone, the workload soon becomes very heavy. As he heads EMMA (Eau, Molécules actives, Macromolécules, Activité - Water, Active Molecules, Macromolecules, Activity), a physical chemistry laboratory

of natural materials that he will head for the next five years or so, he is working with some fifteen teacher-researchers and engineers and some ten doctoral and postdoctoral fellows on “the control of transfers in water-poor matrices.” The laboratory is involved in developing several Vitagora® accredited projects, including Saveurs Vapeurs, sponsored by the SEB group, for the promotion of a naturally healthy rice cooking method that will preserve its taste, which is certainly the most exemplary project. “Sixty to seventy-hour work weeks are usually the rule,” he recalls.

GROWING INTERACTIONS BETWEEN ACADEMIA AND INDUSTRY

Naturally, when Cargill R&D Europe management suggested he come work in Belgium to launch a research project, Philippe Cayot, an engineer at heart, immediately accepted; looking back, he has no regrets. “I practiced very high level science. The scientific skills required for different R&D programs have to be guaranteed to make sure applications are rapidly developed,” the Dijon-based academic explains. “For this purpose, I enjoyed very comfortable and flexible working conditions. My only constraint was to be creative and original,” he adds. The work was carried out in a spirit of cooperation where each person had his or her mission. “I only had to think of science and programs.” Philippe Cayot calls it an enriching experience before returning to the PAM [1] research unit at AgroSup Dijon last autumn. He acknowledges that he learned a lot even though his one-year leave involved constraints on his personal life and at the school where he teaches. “This type of experience should be increased. However, one has to find the academic’s alter ego in industry and have a real exchange. This would allow researchers in industry to recharge their batteries by conducting research combined with teaching,” Philippe Cayot exclaimed.

Contact
Philippe Cayot
Email: p.cayot@agrosupdijon.fr

[1] Food and microbiological processes - Procédés Alimentaires et Microbiologiques (AgroSup Dijon/University of Burgundy)

Lipid Rafts show great promise for health and nutrition

For research scientists, the name ‘lipid rafts’ sounds like an invitation to travel into the heart of the plasmic membrane. This is where these particular microdomains with a very distinctive lipid and protein composition are located. The rafts are especially interesting as they seem to play a subtle role in cell signalling, explaining the emergence of a new technology called ‘raftomics’. Several teams from the universities of Burgundy and Franche-Comté are working on uncovering the mechanisms governing membrane dynamics and their role in cell adaptive response in various models. The scientists are conducting the research with clinical, therapeutic, environmental, food and nutrition purposes.

It is now widely accepted that environment and lifestyle have a major impact on human health. Similarly, animal or plant cell systems are impacted by their micro-environment that conditions cell response. However, the cell membrane is the first to be exposed to these changes. So, it becomes the seat of initiating events involved in its structuring, dynamics and composition, thus in signal translation, gene modulation, cell interactions or molecule penetration into the organism through drugs nutrients, or even microorganisms. Researchers have recently discovered ‘lipid rafts’, somewhat like 50 to 200 nanometer-long mobile platforms whose structure and dynamics will depend on their lipid and protein composition. “For instance, a modulation of the phospholipids and their fatty acids, especially polyunsaturated fats, will alter membrane fluidity, causing a change in membrane dynamics, in receptor regrouping or in molecule penetration via the rafts,” explains Jean-Louis Junien, in charge of development at the Health division of Welience.

Although the microdomains or rafts make it possible to locate and collect the ingredients required for numerous cell processes, they can also play a role in quantitative response. The sequestration of the key proteins of the rafts generate a regulating centre of signalling channel activity. The generated feedback loops are needed so that the cell response

can adapt various agonists according to their dosages and their application time to specific physiological functions. “The disorganisation or modification of raft assembly and ingredients may also cause the reprogramming of cell response. Therefore, it could be processed to develop new nutritional and therapeutic approaches eventually,” says the pharmacology trained scientist.

The Burgundy/Franche-Comté Higher Education and Research Hub (PRES) has all the qualities, skills and expertise to become a reference centre in lipid rafts. “The project underway targets technological advances in microdomains, with a focus on the use of electronic chips as well as the emergence of projects on cross-disciplinary topics in a wide array fields, such as oncology, ophthalmology, or cardiovascular diseases,” said Jean-Louis Junien. Conversations with industry operators are underway. “They’re waiting for us to surprise them,” exclaims the scientist, who knows the pharmacy and health world well and who is convinced that raftomics has huge contributions to make to nutrition. This explains the interest of Vitagora® in this topic, for whom the area of lipid nutrition and metabolism has been identified as a central area for development.

Contact
Jean-Louis Junien
Email: jlc.junien@wanadoo.fr





INTERNATIONAL MISSIONS IN OCTOBER 2013

Two international missions with Vitagora® members are to take place in October and November 2013, with the aim of developing technological partnerships in the following areas:

JAPAN and SOUTH KOREA

Themes: Nutrition, prevention of obesity and metabolic syndromes, functional ingredients

Zones: Japan and South Korea

Dates: 6-11 October, 2013

Contact: Christophe Breuillet, christophe.breuillet@vitagora.com

NORTH AMERICA

Themes: Food safety

Zones: Montréal, Québec (Canada), Detroit (USA)

Dates: 20-25 October, 2013

Contact: Elisabeth Lustrat, elisabeth.lustrat@vitagora.com



9TH INTERNATIONAL TASTE-NUTRITION-HEALTH CONGRESS – SAVE THE DATE!

The 9th edition of the International Taste-Nutrition-Health Congress will take place in Dijon on 3-4 April, 2014. The theme for this new edition of the Congress is “Consumer Health and Enjoyment” and the scientific program will be available for both Congress participants and via webinar.

The 2014 edition of the Congress will also host a special delegation of scientists and company representatives from Quebec.

Stay tuned to find out more at www.vitagora.com



VITAGORA® TECHNOLOGY DIRECTORIES AVAILABLE

Vitagora® is pleased to announce the publication of four Technology Directories to promote the innovative expertise within SMEs and research laboratories within the Taste-Nutrition-Health network.

These directories present the structures and their capabilities around the following themes:

Book I - Preservation of the environment

Book II - Preservation of health

Book III - Development of eating pleasure

Book IV - Understanding and controlling microorganisms

To find out more about these directories, contact:

Marthe Jewell: marthe.jewell@vitagora.com

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CONTACT

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Editor:

Christophe BREUILLET

Contributors:

JFD & Co

Marthe JEWELL

Text and Images:

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ISTockphoto

Vitagora®

Taste-Nutrition-Health
Network Innovation

President:

Pierre GUEZ

Managing Director:

Christophe BREUILLET

Executive Assistant:

Virginie BOUTON

Project Manager:

Claire van

OVERSTRAETEN

Project Engineers:

Delphine GOGET

Agathe PENANT

Communications

Manager:

Marthe JEWELL

Community Manager:

Clémence BOUVEL

Innovation and Scientific
Network Manager:

Elisabeth LUSTRAT

Address:

Maison des Industries

Alimentaires

4 Bd Docteur Jean Veillet

BP 46524

21065 DIJON Cedex

Telephone:

+33 (0)3 80 78 97 91

Fax:

+33 (0)3 80 78 97 95

Email:

vitagora@vitagora.com

Website:

www.vitagora.com