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## Improving health properties of food by sharing our knowledge on the digestive process

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**COST**

## Improving health properties of food by sharing our knowledge on the digestive process

**FA1005**

**Start date: 01/06/2011**

**End date: 31/05/2015**

**Year: 2**

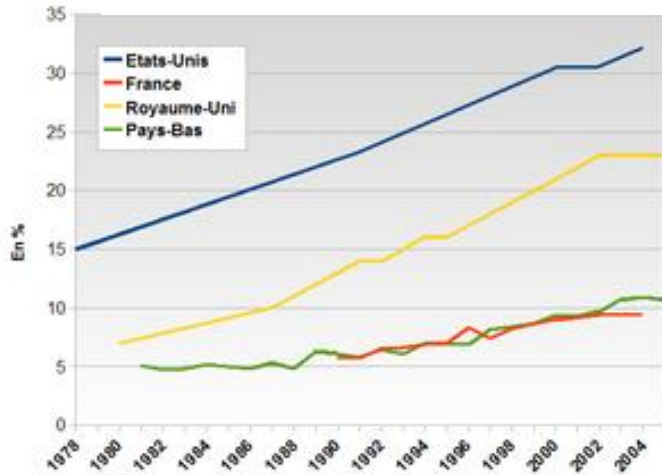
**Didier DUPONT**

Chair

INRA/ FRANCE

**INFOGEST**

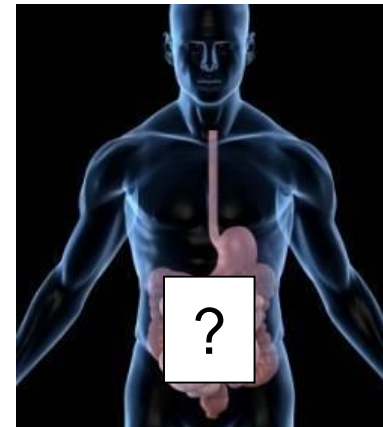
# Scientific context and objectives (1/2)



Diet-related diseases ↑

↪ Prevent these pathologies rather than cure them

Gut = interface between food and human body  
Digestion releases food components that can have a beneficial or a deleterious effect on human health



**Need to increase our knowledge on the effect of food on human health by increasing our knowledge on food digestion**

## Scientific context and objectives (2/2)

- Compare the existing digestion models, harmonize the methodologies and propose guidelines for performing experiments
- Validate *in vitro* models towards *in vivo* data (animal and/or human)
- Identify the beneficial/deleterious components that are released in the gut during food digestion
- Determine the effect of the matrix structure on the bioavailability of food nutrients and bioactive molecules
- Gather scientists from different disciplines (food science, nutrition, physiology, gastroenterology, immunology...) to share and improve our knowledge on food digestion



Chair  
Didier Dupont - France

Administrative  
Manager



Nathalie  
Le Marre



Vice-chair  
Alan Mackie - UK



Dairy, Egg  
Fruits & Vegetables  
Meat, Cereals

Characterization of raw materials and processed food matrices for optimized nutrient bioaccessibility

**WG1**

BFC identification  
Stability during processing  
Food multi-scale characterization

*In vitro, in vivo* and *in silico* models of mammalian gastrointestinal digestion

**WG2**

Digestion models harmonization  
Comparison *in vitro* / *in vivo*  
Digestion products identification  
BFC absorption / bioavailability

Evaluation of the health effects

**WG3**

Immunomodulatory properties  
Regulation of appetite and satiety  
Effect of BFC on human microbiota



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Italy



A. Brodkorb  
Ireland



I. Recio  
Spain

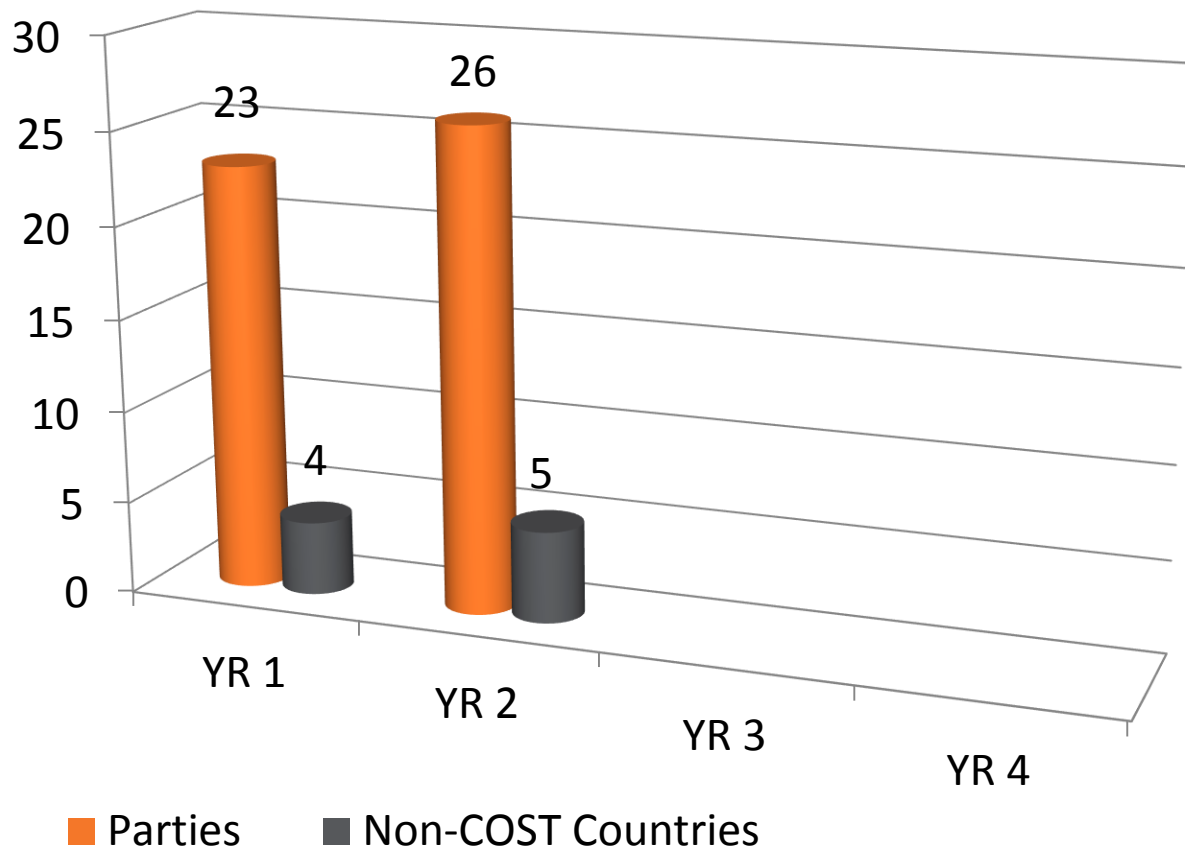


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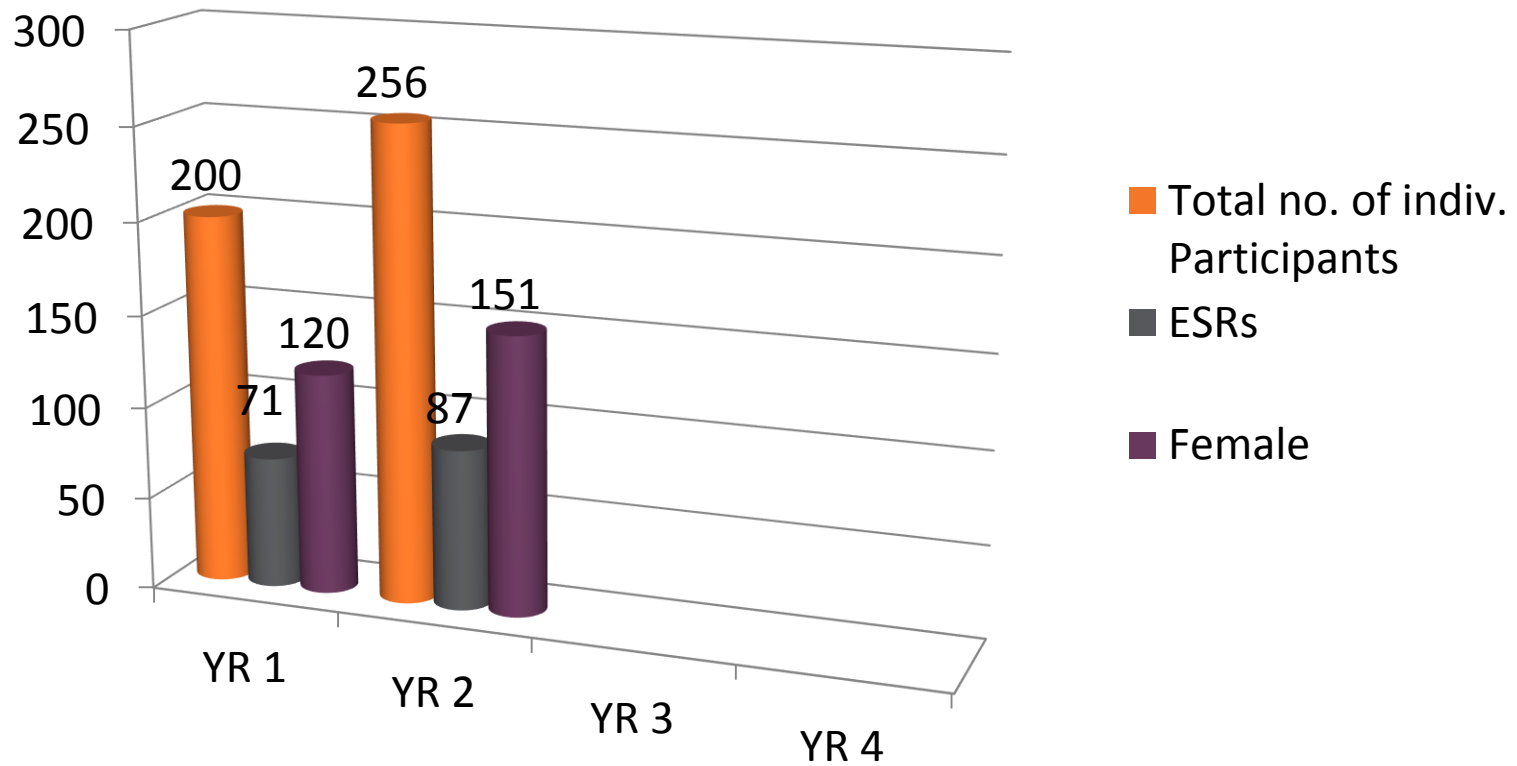
Tor Lea  
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# Action Parties



**Grant Holder:**  
INRA  
Didier DUPONT  
France

# Action participants





Tech Univ Denmark Univ Aarhus Univ Copenhagen MTT Univ Oulu Univ Eastern Finland  
 Norwegian Univ Life Sci Chalmers Univ Tech VTT Nofima Riga Stradin Univ Univ Ljubljana  
 NIZO TNO Lund Univ Univ Zagreb



**Canada**

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 AgroParisTech CTCPA  
 Univ Murcia  
 CSIC Univ Granada  
 NIH Ricardo Jorge  
 Univ Alto Douro  
 ITQB Milan State Univ  
 FEM CNR  
 Univ Milan Univ Naples  
 Univ Bologna Univ Roma  
 Univ Milan Univ Naples



Laval Univ  
 Univ Guelph  
 Czech Univ Prague  
 Inst Chem Technol  
 KTU Food Inst  
 Lithuanian Univ HS  
 Gdansk Univ Tech  
 Maize Res Inst  
 NGO  
 Polish Academy of Sci  
 Univ Belgrade  
 Univ Novi Sad  
 Aristote Univ Thessaloniki  
 Centr Food Res Inst  
 Ben Gurion Univ  
 Technion



**Argentina**  
 CONICET  
 Univ Buenos Aires



**Australia**  
 Deakin Univ  
 Univ Queensland



**Albania**  
 Agric Univ Tirana



**Montenegro**  
 Ege Univ  
 Pom Med Univ



**New Zealand**  
 Riddett Inst  
 Plant Food Res

**270 scientists - 90 institutes – 31 countries**

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# Use of COST Instruments

Activity (No.)	Year 1	Year 2	Year 3	Year 4
MC/WG Meetings	3	3		
STSMs	4	7		
Training Schools	0	1		
Workshops or Conferences	3	3		
Joint Publications	17*	38*		

# Results vs. Objectives

**All the objectives listed in Work-Budget plan for Y2 achieved:**

- International multi-scale characterization of model foods (pasta, dairies...)
- Ring trial for an international comparison of *in vitro* digestion protocols
- Harmonization of *in vitro* digestion models
  - ☞ 1 “Infogest-approved” model
- Publication plan adopted in each WG
- FA1005 gathers most of the EU scientific community involved on Food Digestion + world-leading institutes  
≈ **260 participants, 89 institutes, 31 countries**
- Strong connections developed with the food industry (55 companies) through questionnaire + workshop
- Strong connections developed with EFSA and EC

## Significant Highlights in Science or Networking (1/2)

### FA1005 gives birth to spin-off projects/proposals

- More than 60 National projects funded all over Europe raising more than 43,4 M€
- 8 Bilateral project funded for more than 3,2 M€
- Trilateral project funded between Poland, The Netherlands and Ireland (250 k€)
- 3 European projects funded (6,7 M€) –  
Pathway-27 University of Bologna  
26 partners – 70% of academic are INFOGEST partners



## A new harmonized *in vitro* digestion protocol

- Step 1** • Questionnaire sent to all the participants for describing the protocol they were using 📁 45 ≠ protocols collected in a database
- Step 2** • Listing of each parameter (pH, digestive enzyme and bile concentration...) essential to be kept in a harmonized protocol
- Step 3** • Review of the literature to find physiologically-relevant data for each parameter and set-up of a harmonized protocol
- Step 4** • Application of the protocol to the digestion of milk and pasta samples in an inter-laboratory trial
- Step 5** • Publication and dissemination of the protocol to the international scientific community (peer-review publication, oral conferences...)

# Challenges & Future Plans

- How to involve food industry in Action FA1005?
  - ☞ Publication of an industry newsletter
  - ☞ Integration of industry participants to the WGs
  - ☞ Invitation to the FA1005 events (13 companies participated to the conference, some even sponsored it!)
- Determine the influence of food processing on nutrient bioaccessibility through a ring-trial
- Development of a harmonized dynamic *in vitro* digestion protocol
- Writing of books, reviews and original articles
- Lobbying for getting project 9 (validation of *in vitro* models for the *in vivo* prediction of the behaviour of food ingredients in digestion, absorption...) proposed by ETP Food for life as a topic in the first call of Horizon 2020

## Detailed Research Areas

**Project 9:** Validation of *in vitro* models for the *in vivo* prediction of the behaviour of food ingredients in digestion, absorption, distribution, function and elimination



### Expected Impact:

Collaborative efforts of **academia and industry should define and validate** such studies for the sake of defining “normality” in responses to food intake challenges and for deriving novel biomarkers.

This can conceptually be validated also with putative health-promoting ingredients and should encompass measures that employ all available life science technologies.

### Scope:

The limits (capacity, money, regulations) in assessing the **fate of food ingredients** with respect to human metabolism and health are overcome by a more wider use of **in vitro models** simulating the human metabolism and response (i.e. artificial intestine) including in **silica models**.

Although such models may be valuable, only very limited (if not all) **validation** has been carried out. As advantages these *in vitro* models may be, as limited they are. A concerted effort of academia and industry should validate some of the models, define their most useful applications and define the limits. This is of equal importance for **academic researchers as well as R&D experts in industry**.