DR DIDIER DUPONT

INFOGEST

INFOGEST is an international network of institutes carrying out research on food digestion. Here, **Dr Didier Dupont**, a senior scientist at the French National Institute for Agricultural Research in Rennes, discusses the project's aims and the challenges presented by a multidisciplinary approach

Firstly, what are the primary goals of INFOGEST? As Chair of the project, what does your position entail?

The main objective of INFOGEST is to gather scientists from different disciplines (eg. food science, nutrition, gastroenterology) to better understand the disintegration of food during digestion and its consequences on human health. We would like to determine how the structure of food affects its biological and nutritional properties; harmonise the methodologies we use for studying digestion; and provide scientific proof of the effects of food on human health. As Chair of the project, I determine the priorities we need to focus on, as well as organising the workshops and conferences we have every year and dealing with the budget.

Can you describe the far-reaching implications of greater understanding of the effect of food on human health? For example, how will this project benefit consumers?

Understanding the disintegration of food in the gastrointestinal tract and identifying the biologically-active components that are released in the gut during digestion will enable the impact of food on human health to be determined. Hence, one of our long-term objectives will be to develop a reverse-engineering approach, which means starting from the bioactivity we want to deliver to the body and going back to the most adapted food structure.

I think there is an increasing demand for the consumer to be better informed about the possible effects that food can have on health; INFOGEST should bring new, solid scientific evidence on this topic.

Has progress made in the past year been at the level you wanted? What would you cite as some of the main achievements of INFOGEST to date and where do you hope to be in three years time as the project reaches completion?

I was very happy to see how the Action progressed during its first year. INFOGEST has allowed the development of exchanges of staff between institutions, and eight missions have already been funded. We have been able to quickly organise different events that were all extremely successful. Our inaugural workshop gathered 60 scientists in France in October 2011. This was followed by the first International Conference on Food Digestion, which took place in Cesena, Italy in March 2012, welcoming around 150 delegates from 26 countries. We also had an Industry Workshop where scientists met industry partners, which facilitated the dissemination of the current, basic knowledge to industry.

However, while most of the industry participants to date have been from large companies, we hope to involve more small- to medium-sized enterprises (SMEs) in the future. Many national and international spin-off projects have been funded after discussions within INFOGEST; for instance the 7th Framework Programme (FP7) project Pathway-27 has been funded by the European Commission, with the objective of designing new bioactive-enriched foods for lowering the risk of developing metabolic syndrome. The University of Bologna, which coordinates the project, is one of the most active participants in INFOGEST. So far, 60 per cent of the academic partners of the project are already involved in the Action and have met during our first workshops.

How have the challenges that have been faced by INFOGEST thus far been overcome?

As INFOGEST is a multidisciplinary network, we needed to develop a common language between food scientists, nutritionists, gastroenterologists, etc, in order to understand each other. Another challenge was to involve the European food industry, not only the large companies that already have excellent knowledge on the topic, but also SMEs. Therefore we sent a questionnaire to several companies in Europe involved in dairy, egg products, fruits and vegetables, fish, meat and cereals, asking them what their expectations were in terms of improved knowledge. We found out that one of their main priorities was to evaluate the nutritional properties of the foods they were producing and how they were affected by processing conditions. Since this topic was not really covered in the Action, we decided to create a new subgroup to answer this request.

What is in store for INFOGEST in the immediate future?

INFOGEST is still open to new participants. Our next major event will be the 2nd International Conference on Food Digestion that will be hosted in Madrid on 6-8 March 2013.

Reader's digest

A multidisciplinary, international project – which, amongst other things, is currently researching the relationship between the structure of food (fruits and vegetables, meat, dairy and egg products) and their digestion in the gastrointestinal tract – promises exciting results and novel technology, with potentially groundbreaking consequences

ON A CONTINENT obsessed with diet and digestive health, it seems incredible that there is such an acute scientific need for improving basic knowledge on food digestion in Europe. Simply put, the gut is the interface between food and the human body. However, while it is clear that food needs to be digested to release nutrients, there is an increasing amount of evidence which shows that the structure of food can have a strong influence on the release of compounds with specific health implications. Understanding how these molecules are released during food digestion holds the potential to improve current scientific knowledge on the effects of food on human health.

It is therefore unsurprising that food digestion has become a very hot topic in recent years; a phenomenon that has not been confined to Europe. Indicative of this worldwide determination for a better understanding of digestive health is the work of INFOGEST. Coordinated by the French National Institute for Agricultural Research (INRA) and led by Dr Didier Dupont, INFOGEST is a project which carries out research on the digestion of food. Using a huge network of expertise, the scientists involved span over 29 countries, from both inside and outside of Europe.

FIGURE 1.
ORGANISATION OF THE NETWORK INTO THE WORKING GROUPS AND THE TYPES OF FOOD INVESTIGATED

Such a step is currently being exploited by European scientists, at a time where the European Food Safety Authority (EFSA) is advocating the need for more scientifically-funded proofs for validating health claims. Such scientific concerns are especially important in light of the recent increase in lifestyle-related diseases. There are several factors that are responsible for this rise, which have reached most developed countries; high energy diets and a lack of physical exercise are key parameters. Additionally, foods and specific dietary bioactives have received particular attention for the prevention of these pathologies. However, more scientific proof is needed to really demonstrate their effect on human health.

INFOGEST

Using its network of academic institutes and worldwide team of scientists, INFOGEST's basic aim is to provide and improve basic research on food digestion. More specifically, the project addresses several specific scientific challenges:

- Elucidating the relationship between food structure and food components' bioavailability
- Understanding the effect of processing on beneficial food components' bioavailability
- Developing a multi-scale characterisation of food structures
- Harmonising *in vitro* digestion models at the European level

INFOGEST

OBJECTIVES

To gather scientists from different backgrounds in order to share the current knowledge on food digestion. In particular the Action aims to:

- Compare existing digestion models
- Harmonise methodologies and propose guidelines for performing new experiments
- Identify the beneficial/deleterious components that are released in the gut during food digestion
- Determine the effect of matrix structure on the bioavailability of food nutrients and bioactive molecules
- Demonstrate the effect of food on human health.

KEY PARTNERS

A full list of the institutes involved can be found at **www.cost-infogest.eu/PARTNERS**

FUNDING

COST (European Cooperation in Science and Technology)

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- Validating *in vitro* digestion models against experimental human data
- Creating an international database of bioaccessible food digestion products
- Improving knowledge of the relationship between protein digestibility and allergenicity
- Demonstrating the effect of food protein digestion on satiety and satiation
- Increasing knowledge on the modulation of the human microbiota by food proteins

So far, the team has successfully developed *in vitro* static and dynamic models, in addition to performing *in vivo* experiments on both animals and humans.

COST ACTION

INFOGEST is a project coordinated by 'European Cooperation in Science and Technology', or COST – a framework which supports cooperation among scientists and researchers across Europe. Due to the involvement of COST and its sheer size, this COST Action has been divided into three main Working Groups: food structures; digestion models; and the effect on human health.

Within the Working Groups, there are discussions between scientists on different topics to try to reach a consensus. All participants are invited to be involved in one of these three groups according to their scientific skills, to ensure the most efficient use of knowledge and expertise. Every Working Group meeting is followed by a plenary session, where all the discussions are summarised so that all the participants are fully aware of the decisions that were taken. This structure is imperative for the successful coordination of such a wide range of disciplines and individuals.

WIDER EXPERTISE

Gathering scientists from so many different backgrounds is no mean feat. Indeed, the ways in which INFOGEST approaches focused research priorities can often be a complex process. The project aims to develop a structuring effect, so as to organise the entire European scientific community working on food digestion.

Food digestion has been widely studied in the past by nutritionists and physiologists, but foods were considered in terms of their composition (per cents of proteins, lipids and sugars) rather than by their structure. Recent results have clearly demonstrated that the structure of food drives the kinetics of nutrient digestion and the physiological consequences on the host. Hence, one of INFOGEST's key roles is in gathering experts in food science, nutrition and gastroenterology, which offers the only possibility of understanding the mechanisms of digestion. Before the beginning of the project, every team studying food digestion was using its own digestion protocols and comparison between studies was impossible. INFOGEST provides harmonisation for *in vitro* digestion models and their validation towards clinical data.

NOVEL DEVELOPMENTS

In vitro static models are very popular in the scientific community as a means to study food digestion. They consist of mimicking, in a succession of bioreactors, the environment that food will meet when entering different compartments of the gut. However, almost every group using this type of model uses its own recipe, meaning that comparison of results between studies is impossible.

INFOGEST will provide a limited number of models agreed by all the participants that will each be dedicated to a specific type of food, including liquids, gels, emulsions and solid foods. Dynamic systems are physiologically more relevant since they mimic the flow of food between compartments and allow the regulation, in real time, of the pH, bile and enzyme output. All these models have to be validated through *in vivo* data collected on human or animal models. For instance, the team has recently validated a dynamic model for the digestion of infant formulas through experimental results collected on piglets. This will allow them to study digestion of baby foods without the need of animals.

INFOGEST'S FUTURE

With 210 research scientists from 60 institutions in 29 countries already involved, the project has all the necessary expertise to tackle the major issues in food digestion: "All the key players working on food digestion in Europe are already involved in INFOGEST," explains Dupont. However, INFOGEST is set to grow and progress in terms of organisation, structure and non-European involvement over the next few years: Dupont has been contacted by research groups and organisations from all over the world. For instance, there are several institutions from countries such as New Zealand, Australia, Argentina and Canada that are very active in INFOGEST. There are also institutions from the US, Chile and Mexico which have expressed their interest and might join the Action in a near future.

Horizon 2020, the EU's new financial research and innovation programme, offers great potential for developing INFOGEST. INFOGEST has already given birth to 7th Framework Programme (FP7) projects, including Pathway-27, but it is essential that the Action leads to future research projects within Horizon 2020. Those leading INFOGEST are currently in touch with decision makers in the European Commission, making them aware of the progress of INFOGEST and helping them to build the future calls.