Active Food Scientific Monitor

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Interview

with prof. Christine Cherbut

In this issue we are glad to introduce to you Professor Christine Cherbut, Research Director at the Institut National de la Recherche Agronomique (INRA) in Nantes (France).

"We spent less and less time to buy and cook our meals, nutritional education is not a priority in our society and knowledge is no longer transmitted from one generation to another. This is why I think that functional foods may be extremely important to many people who do not have time nor like to think about their nutritional balance."

We need food that is good to eat, good to think and good to dream...

► She heads a research department on digestive functions and human nutrition. Her research unit has recently started human studies on the mechanisms by which certain carbohydrates such as inulin and oligofructose produce butyrate and the importance of this metabolite for health. One day, she hopes to have more time to devote to her other passions: travels and literature.

Specialised in the study of functional physiology

Prof. Christine Cherbut got an inter-disciplinary education in biochemistry and biology and specialised in the study of functional physiology.
"After my Ph.D. about the physiology of digestion, a lot of questions remained about the influence of the intestinal content and hence of the nutrients on the digestive functions. I quickly realised the importance of human nutrition for a young researcher as I was at that time : an almost completely new and thus exciting field with a lot of unanswered questions. It was an intellectual challenge to make a synthesis of different scientific disciplines. My multi-disciplinary education helped me a lot. Moreover, I felt I was involved in something important for society, I thought I could help to supply a need. And last but not least, I am a gourmet and, as a true French woman, I am convinced that meals are privileged occasions of conviviality and to socialise. I attach great importance to friendship and conviviality."
Professor Cherbut is also a nature lover: she is a devotee of hiking, she loves excursions in the desert and in the mountains and she is a keen scuba-diver.
"On the other hand, I also have a passion for words and language: I am fond of theatre, literature, semantics and linguistics. I hope to have one day the opportunity to devote more of my time to these activities."

"One of the principal objectives of our Research Group is to analyse the interactions between the fermentation in the colon and the digestive functions. We are studying for instance the mechanisms by which certain carbohydrates such as inulin and oligofructose produce butyrate and the importance of this metabolite for human health. Butyrate is a short chain fatty acid produced by fermentation of carbohydrates in the human colon. The amount of butyrate produced depends strongly on the nature of the substrates, the composition of the intestinal flora and the physico-chemical conditions of the digestive tract. We begin to know better the factors

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Preface

by Dr. Anne Franck

The 3rd ORAFTI Research Conference on the Nutritional and Health Benefits of Inulin and Oligofructose

During the last decade, new concepts and approaches have emerged relating to the science of nutrition. Among these, functional foods have attracted considerable interest. In particular, probiotics and prebiotics, which influence the physiological characteristics of the gastro-intestinal tract, have been applied in many food products world-wide. Their importance for human health and well-being is more and more supported by sound scientific data.
A growing body of scientific evidence and even surprising research results have been obtained, especially for chicory inulin and oligofructose.
These low-calorie dietary fibres improve digestive function and bowel habits, selectively stimulate beneficial bacteria in the gastro-intestinal tract, while repressing harmful ones, increase calcium absorption in the body, modulate lipid

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involved in this production and we have recently isolated bacteria which are essential therefor. We started to study butyrate because of its many biological properties: it is the main energetic substrate for the colonocytes; it inhibits the proliferation and differentiation of cancerous epithelial cells ; it stimulates the 'suicide' of these cells (apoptosis); it may enhance the local and general immunity. All these properties make it a serious candidate to assure and/or enhance the integrity of healthy intestinal mucosa, to reinforce the restoration of damaged intestinal mucosa (e.g. due to atrophy or inflammation, after surgery or an infection), and to reduce the risk of colorectal cancer. Animal research confirmed these hypotheses. Human studies are needed however to validate the functional importance of butyrate. We will start very soon such clinical studies."

What are according to you the big challenges to the science of nutrition ?

"It depends on the objectives, the targets. For poor people in our developed countries and third world countries, the challenge is to meet the basic needs in terms of energy and nutriments. Whereas for the more affluent ones, the challenge is to be in control of the nutritional over-abundance. For those who dispose of a wide choice, nutrition may help them to remain healthy, to reduce the risk of certain diseases and to enhance physical and mental performances in an increasingly competitive society. It can be compared to the effects of a regular and adapted physical exercise program contributing to the well-being, enhancing the physical performances through its effects on cardiovascular and muscular functions, and reducing the risk of several diseases (cardiovascular disease, cancer...). Before such food will become a daily routine, it is however essential that it is perceived as something tasteful, preserving the flavour of the ingredients, easy to prepare and absolutely safe. The big challenge to nutritionists in the XXIst century will be to make a synthesis of all those quality aspects of our nutrition, to put into practice the adagio of Claude Levi-Strauss: " Les aliments doivent être bons à manger, bons à penser et bons à rêver" ("we need food that is good to eat, good to think and good to dream")."

Why are oligosaccharides so important in our diet ?

"Most nutritionists in the industrialised world recommend to increase the non-digestible fraction in our diet in order to reduce its energetic

The effect of inulin and oligofructose on lipid metabolism

Cardiovascular disease (CVD) account for 24% of all deaths world-wide, 47% in developed countries. Prevalence of CVD is strongly correlated to lifestyle factors, including diet (saturated fat, dietary fibre...). For over 20 years the primary focus of public health strategies has been the attempt to reduce circulating blood cholesterol concentrations. It is estimated that a 10% reduction in adult cholesterol levels would result in a 10-25% reduction in the CVD mortality rate. Recent evidence has highlighted not only total plasma cholesterol but also plasma triacylglycerol as lipid risk factors for CVD. This has generated a lot of interest since studies in animals have shown markedly reduced triacylglycerol concentrations when diets containing significant amounts of inulin and oligofructose were fed. Human studies available at present are still inconsistent, but indicate that the intake of moderate levels of inulin or oligofructose may affect human lipid metabolism. Especially in diabetic or obese subjects inulin may prove to be useful in moderating raised triacylglycerol levels.

Animal studies

Fiordaliso et al. (1995) observed a decrease in plasma triglycerides (25% decrease), phospholipids (15% decrease) and total cholesterol (15% decrease) in rats fed a 10% oligofructose-containing (RAFTILOSE P95) standard diet. The triglyceride-lowering effect was observed after one week and lasted for at least 16 weeks. It was associated with a reduction in plasma very low density lipoproteins or VLDL (due to a reduction in the number rather than a change in the composition of the VLDL particles). Both LDL and HDL remained unchanged. Faecal analysis at week 6 showed no significant differences in the 24-h excretion of esterified fatty acids. This study has shown that oligofructose (OFS) feeding results in a reduced capacity of isolated hepatocytes to incorporate free fatty acids (palmitate) into cellular triglycerides. Kok et al. (1996b) found that OFS feeding (10%) in rats significantly decreased triacylglycerol (TAG) and phospholipid (PL) concentrations in both blood and liver. It also increased the glycerol-3-phosphate liver content but decreased the hepatic activity of glycerol-3-phosphate acyltransferase, suggesting a decrease in acylglycerol synthesis, and it did not affect the blood non-esterified fatty acid concentrations but reduced by 54% the capacity of isolated hepatocytes to synthesise and secrete TAGs from labelled acetate. The activity of fatty acid synthase (FAS), a key lipogenic enzyme, was also significantly decreased. The postprandial glycemia and insulinaemia were reduced by 17 and 26% respectively. These findings suggest that a decreased de novo lipogenesis in the liver through modulation of FAS-activity, combined with a decrease in fatty acid esterification, causes a reduction in VLDL-TAG secretion in OFS-fed rats. The lower insulin level in the serum of OFS-fed rats could explain, at least partly, the metabolic effect induced by such non-digestible carbohydrates as the transcription level of FAS is primarily activated by glucose and insulin.

Kok et al. (1998a) and Delzenne et al. (1998) showed that OFS feeding, despite a lower postprandial glycemia, increased the glucose-dependent insulinotropic polypeptide (GIP) serum concentration and the caecal production of glucagon-like peptide-1 (GLP-1). GIP directly stimulates lipoprotein lipase activity in rat adipose tissue. Lipoprotein lipase is the capillary-bound enzyme responsible for the clearance of dietary and endogenous (VLDL) triglycerides. GLP-1 on the other hand binds to receptors and exerts insulino-mimetic effects in liver, muscle and fat. However, the exact contribution of these two hormones in the anti-lipogenic effect of OFS remains to be clarified. Other mediators, as for instance propionate, could also be involved. OFS is largely fermented in the caeco-colon, leading to the production of short-chain carboxylic acids and the portal concentrations of acetate and propionate are increased in OFS-fed rats.

In another experiment, Kok et al. (1996a) have observed that OFS feeding could not prevent the hyper-triglyceridemia induced by a high load of fructose, but was able to protect rats against liver lipid accumulation. This means that it may be relevant to use OFS as sugar or fat substitute in a high fructose diet (Kok et al., 1998b). Similar effects have been

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In obese Zucker rats which develop hyper-triglyceridemia associated with muscle insulin resistance and obesity, dietary oligofructose (RAFTILOSE P95) lessens hepatic steatosis, but does not prevent hyper-triglyceridemia (Daubioul et al., 2000). Oligofructose supplementation slowed the increase in body weight (after 10 weeks body weight was 10% lower than in control rats), an effect not shown in experiments with non-obese rats. In contrast to the results obtained with normal rats, serum TAG were not modified by OFS treatment in either the post-prandial or food-deprived state. The increase in triglyceridemia occuring 2h after an oral load of glucose and corn oil was significantly higher in OFS-fed than in control rats, suggesting either a higher capacity to absorb lipids from the intestinal tract and/or a greater secretion of endogenous VLDL from the liver. This study did not detect any modification of glycemia during OFS treatment, but a lower serum glucose concentration was observed in the portal and cava veins at the end of the study. This effect was accompanied by a higher concentration of insulin. This may explain the higher VLDL secretion from the liver. The epididymal fat mass was lower in OFS-fed rats, but the post-prandial and post-food deprivation concentrations of non-esterified fatty acids in the serum were not modified by the treatment. The putative influence of dietary fructans on body weight and fat mass and the hepato-protective effect of oligofructose observed in obese rats would constitute an interesting tool in the control of obesity and of hepatic alterations linked to obesity, if confirmed in humans.

Human studies

In normolipidemic subjects (young healthy women), Pedersen et al. (1997) found no lipid-lowering effect of a daily intake of 14 g inulin (RAFTILINE LS) during 4 weeks. The same was reported by Luo et al. (1996) in a study involving twelve young healthy males who ingested 20g fructo-oligosaccharides daily for 4 weeks. In both these studies, young healthy subjects with relatively low total cholesterol and triacylglycerol concentrations were recruited and this may have contributed to the lack of effects. Maybe the doses were too small or the periods of feeding too short in both studies (Taylor et al., 1998).

A recent subject-blinded but not randomised study (Canzi et al., 1995 and Brighenti et al., 1999) reported however a significant decrease in plasma total cholesterol and triacylglycerol (TAG) levels in healthy normolipidemic men who consumed 50 g of a rice-based ready-to-eat cereal containing 18% chicory inulin during four weeks. TAG levels remained significantly lower after one month of cessation of inulin supplementation. No effects on HDL cholesterol were observed. Breath hydrogen was significantly elevated during the inulin diet. Serum cholesterol results were positively correlated to the daily excretion of secondary bile acids.

In studies with individuals showing moderately raised blood lipids, significant decreases in fasting cholesterol and/or triacylglycerol levels were observed.

Yamashita et al. (1984) have shown that 8 g/day fructo-oligosaccharides for two weeks resulted in a decrease of 8% in total cholesterol and 10% in LDL-cholesterol in non-insulin-dependent diabetic patients. Also a significant reduction in blood glucose was observed. The reduction was greater in hyper-cholesterolemic subjects. No effect on circulating TAG was observed.

Davidson et al. (1998 & 1999) found that inulin supplementation (18 g/day RAFTILINE ST during 6 weeks) could blunt the hyper-cholesterolemic effects of the high fat control foods in men and women with moderately elevated baseline LDL cholesterol. During inulin treatment, small declines were observed for both LDL and total cholesterol. Neither serum triglycerides nor the LDL/HDL ratio changed significantly, although non-significant trends toward favourable changes were observed.

A recent clinical trial (Williams et al., 1998 and Jackson et al., 1999) with healthy but slightly hyper-lipidemic adults who received 10g/day inulin (RAFTILINE HP Gel), found a significant reduction in fasting triglycerides (-19% after 8 weeks) and insulin levels (-17% after 4 weeks and -10% after 8 weeks). This resulted in lower plasma TAG levels, particularly in subjects in whom fasting TAG levels were greater than 1.5 mmol/l. There were no effects on fasting glucose concentrations and on other lipid variables, including plasma total cholesterol, LDL and HDL, apoB and apoA-I levels.

In men with hyper-cholesterolemia, a daily intake of 20g chicory inulin during three weeks reduced serum triglycerides by 40 mg/dl (Causey et al., 2000). Also a trend toward reduction in serum cholesterol and toward short chain fatty acids (SCFA) profile changes were observed. The decrease was serum cholesterol concentration-dependent: subjects with serum cholesterol levels above 250 mg/dl tended to have the greatest reduction after inulin supplementation. Insulin and glucagon levels were increased at 1-hour post glucose load, maybe because of the increase in SCFA.

Schaafsma et al. (1998) investigated the effect of a fermented milk product, containing Lactobacillus acidophilus and fructo-oligosaccharides (2.5%), on blood lipids in healthy adult men with borderline elevated levels of serum total cholesterol. As compared to traditional yoghurt, the daily consumption of three times 125 ml of the test product specifically lowered serum LDL-cholesterol levels (5.4 % decrease), total cholesterol (4.4% decrease) and the LDL/HDL-ratio (5.3% decrease) within three weeks. Levels of serum HDL-cholesterol, triglycerides and blood glucose remained unchanged. It is not clear whether the effect was attributable to either Lactobacillus or the fructo-oligosaccharides or to a combination of these factors.

Conclusion

A large number of animal studies in rats, dogs and hamsters provide convincing evidence of the beneficial effects of inulin and oligofructose on blood lipid levels. There is a marked reduction of serum triglycerides which occurs via reduction of fatty acid synthesis in the liver. The effect on cholesterolemia is not so well established. Oligofructose also modulates insulin concentration in rats, possibly via effects on the secretion of gut hormones. Reviewing the studies on this

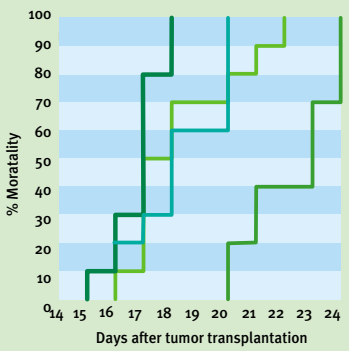
In the following pages we offer you the latest nutritional information on chicory inulin and oligofructose, summarized from key articles in major scientific journals.

Oligofructose and inulin potentiate cancer chemotherapy

15% chicory inulin or oligofructose incorporated into the basal diet for experimental animals significantly potentiate the therapeutic effects of six different cytotoxic drugs commonly used in treatment of human cancer, without any supplementary risk.

Seven days after initiation of the dietary treatment, a transplantable liver tumour was injected intra-peritoneally into all mice from the control and experimental groups. A single, sub-therapeutic dose of cytotoxic drugs (5-fluorouracil, doxorubicin, cyclophosphamide, vincristine sulfate, methotrexate, and cytarabine) was injected 48 hours after tumour transplantation. The mice of the experimental groups received a diet with 15% of either oligofructose (RAFTILOSE P95) or inulin (RAFTILINE HP) until the end of the experiment.

In all experiments oligofructose and inulin considerably potentiated the therapeutic effects of all six drugs. The adjuvant therapy had a synergistic effect in more than 50% of experiments. The results in the remaining experiments were also positive, but with an additive effect. Oligofructose or inulin did not increase the general and organ toxicity induced by the drugs. The non-toxic character of this adjuvant therapy was confirmed by the increase of survival time. Several mechanisms may be involved in this effect of inulin and oligofructose.



Taper H.S. & Roberfroid M.B. (2000), Nontoxic potentiation of cancer chemotherapy by dietary oligofructose or inulin, Nutrition and Cancer, 38 (1), 1-5.

Oligofructose promotes better piglet performance

Oligosaccharides that escape enzymatic digestion may enhance piglet performance by modifying the bacterial population and stimulating the growth of favourable bacterial species within the gut.

96 piglets received either no growth promoter, Avylamycin (40mg/kg) or oligofructose (333mg/kg). Avylamycin acts by inhibiting the growth of Gram positive bacteria.

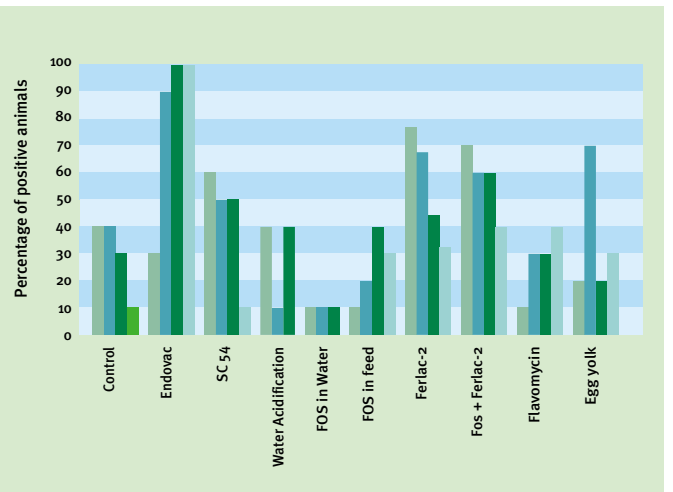
Piglets which received the Avilamycin or oligofructose supplemented diets grew significantly faster than the control pigs during weeks 2 and 3. Feed conversion ratio was not different between the treatments.

Oligofructose thus produced similar levels of performance to Avilamycin and may be used as an alternative for antibiotic growth promotors.

Miller H.M. & Toplis P. (2000), Fructo-oligosaccharides enhance weaned pig performance, Proceedings of the BSAS Occasional Meeting: The Weaner Pig, 5-7 September 2000, 33.

Oligofructose may reduce carriage of salmonella in swine

In this study probiotics, prebiotics, vaccination and acidification of drinking water were assessed as means of reducing Salmonella in swine. Acidification of water (0.02% formic acid), use of egg yolk-specific immunoglobulins and vaccination with an endotoxin vaccine did not reduce salmonella in experimentally infected pigs. A reduction of salmonella in the colonisation of mesenteric lymph nodes was observed with the use of bambermycins (Flavomycin) and a live attenuated vaccine. A reduction of the shedding of S. typhimurium in faeces and changes in the intestinal tract were also observed after supplementation with oligofructose (FOS, 1%) in drinking water. This effect was not observed with FOS in feed or with the use of FOS and probiotics (Lactobacillus spp.) together in feed. Probiotics and prebiotics (FOS) changed the pig faecal bacterial flora as indicated by Gram staining of smears from rectal swabs.



Letellier A., Messier S., Lessard L. & Quessy S. (2000), Assessment of various treatments to reduce carriage of Salmonella in swine, Canadian Journal of Veterinary Research, 64, 27-31.

Determination of oligofructose by high-temperature capillary gas chromatography

Because of its solubility in 80% ethanol, oligofructose is not significantly measured by present dietary fibre methods. It can however be quantified by using HPAEC-PAD (enzymatic treatment with inulinase followed by high pressure anion exchange chromatography with pulsed amperometric detection) determination of released sugars. With cation-exchange liquid chromatography (LC) some oligofructose compounds co-elute and other oligosaccharides such as malto-n-ose may interfere.

High temperature capillary gas chromatography (CGC) proved to be a very robust and productive analytical technique which measures sugars up to a degree of polymerisation of 10 in complex

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of viable cells of Bifidobacterium infantis-longum.

In group 3, quails harbored bifidobacteria at high level in their caecum. The level of total pathogenic clostridia implicated in NEC was lower in the OFS-fed group than in the control group, even if no bifidobacteria were detected in the caecal contents of groups 1 and 2. This confirms other studies which reported that the bifidogenic effect of OFS is dependent on the initial level of bifidobacteria.

This study indicates that the addition of oligofructose in formula milks, especially if supplemented with bifidobacteria, may be a nutritional approach to increasing the level of beneficial bacteria in the intestinal flora of newborns and also a way to maintain this beneficial microflora for a longer period.

Danan C., Huret Y., Tessèdre A.-C., Bensaada M., Szylit O. & Butel M.-J. (2000), Could Oligosaccharide Supplementation Promote Gut Colonisation with a Beneficial Flora in Preterm Infants?, Journal of Pediatry, Gastroenterology and Nutrition, 30, 217-219.

Inulin lessens the effects of phytic acid on mineral assimilation in rats

Phytic acid (PA), present in some foods, binds mineral cations such as Ca, Fe and Zn in the gastrointestinal tract, making these minerals unavailable for absorption into the body. The aim of this study was to investigate the influence of phytic acid and inulin on the caecal and apparent mineral absorption, as well as on the general mineral status (in plasma, liver and bone) in four groups of rats fed a fibre-free diet (FF), the FF diet with 7g/kg PA (FF+PA), the FF diet with 100g/kgchicory inulin (INU) or the FF diet with 100 g/kg inulin and 7 g/kg PA (INU+PA).

The INU diets led to an improved Ca and Mg caecal absorption. Apparent mineral absorption was significantly enhanced by inulin ingestion (Ca +20%, Mg +50%, Fe +23%, Cu +45%), whereas phytic acid (FF+PA) significantly decreased this factor only for trace elements (Fe -48%, Zn -62%, Cu -31%). However, the introduction of inulin into the phytic acid diet counteracted these observed deleterious effects by stimulating bacterial hydrolysis of phytic acid (+60% in rats adapted to INU+PA compared to those fed the FF+PA diet) and by improving caecal absorption of minerals.

Lopez H.W., Coudray C., Levrat-Verny M.-A., Demigné C. & Rémésy C. (2000), Inulin enhances apparent mineral absorption and lessens the deleterious effects of phytic acid on mineral assimilation in rats, Proceedings of the 4th International Fructan Symposium, Arolla, Switzerland, August 16-20, 2000.

Identifying probiotics and prebiotics for human use

This article introduces the rationale for probiotic and prebiotic use in humans: they serve to improve the gut microflora composition. It also summarises how efficacious types of beneficial probiotics and prebiotics can be identified. This involves in particular a molecular approach to the fermentation process in conjunction with well-controlled human trials.

For probiotics, "challenge tests" may be undertaken to determine survivability. The tested strain would be added to a fermentator and/or administered to a laboratory animal or humans and the effects would be determined. One important requirement is that the probiotic strain be detected in the study. Specific metabolic traits may be of some value, as are selected antibiotic resistance markers. However, neither is likely to be as efficacious as the use of certain molecular markers which allow high discrimination and are genetically conserved. The article also gives a number of selection criteria that may be important for the success as a probiotic: strain origin, safety, survivability, production characteristics, processing, sensory and microbiological properties, effects on the consumer, adherence in the gut, effects on pathogens, modulation of metabolic activities and immuno-modulation.

For prebiotics it is important that their non-digestibility as well as selective fermentation be determined. Non-digestibility can be measured using either in vitro conditions that simulate the upper gastrointestinal tract or an ileostomy model. Bacterial fermentability can be determined by using agars, but such methods are not wholly reliable. Several molecular procedures in microbiology and gut bacteriology specifically have been developed. The simplest in vitro fermentors involve static batch cultures. This method takes a relative short time and only small volumes are required. But batch fermentors are closed systems in which the substrate is limited and the culture follows a typical bacterial growth curve. Continuous culture systems (chemostats) can be used to simulate the intestinal conditions more closely. Also semi-continuous culture systems have been used. A number of models are presented in the article. For demonstration of a prebiotic activity, it is critical that as many components of the gut microbiota as possible be measured during fermentation studies. These should include at least bacteroides, bifidobacteria, clostridia, gram-positive cocci, coliforms, lactobacilli, total aerobes and total anaerobes. Pure bacterial studies should be supported by mixed culture work.

The ultimate test for probiotic and prebiotic functionality is the in vivo situation, in particular, well-controlled human studies with placebo control and blind coded samples. Unlike trials using animals, different regions of the gut are inaccessible because only faecal material is readily available. Developments in the application of molecular biological techniques to human gut bacteriology are of enormous value in this respect.

Gibson G.R. & Fuller R. (2000), Aspects of In Vitro and In Vivo Research Approaches Directed Toward Identifying Probiotics and Prebiotics for Human Use, American Journal of Nutrition, 130 (suppl.), 391S-395S.

Prebiotics and probiotics as functional foods

This article reviews recent scientific data showing that probiotics and prebiotics may positively affect various physiological functions in ways that will permit them now or in the future to be classified as functional foods for which health claims (of either enhanced function or reduction in disease risk) will be authorised.

Several health-related effects associated with the intake of probiotics have been reported in human studies: alleviation of lactose intolerance (strong) and immune enhancement (preliminary). Rotavirus-induced diarrhoea and possibly colon cancer are the only disorders for which there is evidence of disease reduction from probiotic consumption.

The only prebiotics for which sufficient data have been generated to allow an evaluation as functional food ingredients are the inulin-type fructans (inulin and oligofructose) considered as non-digestible oligosaccharides. There is strong evidence that their selective in the colon leads to the selective stimulation of growth of the bifidobacteria population and that they enhance mineral absorption. There is promising evidence of a positive effect on the metabolism of lipids and on the reduction of colon cancer risk.

Combining probiotics and prebiotics in what has been called a synbiotic could beneficially affect the host, it could improve the survival of the probiotic bacteria, thus enhancing their effects in the large bowel and it could have a synergistic effect. This remains to be further studied.

Roberfroid M.B. (2000), Prebiotics and probiotics: are they functional foods ?, American Journal of Clinical Nutrition, 71 (suppl.), 1682S-1687S.

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Agenda

► **Los Angeles, USA**
June 28 to July 1, 2001

The First World Congress Convention: New Direction of Modern Medicine – The evolving Probiotics Medicine

Major topics to be discussed in the convention:

- The evolving probiotic medicine
- Human intestinal microbiology
- Probiotic microbes
- Role of probiotics in health and diseases (prevention and treatment of acute bacterial infection, prevention and treatment of chronic infection and diseases)
- Mechanism of probiotics
- Pediatric probiotic medicine
- Functional food and prebiotics
- Animal probiotics

Organizing Committee: Dennis Welch, Francis Lai, May Wang

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tel: +1- 310-784-1818
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► **Vienna, Austria**
August 27-31, 2001

17th International Congress of Nutrition
Modern Aspects of Nutrition - Present Knowledge and Future Perspectives

Under the auspices of the International Union of Nutritional Sciences
Organized by the Austrian Nutrition Society, with the support of the University of Vienna, the International Atomic Energy Agency and the Food and Agriculture Organization of the United Nations, Commission of the European Union, World Health Organization and the United Nations Children's Fund

Congress President and Scientific Program: Prof. Dr. I. Elmadfa, Institute of Nutritional Sciences, University of Vienna

Symposia include topics on:

- Food Components: Major and Minor Nutrients
- Recommendations, Guidelines and Policy on Nutrition (including Functional Foods)
- Nutrition in Health and Disease
- Advances and Trends in Nutrition Research
- Advances in Food Production and Food Processing
- Nutrition of Specific Groups
- Food Security and Safety
- Food Risk assessment - new approaches

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► **Paris, France**
October 17-19, 2001

International Symposium on Functional Foods - Scientific and Global Perspectives

Organized by International Life Science Institute - ILSI Europe, in collaboration with ILSI Human Nutrition Institute, ILSI Focal Point in China, ILSI Japan, ILSI North America, ILSI Southeast Asia.
Organizing Committee: Prof. W. Saris (Maastricht University, NL), Dr. J.-M. Antoine (Groupe Danone, F), Prof. N.-G. Asp (University of Lund, S), Mr. O.-P. Ballevre (Nestlé, CH), Dr. M. Blum (Roche Vitamins Europe, CH), Dr. L. Contor (ILSI Europe, B), Dr. A. Franck (Raffinerie Tirlemontoise, B), Prof. I. Rowland (University of Ulster, UK).
Scientific Committee: Dr. P. Anderson (Ross Products Div./Abbott Labarotories, USA), Prof. Chan Soh Ha (WHO Immunology Centre/Univ. of Singapore, SGP), Dr. J. Chen (ILSI Focal Point China/Chinese Academy of Preventive Medicine, PRC), Dr. L. Contor (ILSI Europe, B), Dr. A. Huggett (Nestlé, SGP), Dr. J. Milner (Pennsylvania State University, USA), Dr. Y. Morinaga (Ajinomoto, J), Prof. T. Osawa (Nagoya University, J), Dr. G. Pascal (National Institute of Agronomical Research, F), Prof. M. Roberfroid (Catholic University of Louvain, B), Prof. W. Saris (Maastricht University, NL), Drs. P. Verschuren (Unilever, NL), Dr. W. Yan (Ministry of Health, PRC).

Objectives of the meeting:

- To review current world view on the scientific basis of functional foods and to identify areas of agreement and disagreement
- To identify unifying concepts and illustrate with relevant examples
- To review current scientific support for biomarkers to link functional food consumption to quality of life and/or health
- To review the communication requirements from a scientific, consumer and regulatory point of view
- To identify new trends in functional food science

The program will cover a wide range of subjects related to functional foods.
The focus will be on:

- Global View on Functional Foods
- Scientific Basis of Biomarkers and Benefits of Functional Foods
- Human Variability and Safety of Functional Foods
- Future of Functional Foods

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► **Coventry, United Kingdom**
June 12-13, 2001

AIM 2001

Keynote speakers include:

Paul Coussement: Raftilose Synergy for better calcium absorption

Info: contact Jane Staniforth on +44 118 9212026 or
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Colophon

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