Joint Programming Initiative

A HEALTHY DIET FOR A HEALTHY LIFE

DRAFT Strategic Research Agenda

2011-2020 and beyond

October 2011

Foreword

This Joint Programming Initiative (JPI) provides a roadmap for harmonised and structured research efforts in the area of food, nutrition and health with defined priorities to reach the goals as identified in the Vision Document (September 2010).

Food production, human nutrition and the incidence of diet-related diseases are becoming increasingly important in our rapidly changing scientific, economic and societal environments. High quality diets and proper physical activity are the most critical determinants in human health and for quality of life in an ageing society. At the same time, food production systems are challenged by an increasing competition for biomass and the need to improve food security and sustainable production. Consumer expectations, for example regarding food quality, safety, price and convenience, are also changing. Taking this all into account, the aim of the Joint Programming Initiative *A healthy diet for a healthy life* is to better understand the factors that determine food choices and physical activity behaviours and thus human health and subsequently translate the knowledge into programmes and products that promote healthy food choices.

This document describes the Strategic Research Agenda for the period 2011-2020 and beyond. The overarching principle of the JPI is to bring together scientists and scientific programmes and to create an added value for Europe by sharing knowledge, expertise and data that will enable high-quality research without duplication or leaving gaps. The JPI aims to provide a holistic approach to the interplay of key factors that affect diet-related diseases, discover new relevant parameters and mechanisms and define strategies that contribute to the development of actions, policies and innovative products suitable to reduce the burden of diet-related diseases. Key to achieving this is a better coordination of existing and new research in the areas of food, diet, physical activity and health. Moreover, improved coordination and joint research efforts will strengthen European leadership and competitiveness in the field.

Various themes and research subject defined here in the JPI are closely linked to changes in global food production systems and therefore critical policy issues such as on a European food economy management are addressed as well. In these areas the JPI *A healthy diet for a healthy life* seeks exchange and collaborations with other JPIs such as, for example, *Agriculture, food security and climate change (FACCE)*.

This Strategic Research Agenda (SRA) was drafted by the Scientific Advisory Board (SAB) of the JPI. The SAB members were selected on the basis of their expertise and scientific standing. The first meeting of the SAB was held in January 2011, followed by meetings in April, September and November 2011. In October and November 2011, the draft SRA was subjected to consultations to input and set priorities.

The SRA was approved by the Management Board on …., representing members from the following countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

As SAB we are committed to collaborative efforts and for establishing a fully operational and vital European Research Area on the prevention of diet-related diseases, to increase the knowledge base and for delivering innovative and novel approaches to improve nutrition and health.

March 2011,

Prof. Dr Hannelore Daniel, Chair Scientific Advisory Board

&

Prof. Dr Wim H.M. Saris, Chair Management Board

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Executive summary

To address major societal challenges, the European Commission has suggested an enhanced cooperation in European R&D. This joint programming is a process by which Member States engage in defining, developing and implementing a common strategic research agenda, based on a common vision of how to address major societal challenges that no Member State is capable of resolving independently.

In September 2010 the Vision Document of the Joint Programming Initiative (JPI) *A healthy diet for a healthy life* was approved by the Management Board.

The vision of the JPI on *A healthy diet for a healthy life* is that in 2030 all Europeans will have the motivation, ability and opportunity to consume a healthy diet from a variety of foods, have healthy levels of physical activity and the incidence of diet-related diseases will have decreased significantly.

The following three key interacting research areas were identified and are described in this document:

- Determinants of diet and physical activity: ensuring the healthy choice is the easy choice for consumers. The challenge is to understand the most effective ways for improving public health through interventions targeting dietary and physical activity behaviours.
- Diet and food production: developing high-quality, healthy, safe and sustainable food products. The challenge is to stimulate the European consumers to select foods that fit into a healthy diet and to stimulate the food industry to produce healthier foods in a more sustainable way.
- Diet-related chronic diseases: preventing diet-related, chronic diseases and increasing the quality of life. The challenge is to prevent or delay the onset of diet-related chronic diseases by gaining a better understanding of the impact of nutrition and lifestyle across Europe on human health and diseases.

These areas need to be framed by effective strategies for joined research including new infrastructure but also by development and innovation activities. Efficient communication within the JPI but also in dissemination to all stakeholders is most crucial for success.

Introduction

Diet, health and physical activity

According to the Kondratieff cycle theory, health is the key driver for Europe's growth and prosperity[1]. European governments are struggling with the growing social and economic consequences of an alarming increase in obesity and diet-related diseases, including malnutrition[2] and micronutrient deficiencies in subgroups of the population. Lack of sufficient physical activity and high energy intakes are the prime factors determining overweight and obesity development and the growing incidence of diseases directly or indirectly linked to these lifestyle parameters. Increased affluence and urbanisation are contributing factors that result in lifestyles and daily routines, which require less physical activity. At the same time, access to foods with high energy density is becoming more prevalent. It can be foreseen that without effective prevention of diet-related diseases, health systems will be overwhelmed to breaking point. Consequently, improving health by increasing energy expenditure and providing more healthy diets are key priorities for most EU Member States in fighting obesity and diet-related chronic diseases amongst their populations.

A recent series of four articles in *The Lancet*[3] critically examined the state of knowledge about the global obesity pandemic by summarising its drivers, its economic and health burden, the physiology behind weight control and maintenance and by defining actions to change obesogenic environments and to reverse the risk factors for chronic diseases in future generations. Swinburn and colleagues[4] reported estimates of 1.46 billion adults and 170 million children overweight or obese worldwide in 2008. Without successful interventions, the projections for 2030 as described in the second paper of the series[5] estimate 65 million more obese adults in the USA and 11 million more in the UK alone with an additional 6-8.5 million people with diabetes, 5.7-7.3 million with heart disease and stroke, and 492,000–669,000 with cancer. The projected costs to treat these additional preventable diseases are by an increase of $48-66 billion per year in the USA and £1.9-2 billion per year in the UK. It was concluded[5] that successful strategies for reduction of obesity rates need to target all age groups and use a life-course approach and natural experiments. Prevention should start in early life phases as there is increasing evidence that prenatal and infant nutrition can condition for health problems later in life and this needs a better understanding of the underlying mechanism and the translation into the public health domain. A special demand of research exists for ageing societies as in Europe to define the dietary needs of the elderly and geriatric groups, examine their lifestyles and develop foods that can promote a healthy aging trajectory. Proper health-maintenance throughout the life stages has to be assured by all means including education, adequate physical environments and diets and with a high level of commitment by commercial and public entities.

Key messages[4]

-Changes in the global food system, including reductions in the time-cost of food, seem to be the major drivers of the rise of the global obesity epidemic during the past three to four decades, although substantial differences in national and local environments (especially socio-cultural, economic, and transport environments) produce the wide variation in obesity prevalence recorded across populations.

-In the first half of the twentieth century, increased mechanisation and motorisation were accompanied by corresponding decreases in food energy supply (indicative of consumption), thereby keeping obesity prevalence low.

-In many high-income countries, an energy balance flipping point seems to have occurred in the 1960s-70s, with an increasing food energy supply now pushing up energy intake and population weight.

-Adult obesity continues to increase almost universally, but in some childhood and adolescent populations the epidemic seems to be flattening or even decreasing.

-Present systems for monitoring population weight and nutrition are inadequate in almost all countries.

-Obesity is the result of people responding normally to the obesogenic environments they find themselves in.

-Support for individuals to counteract obesogenic environments will continue to be important, but the priority should be for policies to reverse the obesogenic nature of these environments.

-Governments have largely abdicated the responsibility for addressing obesity to individuals, the private sector, and non-governmental organisations, yet the obesity epidemic will not be reversed without government leadership, regulation, and investment in programmes, monitoring, and research.

1 http://www.kondratieffzyklen.de

2 Stratton RJ. Malnutrition: another health inequality? Pennington Lecture. Proc Nutr Soc 2007;66:522-529.

3 Editorial. Urgently needed: a framework convention for obesity control. Lancet 2011; 378:741.

4 Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, Gortmaker SL. The global obesity pandemic: shaped by global drivers and local environments. Lancet 2011;378:804-815.

5 Gortmaker SL, Swinburn BA, Levy D, Carter R, Mabry PL, Finegood DT, Huang T, Marsh T, Moodie ML. Changing the future of obesity: science, policy and action. Lancet 2011;378:838-847.

A UK House of Lords Science and Technology Select Committee[6] examined the evidence base for the effectiveness of nudges in the context of alcohol, food, and physical activity. It was concluded that while businesses and industry with their enormous, expensive and clever advertisements are very effective at nudging people to buy and consume their products, non-regulatory measures to increase consumption of healthy food in isolation are unlikely to be effective.

In the recommendations provided in *The Lancet* five messages for a concerted response were formulated: 1) the obesity epidemic will not be reversed without government leadership; 2) business as usual would be costly in terms of population health, health care expenses and loss of productivity; 3) speed and sustainability of weight loss are usually overestimated and need to be readjusted; 4) basic population weight data and intervention outcomes need to be accurately monitored and evaluated and 5) a systems approach is needed with multiple sectors involved. These recommendations set the basis also for projects and programs developed in the JPI.

WHO[7] identified based on exposure data and the causal associations of risk exposure to disease and injury outcomes as the leading risks for worldwide mortality: high blood pressure (responsible for 13% of deaths globally), tobacco use (9%), high blood glucose (6%), physical inactivity (6%), and overweight and obesity (5%) (WHO, 2009). These risks are strongly associated with the development of chronic diseases such as heart disease, diabetes and with cancers. The burden of disease attributable to risk factors is measured in terms of lost years of healthy life using the metric of the disability-adjusted life year. The DALY combines years of life lost due to premature death with years of healthy life lost due to illness and disability.

Table 1. Ranking of selected risk factors: ten leading risk factor causes of death and DALYs in high-income countries, 2004 (WHO, 2009)

	Risk factor	Deaths (millions)	Percentage of total	DALYs (millions)	Percentage of total
1	Tobacco use	1.5	17.9	13	10.7
2	High blood pressure	1.4	16.8	7	6.1
3	Overweight and obesity	0.7	8.4	8	6.5
4	Physical inactivity	0.6	7.7	5	4.1
5	High blood glucose	0.6	7.0	6	4.9
6	High cholesterol	0.5	5.8	4	3.4
7	Low fruit and vegetable intake	0.2	2.5	2	1.3
8	Urban outdoor air pollution	0.2	2.5		
9	Alcohol use	0.1	1.6	8	6.7
10	Occupational risks	0.1	1.1	2	1.5

Eight risk factors, including high blood pressure, high body mass index, high cholesterol, high blood glucose, low fruit and vegetable intake and physical inactivity account for 61% of cardiovascular deaths. Combined, these same risk factors account for over three quarters of ischemic heart disease: the leading cause of death worldwide (WHO, 2009). Health risks are in transition: populations are ageing owing to successes against infectious diseases; at the same time, patterns of physical activity and food, alcohol and tobacco consumption are changing. Understanding the role of these risk factors is important for developing more effective strategies for improving global health.

Poor diet, sub-optimal lifestyle choices and obesity are implicated as key determinants in many chronic diseases including metabolic disorders, heart disease, stroke, some cancers, chronic respiratory diseases and diabetes. This group of non-communicable diseases alone accounts for almost 60% of all the deaths worldwide on an annual basis. If no positive action is taken it is expected that diet- and lifestyle-related diseases will increase rapidly in the next decade having a negative social and economic impact for many Member States. Cardiovascular diseases and cancer are the top two causes of death in Europe and obesity is the second main cause, after smoking, of developing cancer. The cost of cardiovascular diseases to the EU economy is

[6] Wang YC, McPherson K, Marsh T, Dip PG, Gortmaker SL, Brown M. Health and economic burden of the projected obesity trends in the USA and the UK. Lancet 2011;378:815-825.

[6] House of Lords. Science and Technology Select C0mmittee. Behavioural Change. 2nd report of Session 2010-12. London: The Stationery Office Limited, 19 July 2011.

[7] World Health Organization (WHO). Global health risks. Mortality and burden of disease attributable to selected major risks. Geneva: WHO, 2009.

estimated at €192 billion per year. This figure is all the more staggering when compared to the 2008 EU budget of €129.1 billion. Of the total cost of cardiovascular diseases in the EU, 57% is due to direct health care cost, 21% to productivity losses and 22% to the informal care of people with CVD[8]. It has been projected that by 2020 chronic, diet-related diseases will account for almost three-quarters of all deaths worldwide[9]. There is evidence that improved lifestyles can reduce the risk of type 2 diabetes by 58% over four years. Population studies have shown that up to 80% of cases of coronary heart disease and up to 90% of cases of type 2 diabetes, could potentially be avoided through changing lifestyle factors, and that about one-third of cancers could be avoided by eating healthily, maintaining normal weight and regularly exercising[14].

The incidence of childhood obesity globally is of epidemic proportions with the prevalence continuing to increase at an alarming rate, yet not in all European countries. Globally, in 2010 the number of overweight children under the age of five is estimated to be over 42 million with some 35 million of these living in developing countries. What is more worrying is that evidence is now being presented that overweight and obese children are likely to stay obese into adulthood and more likely to develop diet-related chronic diseases at a much younger age. Cost-effective measures to improve citizens' state of health will deliver social and economic benefits for society and improvements in future productivity and competitiveness.

Physical activity is seen as an equally important key modifiable factor, which contributes to risk of obesity and associated diseases. Furthermore, sedentary behaviour is beginning to be seen as a separate important risk factor; it appears that being sedentary for large periods of the day may carry a separate risk that is not prevented by short periods of activity[10]. There is a need to quantify physical activity and sedentary behaviour combined with research on dietary intake to gain full insight into energy balance and obesity in European populations.

The European population and their food

Attempts to increase public awareness of the best way to eat more healthily have not led to major changes in patterns of food purchase and consumption. More attention must be given to finding ways to increase people's motivation, abilities and opportunities to make healthy choices[11]. To do this effectively, research is needed to discover why consumers make certain choices; what they understand about food; what type of information is lacking; how this information can best be presented; what factors prevent individuals and populations from exercising a healthy lifestyle; and what changes in the food and nutrition environment can 'nudge'[12] us towards more healthy choices. Research has shown that knowledge is often not a direct determinant of eating behaviour. Although some nutrition knowledge appears necessary, effective health behaviour changes need a comprehensive set of measures.

Increased differentiation of (European) populations on socio-economic grounds may increase vulnerabilities in some target populations and this might be exacerbated by genetic population differences. Population subgroups appear more vulnerable to diet-related diseases (for example, population groups with a lower socio-economic status, socially excluded groups, some immigrant communities and ethnic minorities) and in particularly during critical life periods such as pregnancy, lactation, infancy, childhood and older age. Any delay in the onset of chronic diseases, such as cardiovascular diseases, type 2 diabetes and some cancers, or their reduction are important from the perspective of improving quality of life as well as improving European competitiveness through reduced absenteeism, impact on household economic functioning and health services costs.

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8 Allender S, Scarborough P, Peto V, Rayner M, Leal J, Luengo-Fernandez R, Gray A. European Cardiovascular Disease Statistics 2008 edition. Brussels: European Heart Network, 2008.

9 WHO/FAO. WHO/FAO Expert Consultation on Diet, nutrition and the prevention of chronic diseases. WHO Technical report Series, No. 916. Geneva: WHO, 2003.

10 Owen N, Healy GN, Matthews CE, Dunstan DW. Too much sitting: the population health science of sedentary behavior. Exerc Sport Sci Rev 2010;38:105-113.

11 Brug J. Determinants of healthy eating: motivation, abilities and environmental opportunities. Family Practice 2008;25:i50-i55.

12 To nudge is to push into action gently.

The food and drink industry

The food and drink[13] industry is the largest manufacturing sector in Europe and is essential to Europe's wider economic development. It has a share of 1.9% in the total value added of the economy and 2.2% of the employment in 2003, often in rural areas[14]. Key assets of the EU food industry - including plant-, animal- (meat and dairy) and marine (fish, shellfish and seaweed) production - are its cultural diversity, regional specialisation and long-standing tradition. The food and drink industry covers a market of more than 450 million people in the EU. The sector offers a scope for economic growth, especially in the new EU Member States. A highly diverse range of foods is produced but these often involve methods based on craft techniques rather than industrial scale technology. To remain competitive, innovation is essential and the European food and drink industry, which is increasingly unable to compete on raw material costs alone, needs to add value to foods and create healthier, convenient and sustainable products in a more resource-efficient way.

Consumers are also demanding assurance from food producers that ethical and ecological concerns are reflected in the food products they purchase and consume. While these factors exert pressure for change, another group of consumers demands affordable foods. This poses a great challenge to governments and the food and drink industry. New technologies and novel products need to be introduced while establishing and maintaining consumer acceptance and confidence. In addition, the health effects and promotion of key natural foods such as fruit and vegetables, whole grains, meat, dairy and marine products, including fermented foods in the diet should also receive proper attention.

Neither the primary production sectors nor small SME food companies can invest in long-term or large-scale research and development (R&D). In particular, small food companies are unable to take on the innovation challenge: therefore a joint and coordinated initiative is required. Effective partnerships built on public and private collaborations and funding are necessary to identify the most important research needs and to pool resources. Consideration should also be given to laws and regulations and the protection of intellectual property arising from this research to ensure that SMEs can derive benefits from its outputs thus fostering a strong culture of investment in R&D in this sector. This is addressed in the European Technology Platform Food for Life[15].

The way forward: A Joint Programming Initiative for well coordinated and harmonised research activities

Joint Programming is the process by which Member States engage on a variable-geometry basis in defining, developing and implementing a common strategic research agenda based on a common vision, of how to address major societal challenges that no individual Member State is capable of handling independently. For research on the relationship between diet, exercise and health in particular, large population studies and controlled trials are needed that have sufficient power to demonstrate the influence of factors such as individual differences in genotypes and variable dietary patterns on health parameters. Joint Programming entails a voluntary partnership between Member States (and Associated Countries) of the European Union and aims to tackle major European societal challenges by combining and coordinating national research programmes and thereby making better use of Europe's public R&D resources. The Joint Programming process has the potential to bring major benefits by:

- helping to coordinate the scope of research programmes across Europe and diminish duplication in effort;
- making it easier to address common challenges, to develop common solutions and to speak with one voice in the international arena on food and nutrition policy;
- promoting scientific excellence through joint calls with common funding;

[13] In this document when food industry is mentioned, this refers to the food and drink industry, including plant-, animal- and fish production.

[14] Wijnands JHM, van der Meulen BMJ, Poppe KJ (eds.) Competitiveness of the European food industry. An economic and legal assessment. Luxembourg: EC, 28 November 2007.

[15] www.etp.ciaa.eu

- supporting cross-border collaboration and facilitating data pooling (preferably collected in a uniform and standardised way) and by sharing expertise scattered across the countries or throughout Europe as a whole, so as to enable the rapid dissemination of research results, promoting cross-border mobility and training of human resources and by increasing the scientific, technological and innovative impacts of every Euro invested in public research;
- increasing programme depth; help strengthen the coordination with other related policies by virtue of greater programme visibility and by enabling cross-border policy learning;
- use of public resources more efficiently and effectively by reducing programme management costs and by improving the accountability and transparency of public research programmes.

Europe's research landscape is still highly compartmentalized. Today, 85% of public R&D is programmed, financed, monitored and evaluated at national level, with little trans-national collaboration or coordination. Less than 6% of total R&D investment and only 15% of European publicly-funded civil R&D (of which 10% is accounted for by intergovernmental organisations and schemes, and 5% by the Framework Programme of the European Commission) is financed in a cross-border collaborative manner[16]. Thus, one of the most obvious causes of sub-optimal returns from R&D has been insufficiently addressed, namely the lack of collaboration and coordination between national public R&D programmes. By enhancing cooperation among those that develop and manage research programmes, Joint Programming aims to:

- reinforce the capacity to transform research results into societal and economic benefits, notably through the innovative capacity of European industry as well as through educating consumers to better understand novel, healthier food products;
- contribute to the creation of the 'fifth freedom' by removing barriers to the free movement of knowledge;
- develop suitable methodologies and research protocols and standards;
- help overcome barriers to entry, such as high start-up and operating costs in certain science and technology fields;
- lead to improved and standardised nutrition- and health-related statistics and evidence needed for policy-makers to base their decisions on.

Joint Programming may involve strategic collaboration between existing national programmes or jointly planning and setting up new initiatives. In both cases, it entails commitment from Member States and putting resources together, selecting or developing the most appropriate instrument(s), implementing, and collectively monitoring and reviewing progress. There is no need for all Member States to be involved in a specific initiative, but the partners must be able between them to provide the required critical mass of resources. Close cooperation is needed to ensure that resources are targeted effectively and efficiently to societal and scientific challenges, without unnecessary duplication of effort or leaving gaps that would reduce opportunities for innovation. Where necessary, experience and best practices from outside Europe must be captured and, if necessary, adapted before being exploited across the continent.

As well as having implications for quality of life, additional ramifications for a European innovation trajectory can be identified. For example, there is an urgent need to more effectively translate results of scientific research into concrete and actionable policy initiatives. Closer interaction between policy actors and scientists would ensure that policy questions asked are translatable into scientific activities, and *vice versa*. More effective collaboration between the natural and social sciences is required, as many of the issues and emerging problems are caused by both biological and socio-economic factors and their interaction.

[16] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the committee of the Regions. Towards Joint Programming in research: Working together to tackle common challenges more effectively. Brussels, COM(2008) 468.

The Vision

Vision

The vision of the JPI on *A healthy diet for a healthy life* is that in 2030 all Europeans will have the motivation, ability and opportunity to consume a healthy diet from a variety of foods, have healthy levels of physical activity and the incidence of diet-related diseases will have decreased significantly.

Strategy

Joint programming will contribute significantly to the construction of a fully operational European Research Area on the prevention of diet-related diseases and by strengthening leadership and competitiveness of the food industry by effectively integrating research in the food-, nutritional-, social- and health sciences to increase knowledge and deliver innovative, novel and improved concepts and products.

Strategic goal

To change dietary patterns based on developments in food-, nutritional-, social- and health sciences and to develop science-based recommendations and innovative product formats, that will, together with concomitant changes in physical activity, have a major impact on improving public health, increasing the quality of life and prolonging productive life.

Joint programming in the field of nutrition, food, exercise and health with improved coordination of research should lead to a fully operational and coherent European Research Area on prevention of lifestyle and diet-related diseases with strengthened leadership and competitiveness of the research[17]. An integrated multi-sector approach, embracing education, health care, agriculture, environment, food and drink industry, transport, advertising and commerce is essential to position food, nutrition and related public health policy and evidence from research sufficiently high on the political agenda to ensure the combined effort translates into real health improvements.

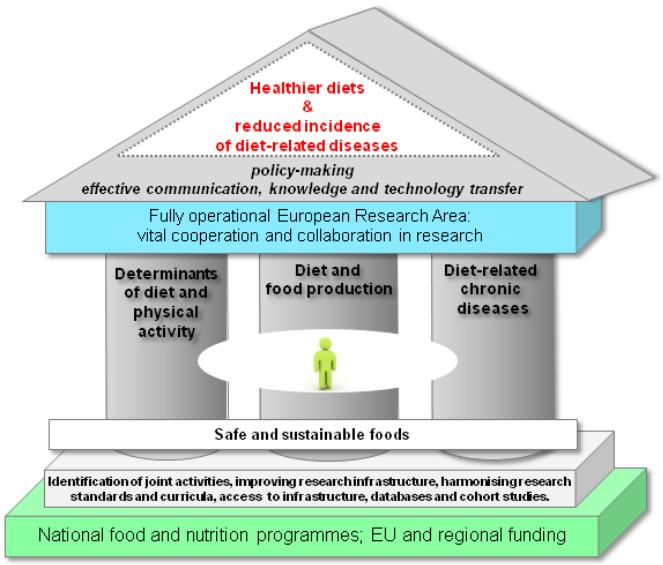

Figure 1. Schematic presentation of the activities and research areas of the JPI A healthy diet for a healthy life.

Figure 1 shows the activities and research areas identified to reach the vision of the JPI *A healthy diet for a healthy life*. The following three key interacting research areas were adopted in the Vision Document.

[17] Commission staff working document. Research Joint Programming Initiative on ' A healthy diet for a healthy life': motivations and state of play of research at European level. Brussels, 28.4.2010. SEC(2010)480 final.

Determinants of diet and physical activity: ensuring the healthy choice is the easy choice for consumers

This research is to understand the most effective ways of improving public health through interventions targeting diet and physical activity. Research would include studies, which aim to improve understanding of the different biological and socio-cultural factors, which impact on health and how they interact. The research would deliver information which would allow the development of interventions which would modify the impact of individual, social, economic, cultural, biological and other factors, which affect dietary and physical activity behaviour. Interaction with the other research areas is required to develop a full picture of potential determinants.

Diet and food production: developing high-quality, healthy, safe and sustainable food products

The food industry is faced with the challenge of producing tasty foods that are consistent with health status and lifestyle, and which meet consumer preferences. This requires research to develop new food products and to improve production, processing, packaging and proper food chain management. New food products have to comply with nutritional, energetic and safety needs of the consumer and also with legislation. An additional challenge is to develop innovative products and processes in a cost-effective and sustainable way. Foods must originate from systems that produce, process, store, package, supply foods in a sustainable way[18].

Diet-related chronic diseases: preventing diet-related chronic diseases and increasing the quality of life - delivering a healthier diet

Effective nutrition and lifestyle-based strategies are needed to optimise human health and to reduce the risk, or delay the onset, of diet-related diseases. These strategies require, for example, research efforts on obesity, its causes including neuroscience and its associated metabolic disorders; on maternal and infant nutrition; on osteoporosis and malnutrition in the elderly; on micronutrient deficiencies and cognitive development and decline. The gastrointestinal tract is the key interface between food and the human body and its role to human health (including immune functions) needs to be fully elucidated. This needs the incorporation of the gut indigenous microbiota as a metagenome with unique metabolic features.

Strategic Research Agenda

This Strategic Research Agenda (SRA) defines in its three research areas and based on the Vision Document the knowledge base and the structural framework that needs to be generated and proposes strategies on how to apply new and established knowledge to achieve the overall goal of the JPI *A healthy diet for a healthy life*. In the following chapters the research priorities for each of the three defined themes of the JPI are described. The SRA identifies in each theme the knowledge gaps and defines research needs and instruments. It also defines the different types of knowledge needed and how they relate to each other and proposes of how results can be implemented. The inventory of European research projects made by FAHRE was used to identify possibilities for short-term cooperative efforts.

In the following chapters the prime initiatives and research challenges for each research area are indicated for 2012, 2015 and 2020.

Most important policy and societal problems

- Preventing or decreasing the incidence of diet-related diseases;
- Quality of life, health and participation of the ageing population;
- Social inequality related to health, diet and physical activity;
- Reversing the increased incidence of obesity because of the negative impact on economic, social and health-related issues;
- Maintaining competitiveness of the food and drink industry for employment and wealth in Europe;
- Providing a healthy, sustainable and safe food supply and at a reasonable price;
- Training and education to remain in a leading position.

[18] A call for an ERA-NET on Sustainable food production and consumption will be launched by the EC begin 2011.

Research area 1: Determinants of diet and physical activity

Ensuring the healthy choice is the easy choice for consumers

The challenge is to understand the most effective ways of improving public health through interventions targeting dietary and physical activity behaviours.
In 2030, all European consumers will have the motivation, ability and opportunity to choose a healthy lifestyle.

Overall goal

To understand the determinants at the individual and group levels regarding diet, physical activity and sedentary behaviour from a biological, ecological, psychological, sociological and socioeconomic (multidisciplinary) perspective and their interrelationships and translate this knowledge into a more efficient promotion of a healthy lifestyle.

Scope

The consumption of food is associated with please and is also associated with cultural association and symbolism. Economic factors are also relevant as well as consumer preferences for sustainable production, etc. If food and drinks are consumed in the right amounts and with the right composition, they should make a major contribution to well-being and healthy ageing. Research is required to increase the understanding of health-impacting behaviour with respect to making food choices and the extent to which people engage in physical activity, to create insight on how the social and physical environments influence this behaviour and to raise consumer understanding of healthy foods, healthy diets and healthy lifestyles.

The European consumer population is highly diverse and there is a wide variety of foods and drinks consumed across Europe. Consumers also have different levels of physical activity. This provides a unique opportunity to study the relationship between food intake, physical activity and health. Research in this area should be focussed on developing the most effective ways of improving public health through interventions by diet and physical activity, and this requires a better understanding on how individual, biological, social, economic, cultural and other environmental factors collectively determine consumers dietary and physical activity behaviour and how to change it. Conceptually this requires a choice architecture that can help nudge people to make better choices (as judged by them) without forcing certain outcomes upon them. Special attention needs to be put into health issues based on the background of social inequality and of minority groups. Results generated will be of importance for policy makers, professionals in the public health area, food industry and citizens. Proposed research efforts should reach from research networks to an integrated European programme.

Prime initiative for 2012: Establish a European trans-disciplinary research network on determinants of dietary and physical activity behaviours and the relation with health and best practice implementation strategies for sustainable changes

The objective is to improve the understanding of how individual, social, economic, cultural, gender, biological, environmental and policy factors influence consumer decision-making in the context of diet and healthy lifestyle. An important element is to integrate the biological and social sciences for a better understanding on how individual social environmental parameters interact when considering the effects of food and physical activity choices on health.

Increased differentiation of (European) populations on cultural, socio-economic and environmental grounds increases disease vulnerabilities in some target populations and this may interact with biological differences across the European population. For example, groups with a lower socio-economic status, individuals living in disadvantaged neighbourhoods, socially excluded groups, some immigrant communities and ethnic minorities have frequently lower health status. People

may also be differentially vulnerable during critical periods throughout life, such as pregnancy, lactation, infancy, childhood and at older age. Given that the causes of diet-related diseases, as well as other barriers to health, have altogether socio-economic, environmental, and biological origins, more effective collaboration between the biological and social, economical, environmental and political sciences is required. Theoretical frameworks and models which integrate in a systems approach determinants of food and physical activity choices originating in these different domains are needed if effective policy is to be developed regarding optimisation of European consumers health.

Although there has been extensive research in different disciplinary areas focusing on this topic, integration is poor. Results can not easily be translated to integral interventions. An effective approach to integrating activities might involve funding of science networks which will enable researchers from the different disciplines to collaborate and create databases for further analysis with standardised and innovative measures on consumption of food, on physical activity levels and sedentary behaviours as well on other determinants with the goal to facilitate prospective studies at a pan-European level. The great variability of diet and activity patterns observed across Europe concomitantly with a high diversity in cultural, social and environmental aspects as well as in health outcomes is useful to learn more about determinants of food choice and physical activity.

Research challenges

This research challenge requires first the collection, integration and assessment of monitoring systems, databases, determinants and outcome measures. This could be realised by European trans-disciplinary research networks that bring different science disciplines together and promote their interactions. Key participants from both the biological sciences and the human and social sciences should map the requirements of such a network and discuss the predefined research challenges and develop strategies on how to implement pan-European activities. This should also lead to capacity building across Europe and by integrating areas where capacity is low, for example on research focused on understanding consumer behaviour, food choices, physical activity and other lifestyle behaviours. An important challenge is to overcome the gap between research and policy translation. To meet policy demands, research needs on type of data required, for example related to consumer food choices, sedentary and physical activity behaviours, health and related policy issues have to be defined.

- Foster methodological harmonisation and development of standard operating procedures in all relevant disciplines, including the social and geographic sciences with the goal to obtain *all* relevant data in the most harmonized manner. Examples are the initiated nutritional phenotype database or those that cover consumer attitudes/behavioural measures under real-life conditions. Harmonising existing and developing new, innovative methods to measure food intake, physical activity and sedentary habits is as well urgently needed.
- Establish a joint and standardised monitoring system of dietary intake and physical activity patterns across countries. Much information can be gained from pooling existing prospective cohort studies and regular food consumption measurements.
- Establish and maintain an integrated trans-disciplinary database, with potential for secondary analysis by interested researchers with specific research hypothesis, assuming the initial data are collected according to best practice in biological, behavioural, socio-economic and environmental science traditions.
- Implement systematic foresight activities and initiate scenario building processes, which include relevant expertise from all EU countries, for example, through application of Delphi surveys or systems analysis approaches involving multiple sources of expertise. The goal of such activities would be the generation of a common research agenda focused on integrating the social, environmental and biological determinants of food, physical activity, sedentariness and health relevant to European research needs.

Prime initiative for 2015: Create pan-European programmes that utilize a prospective design and a comprehensive approach of diet and physical activity in real-life conditions to better understand how individual, social, environmental and policy factors interact to shape behaviours that promote the incidence of chronic diseases; use pilot and feasibility studies with different levels of complexity in interventions (including natural experiments) to determine the most effective ways of promoting a healthy lifestyle by also integrating social inequities

There is a lack of validated predictive models of consumer food and activity choices and behaviours in relation to health and, therefore, the impact of interventions is still difficult to predict. Current research is mostly observational and often cross-sectional precluding any causal relationship inference. Moreover, studies tend to relate to a single outcome and do not integrate the complexity of the interactions between biological, psychological, social and environmental determinants. The variability of diet and activity patterns observed across Europe associated with the high diversity in foods offered in different social, economic, cultural and built or environment settings offers a unique opportunity for pan-European longitudinal research approaches with prospective multi-centre 'natural experiment' studies. The aim is not only to raise consumer understanding but also their motivation, ability and opportunity to change their behaviours, in order to inform policy-makers, health care professionals, food industry on the best way to improve health. Research outcome will be a better insight into the relationships of behaviours and health in humans with a given social, organisational and built environment.

Research challenges

As well as developing targeted interventions, or developing empirical research which is hypothesis-driven, it is possible to assess the impact of changes in the 'real world' on people's behaviour in relation to diet and exercise. Examples would include changes in the disposable income of consumers or the way in which food retail environments are developed or foods are marketed. The aim is not only to raise consumer understanding but also their motivation, ability and oppurtunity to consume healhty foods and being active. For example, it is of interest to develop new approaches to assess socio-spatial influences on food and physical activity choices in different settings, as well as how people actively move within spaces and environments. An essential element is the study of complex interactions of biological, psychological, environmental and socio-cultural factors underlying dietary choices. Validated predictive models of consumer food-related behaviour need to be developed and tested against health-related quality of life and economic functioning including targeted interventions. The interaction between biological, psychological and socio-cultural factors is important determinants in dietary choice, and cultural factors play an important role in determining food choices. Full account needs to be taken of people´s education and socio-economic status when developing and testing interventions.

- Develop new approaches to assess socio-spatial influences on food and physical activity choices in different settings.
- Characterise the basis of individual differences regarding the effects of nutrients, physical activity and sedentary behaviour on health and identify genetic factors and biomarkers which influence these parameters food choice, food impact on peripheral organs, interactions between food and physical activity and the underlying mechanisms and study the differences in the individual effects of the dietary habits and their correlation. Study brain functions in the context of (sensory) inputs and decision making regarding food choices, behaviours and health.
- Design new prospective, multi-site cohort studies in order to better investigate determinants across various population groups. Such studies could also help serve as an infrastructure for evaluation of interventions and policies to improve the diet and physical activity levels.
- Test different types of designs, including large scale intervention studies, to assess changes in food and physical activity behaviour in real life conditions and define outcomes that would be relevant according to settings. In this context an integrative and comprehensive approach of diet and physical activity could rely on the use of new tools such as accelerometry or energetics and feeding behaviour loggers or biomarkers, combined with the most recent geographic and environmental measures. Pilot studies conducted in a few European regions with different living

conditions could allow to identify the more pertinent methodologies and help to standardise their use.

- Promote science in analysis of cost-effectiveness of policies and interventions and evaluating these against quality of life indicators and well-being measures. Validated predictive models of consumer food-related behaviour need to be developed and tested against health-related quality of life and economic functioning including targeted interventions.
- Incorporate better standardised and innovative measures of behaviours and of social/built environments into on-going large multi-centre longitudinal studies, such as EPIC, or in newly established or designed cohorts with a large number of participants in different age groups. As part of this, it is important to extend existing cohort studies by including Member States not yet part of any of these programmes.
- Examine implications of social inequality and minority health challenges require much more research and knowledge related to the needs of specific target groups (SES and minority groups), and in particular the impact and effects of policies and interventions on these various groups. Develop a theoretical framework for the design of studies assessing behavioural changes in real life conditions.
- Carry out systematic reviews, meta-analyses, and mediation and moderation analyses of intervention and policy programmes across Europe to identify the policies and interventions that had an effect. These results could be translated into large scale demonstration projects.

Research area 2: Diet and food production

Developing high-quality, healthy, safe and sustainable food products

The challenge is to stimulate the European consumers to select foods that fit into a healthy diet and to stimulate the food industry to produce healthier foods in a sustainable way.
In 2030, European consumers will have a good choice of healthy foods to select from: the healthy choice has become the easy choice.

Overall goal

To improve the quality of foods, food production systems, distribution and marketing to provide healthier, safe and sustainable foods that contribute also to market advantages for the European food producers and the food and drink industry.

Scope

The concept of food quality has changed over the years. Whereas in former days safety was strongly emphasised, food and drinks nowadays are expected not only to be safe and of good taste, but be affordable, easy to prepare and to contribute to enjoyment, health and well-being. Changes in society and demographic trends, such as smaller household sizes, an ageing society, working parents, and increases in proportion and integration of ethnic groups in many EU Member States, will have an impact in the choice of foods, the ways on which food will be prepared and the places of consumption.

Traditionally, nutrition goals have been set at the average population level. However, new research is increasingly showing that the risks, benefits and nutritional requirements may vary between different population groups and even between individuals on basis of their genetics. Better understanding of these determinants and requirements is necessary so that dietary advice can be more focused on the needs of particular consumer groups and can even lead to development of specialised food products and services for specific groups of consumers (‘personalised nutrition’, functional foods, food supplements). These needs, but also special nutritional requirements for different age groups, are strong drivers for the food and drink industry to produce innovative products that fulfil these expectations.

The food industry is faced with the challenge of producing tasty foods that are consistent with health status and lifestyle, and which meet consumer preferences and thus ensure repeated purchase. This requires research to develop new food products and to improve production processing, packaging and proper food chain management. All new products have to comply with nutritional and safety needs of the consumer. Health promotion via food products requires research to identify key bioactive components in foods and the mechanisms by which they are handled in the organism and their mode of action, including dose-response studies. Therefore, it is essential to obtain in-depth knowledge of the nutritional and functional characteristics of foods and diets. This knowledge is also important for improved benefit-risk assessments.

An additional challenge is to develop innovative products and processes in a cost-effective and sustainable way. Foods must originate from systems that produce, process, store, package, supply foods in a sustainable way. Several European Member States have or are implementing programmes for the production of more sustainable foods and for reducing food spoilage. It is a challenge to provide the consumer with the right type of food at the right time and in the right place. Innovative processes, value-added products, new marketing concepts, novel ways of selling products and improved production and supply chains are needed. Products must fulfil consumer expectations on safety, the required sensory characteristics and provide a maximum of convenience at an affordable price. Research on new technologies is continually required, also in the food safety field. There is a need for improved methods, including rapid methods for field application, in-line methods for continuous safety management in food processing, and precision and reference techniques for research and confirmatory purposes. New technologies are expected

to lengthen shelf-life and reduce food spoilage. In addition, environmental issues related to sustainable food production, minimisation of waste production and use of non-renewable raw materials will obtain increased priority.

The food industry will need to adapt and incorporate modern production philosophies, such as lean and agile manufacturing which have proven successful in other market sectors and which allow producers to remain at the forefront of market innovation. Overall, attention must be paid to the entire process and production lines to optimise each of the individual elements.

Prime initiative for 2012: Set up a roadmap-initiative for biomarkers of nutrition and health; define research strategies and launch research activities that address the needs of consumers as well as industry towards measures on health claims and explore new methodologies or emerging biomarkers in consumer subgroups (target groups) or individuals at risk

A first step should be to set up a roadmap-initiative and create a European research and stakeholder´s network. A large number of applications on health claims according to the EU regulation on health claims (EC No 1924/2006) have been received by EFSA demonstrating the general interest of industry (both small and large) on claims such as the generic health claims (Article 13.1), specific health claims (Article 13.5) or health claims referring to the reduction of disease risk and those regarding children's development and health (Article 14). In assessing the applications, the EFSA's NDA Panel (Panel on Dietetic Products, Nutrition and Allergies) in most cases came to the conclusion that the scientific evidence is insufficient in support of the intended claims. Although the NDA panel has been criticized by parts of the science community and industry for 'rigid' assessments, a large number of the applications did indeed not meet the required criteria for scientific prove. This can be attributed to a lack of knowledge of the applicants on the scientific requirements and/or their inability to allocate the financial resources (and other caveats) to meet the criteria. As a prime outcome, numerous activities in industrial R&D in exploring the functions of food ingredients in human health and in developing health-promoting food have been markedly reduced. This has major implications. Even public funding of the research may be affected if translation into products and other applications cannot be made as some national funding agencies require the participation of industry – mainly SMEs – in grant applications.

Competitiveness of the European food and drink industries may be threatened with markets moving away. If industry is not developing and promoting healthy choices, the burden of diet-related diseases will further increase in Europe. This all needs a reassessment and new balancing of consumer expectations, consumer protection and the scientific requirements for claims. There can be no doubt that insufficient scientific knowledge on the effects of individual food ingredients and technologies is hampering progress in the field. This applies to both academic research and industrial R&D and finally also to consumer interests in a wider range of healthy products. More human studies taking into account human diversity and phenotypic differences and in specific target groups (children, seniors) or groups of increased disease risks are required. There is also a need for better (surrogate) markers that indicate health improvements or at least for preventive measures in an organ-specific and target group specific manner. Procedures for finding scientific consensus in support of the NDA Panel as well as for academic and industrial research need to be improved as well.

Research challenges

- Establish a health claim and biomarker expert platform for defining organ-specific health (gut, brain, immune system, cardiovascular system, bone, muscle, skin, respiratory and endocrine systems) in the general population as well as for defined subgroups.
- Promote large scale biomarker assessment programmes employing bio-bank samples (omics-based) and other disease register sample collections in which clinical endpoints can be tested against the putative biomarkers of health with an emphasis on identification of dietary components effects (if covered) as an input variable.

- Initiate new programmes in which shared concepts and joint research efforts for SMEs in the food and drink industry (with IP sharing) allow product development and launching (distribution of financial risks).
- Implement better educational programmes on progress in science in the nutrition and food science areas and on needs for scientific proof of dietary interventions and the effects of ingredients.
- Launch programmes that take advances in science (genotyping, phenotyping) into account when planning human trials for assessing safety and functionality of food ingredients.
- Develop and validate biomarkers of health and food intake using novel approaches including functional genomics, food metabolomics, microbiomics, epigenetics and by exploring markers in human studies based on foods (not solely individual ingredients).
- Define research activities and strategies that also address the needs of industry towards EFSA measures on claims and for comparison along consumer subgroups (target groups) with individual risk.
- Define the methodology necessary to prove the nutritional effects in the development of food products. The pharmacological approach is generally not applicable to food complex products with their smaller physiological activities and effect sizes. A new framework for the evaluation of the scientific value of the studies conducted for health claims should be defined.
- Discuss, evaluate and decide on price policy and nutrition profiling.

Prime initiative for 2015: Initiate research programmes (i.a. ERA-NETs) on comprehensive analyses of the metabolic fate of food constituents (nutrients and other bioactives, including microbiota effects) in human physiology with a strong emphasis on different population groups, including the elderly.

It is the goal to define and catalogue the fate of food constituents in humans. Bioavailability of food constituents is dependent on numerous factors including food matrix and meal composition but also the biology of the host and its microbiota. Numerous studies have addressed the putative health-promoting functions of a wide range of foods, ingredients and in particular of plant bioactives. Yet in most cases, the nature of the compound(s) that carry the biological activity is not known. One of the reasons is that the compounds undergo substantial phase I, II and III metabolism in intestine, liver and other tissues with a large spectrum of conjugates appearing in circulation. In addition, it has become clear that for some categories of plant bioactives the microbiota plays a crucial role in bioavailability and function in the host allowing responders and non-responders to be defined. Moreover, bioavailability of dietary constituents (essential as well as non-essentials constituents) appears to be reduced in the ageing organisms putting the elderly at risk for malnutrition not only by low intake of nutrients (impairments in taste perception, satiety control, chewing, etc.) but also by impaired functions of the gastrointestinal tract and the metabolic system.

To better understand the fate of food constituents in humans and their biology, including the heterogeneity in individuals (host and microbiome) in handling of the compounds a concerted action of academia and industrial R&D is needed. New parallel methods for detection, identification and quantification of food compounds (nutrients and plant secondary components and metabolites) including stable isotope labelled standards for quantification in metabolism are required. This should allow for example, a classification of compounds undergoing similar biochemical reactions and could lead to a reference data base on bioavailability and kinetic behaviour. A stable-isotope labelled food ingredient inventory for all studies in the food sciences and for analysing their properties (ADME) in humans would be a helpful tool.

Bioactives in foods use the same pathways of xenobiotic metabolism as drugs and this means that food ingredients can alter drug bioavailability and drug efficacy. The most impressive examples are the ingredients in grapefruit; one glass of grapefruit juice was shown to alter drastically the plasma concentrations and functions of numerous drugs of all different classes. These possible side effects are labelled in drug use leaflets (package insert) but are not considered in the food area. In an ageing population with multi-morbid individuals using a large variety of drugs on a regular basis,

food-drug interactions are a growing problem and this in particular with respect to bioactive food ingredients. But also other food ingredients (fat, protein, etc.) can alter drug availability, action and elimination. It is a necessary also for food industry to address this issue (liability) and create awareness. A research effort that addresses in proof of concept studies these food-drug interactions with partnerships along pharma and food (R&D and academia) is needed to provide a knowledge base and create awareness for this problem. An expert panel on food-drug interactions for safety assessment (both in drug as well as food) should as well be established. This project is of high societal importance and crosses borders between pharma and food for the safety of the European consumers. It can be foreseen that this issue will obtain more public attention and may become important also from a liability perspective.

Research challenges

Increasing the scientific knowledge needed to develop foods to improve health

Research and innovation in food processing should be both fundamental and consumer-oriented with the goal to improve product quality and promote healthy eating. This may include reformulation of existing products to make them healthier without changing the characteristics of the product or by new, innovative foods. European research on the composition of foods, the effects of the food matrix and of food constituents in the human system will help product development and set the basis for approved health benefits. Important other issues are the presentation and marketing of foods and various social aspects. The development of healthy food products with scientifically validated health effects, and therefore with a clear added value, is another challenge for food industry and society. Collaboration of scientists in academia and industry but also partnering with various stakeholder groups is essential for the development of these products and their validation.

Food chemistry and technology research

- Enable redesign and optimisation of food processing and packaging.
- Improve food composition databases by including apparent bioavailability of ingredients.
- Explore the use of nanotechnologies and biotechnologies including their safety assessment in food systems or for food ingredients/bioactives with improved stability, absorption and efficacy.
- Promote more efficient and better coordinated (trans-disciplinary) research on new and known bioactives (plant and animal raw materials and Improve food composition databases by including apparent bioavailability of ingredients (involve EuroFIR).
- Use of nanotechnologies and biotechnologies including their safety assessment in food systems or for food ingredients/bioactives with improved stability, absorption and efficacy.
- Promote sensory science (flavour and texture) related to satiety and food intake control.

Health-related research

- Develop and validate biomarkers of health and food intake using novel approaches including functional genomics, food metabolomics, microbiomics, epigenetics and exploring markers in human studies based on foods (not solely individual ingredients).
- Launch a programme on bioavailability of plant secondary metabolites in the human system with validated methods and compound identification as well as defining the role of microbiota (food metabolomics approach) in functions and the effects of the diet on the microbiota. Understanding microbial metabolism and identifying metabolites produced and their effect on human health is essential for food products that combine bioactives with ingredients that modulate the gut microbiota (including the supply of probiotics and prebiotics). This research could benefit from collaboration between food and medical sciences.
- Promote more efficient and better coordinated (trans-disciplinary) research on new and known food bioactives.
- Define, evaluate and coordinate research on structure-function relationships (bioavailability and bioefficacy) of foods and ingredients for better design of food structure/properties in relation to nutrition and health.
- Define strategies and methodologies that address measures on health claims (particular consumer subgroups at risk) and re-evaluate the scientific assessment process.

- Establish scenario-building processes to explore how a healthy lifestyle can be better achieved in the economics boundaries of current market systems.
- Explore the concept of personalized nutrition with balanced meals and new business models.
- Explore the use and safety of novel technologies (including nanomaterials and nanotechnologies) for food ingredients (food bioactives) with better stability, absorption and efficacy or improved sensory characteristics.
- Promote public dining: meals at schools, hospitals, workplaces.

Reducing food spoilage and increasing safety and sustainability of foods

The fast pace of modern lifestyles and the increase in single-person households, one-parent families and working women have lead to changes in the food preparation and consumption habits. Food technology, processing and packaging techniques have already adjusted to these changes but must ensure the safety and wholesomeness of the food supply in the convenience sector. In spite of major advances in the past, contamination in the food chain by either naturally occurring or accidentally introduced contaminants or by malpractice does occur. Ultimately, the quality and safety of food depends on the efforts of everyone involved in the complex chain of agriculture production, processing, transport, food production and consumption. As the EU and the World Health Organisation (WHO) put it succinctly - food safety is a shared responsibility from farm to fork. Maintaining the quality and safety of food throughout the food chain requires both operating procedures to ensure the wholesomeness of food and monitoring procedures to ensure operations are carried out as intended.

There is only little information on food spoilage on a European scale. If there is more information on (determinants of) food spoilage, strategies could be developed for reduction of food spoilage. On the consumer level this should be done by creating awareness and on industrial level this should be done by improving agricultural and food production systems and packaging.

- Compile on European scale food spoilage (in production and households) and develop strategies for reduction of food spoilage (on consumer level, awareness) and by improving agricultural and food production systems and packaging.
- Develop smart sensor systems that allow safety of foods and quality to be monitored.
- Improve food production systems in view of sustainability including agronomic traits, transgenic technologies, optimisation of fermentation processes, separation and processing technologies

Developing specific products for population groups

There are several target groups that could use products that meet their specific dietary needs. Although there are specialised food products for consumers suffering for example form celiac disease or lactose intolerance, foods that help to manage better other (chronic) diseases ma y be developed. This may cover all diet-dependent diseases (cardiovascular, diabetes, intestinal bowel diseases (IBD/IBS) and others. Elderly are a target group for whom more specific products should be developed and so are pregnant women and children. The specific products for these target groups should match the dietary needs but attention needs to be paid to sensory aspects.

- Develop proper products for the elderly that target dietary and sensory needs and assess routes of placement and target-group specific marketing.
- Develop proper products for pregnant women and children and assess routes of placement and target-group specific marketing.
- Develop packages targeted for specific populations such as ‘easy to open’ for the elderly or for single person households. Design should as well satisfy the need for information and motivation to use.

Research area 3: Diet-related chronic diseases

Preventing diet-related chronic diseases and increasing the quality of life - delivering a healthier diet

The challenge is to prevent or delay the onset of diet-related chronic diseases by gaining a better understanding of the impact of nutrition and lifestyle across Europe on human health and diseases.

In 2030, the incidence of diet-related diseases will have decreased significantly and will continue to decline thereafter.

Overall goal

To pool existing national data and knowledge and define new research lines to improve our capacity to understand the qualitative and quantitative links between diet, the nutritional phenotype and risk factors for diet-related chronic disease. This includes the needs for proper and predictive biomarkers (based on novel life science technologies) that characterise the trajectory form health to disease in the context of dietary intake and phenotypic changes. This may be achieved by the re-analysis of existing dietary intervention studies and newly designed studies. Individual organs display different susceptibilities and the effects of dietary factors and lifestyle, including a too high food intake and low grade inflammation, need to be explored with respect to new treatment options or adjuvant approaches for organ-specific improvements.

Scope

Although epidemiological studies suggest an association of food categories (meat, fruit and vegetables) and individual dietary constituents such as fibres, vitamins and trace elements with human health, randomised controlled trials with, for example, vitamin supplements have in many cases failed to show beneficial effects. This may be due to the heterogeneity of the study populations (including genotypes) and future studies should take this into account. Although genome-wide association studies (GWAS) have yield a wealth of information on human genetic heterogeneity and risk alleles, what has become obvious, is that information on dietary exposure as well as on phenotype is insufficient for defining causal relationships. Obtaining information on diet and other lifestyle factors and in particular on the human metabolic condition is much more difficult and demanding than genotyping which is just based on technological advancements. A better understanding of how diet contributes to the health-disease trajectory on basis of a given genetic makeup therefore requires large scale cohort studies with a much better definition of the volunteer phenotype. For such studies more focus should in future be put on whole diets, whole foods and food patterns in assessing their contribution to the health status as well as on their interactions with physical activity and other health behaviours. Much of the research below will be intricately linked with that of the other research areas.

Both, poor nutrition but also overeating and insufficient physical activity can lead to changes in gene expression and epigenetic alterations that cause sustained impairments for example in immune responses and increase the susceptibility to disease. They also contribute to impaired physical and mental development, and reduced productivity. Advanced technologies for the first time allow the effects of diets to be studied on each level along the flow of biological information from the genome to the transcriptome, proteome and metabolome and thus the human phenotype. When embedded into the life stages this research can deliver improved assessment methods for disease risk and when applied to optimise human health can help to reduce the risk, or delay the onset, of various diet-related diseases. These strategies require, for example, research efforts on how diets affect the conditioning to obesity and cause alterations in food intake control and this research should bridge to the neurosciences. Almost all chronic diseases have a state of low grade inflammation as base and this derives from the metabolic perturbations. Understanding how diet (diet composition) can interfere with these mechanisms is of greatest importance for effective food-derived strategies in prevention. Maternal diet and infant nutrition are key determinants that by imprinting and epigenetic effects can cause a disease predisposition and current knowledge is

insufficient for translation into public health. Age-related diseases such as osteoporosis, sarcopenia or cognitive require better treatment options and prevention strategies and proof of concept studies. Micronutrient deficiencies in various subgroups are emerging despite high energy intakes. Awareness for this problem needs to be created and proper prevention strategies need to be developed.

But not only biology is a key factor in the diet-disease relationship. Taking into account the greater incidence of obesity in people with lower income or lower education or nutrient deficiencies in subgroups of the population, it is important to improve education on the role of healthy diets and by providing proper foods at an affordable price for those target groups.

Prime initiative for 2012: Establish a European Nutrition Phenotype Assessment and Data Sharing Initiative providing a standardised framework for human intervention studies on food and health and their phenotypic outcomes with an open access reference database

Over the last several decades, dietary surveys have been conducted at national or large regional level, providing valuable data on patterns of food intake, the nutritional quality of nutrient intakes, some overview of anthropometric data such as weight and height, data on physical activity and in a limited number of such surveys, data on standard nutrient-relevant biochemical variables. These data have helped policy makers to develop guidelines to improve dietary habits and have been valuable to industry to understand the relevant contribution of different foods to given nutrient patterns.

In recent years there has been a move away from these limited databases to larger, more comprehensive databases which embrace the traditional food and nutrient intake data but which are extended to include much more comprehensive data on physiological function, physical activity and clinical data as well as the collection of extensive data on genotype, on metabolomic profiles and to a limited extent data on proteomics or protein profiling and transcriptomics (gene expression). These new large comprehensive datasets are now referred to as Nutritional Phenotype Databases.

The challenge to create large national nutrition phenotype databases was first mooted by the Long Range Planning Committee of the American Society of Nutrition Sciences[19] and was the take on by the European Nutrigenomics Organization (www.nugo.org) leading to a major initiative of the FP6 network of excellence (www.nugo.org/dbnp) with the publication of some key influential papers[20, 21]. Several countries have moved toward the construction of nutritional phenotype databases such as in Ireland (www.ucd.ie/jingo) and in the Nordic region (http://www.sysdiet.fi). Other organizations in the EU, such as for example the Netherlands Metabolomics Centre (www.metabolomicscentre.nl) are also operating in this area. The large amount of phenotypic data linked to genotypic and dietary data allows these Nutritional Phenotype Databases to search for nutrient-gene interactions, which drive phenotypic changes.

The different national dietary or phenotype databases need to be merged into large mega-databases in a harmonized and standardised manner to increase their statistical power and provide better across-border comparisons for identifying dietary effects on outcome. Only with such scale can we hope to maximise our understanding of the role of genes, nutrients and phenotypes in the

[19] Zeisel SH, Freake HC, Bauman DE, Bier DM, Burrin DG, German JB, Klein S, Marquis GS, Milner JA, Pelto GH, Rasmussen KM. The nutritional phenotype in the age of metabolomics. J Nutr 2005;135(7):1613-1616.

[19] Ommen B van, Bouwman J, Dragsted LO, Drevon CA, Elliott R, de Groot P, Kaput J, Mathers JC, Muller M, Pepping F, Saito J, Scalbert A, Radonjic M, Rocca-Serra P, Travis A, Wopereis S, Evelo CT. Challenges of molecular nutrition research 6: the nutritional phenotype database to store, share and evaluate nutritional systems biology studies. Genes Nutr 2010;5(3):189-203.

[19] Ommen B van, Keijer J, Kleemann R, Elliott R, Drevon CA, McArdle H, Gibney M, Muller M. The challenges for molecular nutrition research 2: quantification of the nutritional phenotype. Genes Nutr 2008;3(2):51-59.

initiation, development and progression of risk factors for diet-related chronic disease. This is and should remain a very high priority for EU food and health research.

Research challenges

- Organise a series of training workshops on the use of the NuGO Nutritional Phenotype Database.
- Launch a scouting exercise for existing databases and the requirements for merging those.
- Organise a joint meeting between JPI and EFSA on the area of harmonising the collection of national and large regional dietary data.
- Define the minimal standards for data collection and phenotypic measures (SOPs).
- Develop an agreed methodology to incorporate data from different omic-technlogies with standard phenotype data.
- Create an initiative for a pan-European genotype-phenotype database on food-health relationships.
- Provide a basis for assessment of the nutritional phenotype by integration of genetic and 'omics' as well as functional parameters and behavioural measures that better define the human nutritional status.
- Develop standardized approaches to assess the impact of chronic diet-related diseases on the quality of life, the economic condition of individuals and the health system and how health-services impact diet-related diseases.

Prime initiative for 2015: Expand and foster existing prospective diet-related cohort studies, merge them into open access nutritional databases and initiate new pan-European prospective studies on the diet-health relationship with new markers of health as derived from comparative phenotype analysis

Whereas nutritional phenotype databases will provide a deep insight into the associations between genotype, phenotype and diet, such associations require dietary intervention studies to validate these associations. In many cases, new intervention studies will need to be initiated but in many more, we can hope to exploit such intervention studies which have been completed. Several studies have been set up as part of EU Framework Programmes including Lipgene, Diogenes, Earnest, NuAge, EPIC and many more.

There are two major limitations to maximising the exploitation of such dietary intervention studies. The first is the need for a clear policy on public accessibility to such data and secondly the merging of these databases. This should be the main focus for 2015.

Determining optimal dietary intakes to maintain health requires a means of assessing the physiological effects of macro- and micronutrients, toxins, and non-nutritional bioactives. Biomarkers to quantify health optimization are needed since many if not all biomarkers are developed for disease endpoints. Quantifying 'normal homeostasis' and developing validated biomarkers are difficult tasks because of the robustness of homeostasis and of inter-individual diversity. This might be achieved by focusing upon the functional significance of the variations within the range of data that would generally be considered normal with the aim to identify successively earlier indicators of any deterioration. Even with such refinements, individual markers used in isolation will not be able to measure health reliably. Instead, integrated multi-component biomarkers are required. Ideally, these would examine a far broader concept of health than simply defining acceptable values for each parameter individually. The 'omic' technologies that measure large numbers of parameters in parallel offer significant opportunities in this respect. However, even with these new approaches, it is a major challenge to capture the functional status of a biological system with measurements at a single static point. Dynamic measures, taken under varying conditions, may provide a starting point. Therefore, there is a growing demand for more comprehensive phenotyping including challenge tests of human volunteers collected prospectively. This needs standardized methods (see also "European Nutrition Phenotype Assessment").

Research challenges

Studying the incidence of diet- and lifestyle-related diseases

- Launch a scouting exercise for existing dietary intervention studies and explore the possibility of merging these studies.
- Foster methodological harmonisation and development of standard operating procedures for human studies and sample collection and coordinate and support ongoing nutrition and health related cohorts activities by improving standardization and excess to data (open access).
- Link genotype to healthy nutrition (nutrigenomics); promote research on the role of nutrients in gene expression and biological networks and on genetic, epigenetic and diet-gene interactions to better define the causal relationship between genetic variability, gene functions, nutrients and the phenotype (including weight maintenance and obesity susceptibility).
- Collect samples (biobanks) and create sub-databases on human genetically defined populations either from population studies or from controlled trials with sufficient statistical power to demonstrate the influence of differences in genetic makeup and dietary patterns on health parameters. Animal models with defined genetic backgrounds should support this research in a mechanistic manner.

Understanding the mechanisms and underlying factors in the development of diet-related chronic diseases

Obesity appears to condition the human system to low grade inflammation and this seems to be a unifying biological process that causes impairments in metabolic control and malfunctions of the immune system and associated chronic diseases such as COPD, type 2 diabetes but also bowel diseases such as Crohn´s and colitis and others. Understanding the preconditioning of inflammatory responses and how dietary components can affect it is central for improving dietary guidelines and to create new food products. The scientific progress in the field requires to better defining these disease-preconditioning mechanisms on background of human genetic heterogeneity and in context of life style factors. The new profiling and phenotyping technologies appear particularly suited to obtain mechanistic insights. Yet, this needs an integrated and highly standardised effort and includes the identification of indicators that as early biomarkers (including omics-based signatures) can predict disease on-set and progression. These biomarkers or signatures need in the next step to be validated in cohort studies. As early environmental exposures (during pregnancy) predisposes to obesity and diseases such as diabetes in later life phases optimising foetal and early postnatal development is of high priority and needs adequate research efforts that allow sound knowledge to be transmitted into the public health domain. Knowledge on how diet and physical activity affect cognitive function and performance in the different life stages is a so far also a largely neglected area. In the elderly, not only cognitive functions but also malnutrition, muscle wasting and metabolic abnormalities are observed. Chronic loss of organ performance is a critical condition and needs a better understanding of the underlying mechanisms and needs predictive biomarkers. The impact of other life style changes (’electronic life’, computer games/other common new technologies) that may for example affect food intake and exercise behaviour is not yet well defined and should be explored to understand their contribution to obesity development and the associated diseases. Based on global changes in the availability of food (energy supply, protein and micronutrients) future studies on diet and health should also consider these factors and should explore for example replacement strategies for meat with high quality plant protein of proper sensory quality.

- Link genotype to healthy nutrition (nutrigenomics); promote research on the role of nutrients in gene expression and biological networks and on genetic, epigenetic and diet-gene interactions to better define the causal relationship between genetic variability, gene functions, nutrients and the phenotype (including weight maintenance and obesity susceptibility).
- Better understand the early environmental exposure for development of obesity and diabetes (pregnant women) for optimising foetal and early postnatal development. Of special concern is the increasing incidence of childhood obesity and the role of lifestyle (’electronic life’, computer games, other common new technologies) on disease risks as well as on brain functions.

- Identify the mechanisms by which different diets and dietary components influence food-reward, appetite, body weight and metabolic homeostasis. These studies should be carried out in experimental animal models and in humans (using functional NMR or PET).
- Examine the organ-specific causes and consequences of sub-clinical chronic low grade inflammation in view of the predisposition to developing diabetes type 2 and other chronic diseases, explore the origin of the variability amongst individuals and assess how diet and food ingredients and physical activity can prevent organ-specific malfunction.
- Uncover the basis of the central nervous system nutrient signalling and its implications in the regulation of energy balance and metabolic homeostasis and how dietary factors relate to brain cognitive and metabolic function and performance in various life stages.

Managing chronic organ-specific diseases and malnutrition in a multimodal and integrative manner

Chronic organ diseases, mainly chronic obstructive pulmonary disease (COPD), chronic kidney disease and chronic heart failure share a common clinical and metabolic phenotype made of physical inactivity, anorexia, inflammation, oxidative stress, insulin resistance, anaemia and frequently hypogonadism. In concert this results in disease-associated malnutrition, myopathy and other altered body functions and as a commonality constitutes the systemic component of organ-specific diseases. As for example, respiratory insufficiency in COPD causes hypoxemia affecting at a systemic level a variety of other organs. Similarly, kidney disease can cause acidosis affecting a variety of metabolic processes far beyond acid-base homeostasis. Besides the common clinical and metabolic disturbances each organ prominently affected can secondarily alter the health condition in a specific manner. Acute and chronic treatments of the organ-specific diseases need a better understanding of the mechanistic basis for adequate disease management and proper dietary interventions. In addition, in elderly, in particular when institutionalised, insufficient energy intake and supply with essential nutrients can frequently be observed and this promotes disease progression and causes a loss of quality of life.

- Determine the quality of the diet in institutionalised elderly persons with respect to food safety and states of malnutrition and develop strategies for adequate nutrition in geriatric subgroups.
- Better define the optimal nutritional needs and proper dietary intervention strategies according to the organ-specific metabolic abnormalities and derive optimal organ-specific rehabilitation programmes.
- Investigate the effect of multimodal approaches to malnutrition in chronic organ diseases by taking into account the various determinants of impaired organ functions.
- Study in an integrative way (including lifestyle, nutritional and environmental factor assessment) the mechanisms underlying malnutrition, muscle wasting and other muscle metabolic abnormalities (as by inadequate physical activity, insulin resistance, hormone disturbances or micronutrient deficiencies) associated with chronic organ diseases and identify predictive biomarkers.
- Build scenarios for the consequences of dietary and/or activity changes for health improvement and economics - what can be achieved by changing the system (against the current treatment-based approaches).

Horizontal issues

Primary goal for 2020: Full integration of the research areas

2020: Establish a European Nutrition and Food Research Institute to improve scientific collaboration and communication across national borders for a better integration of food, nutrition and health research throughout Europe

Research in nutrition, food and health is becoming increasingly complex. It has distinct and discipline-specific requirements for analytical as well as physiological methods, including specific research procedures. Nutrition research is also driven by the progress in genetics, epidemiology, biobanking, biomedicine, molecular biology and material sciences. Food science similarly is driven by advanced analytical techniques, biotechnology, material science and IT. Regulatory demands such as the health claims and novel foods regulations require comprehensive safety assessment procedures and scientific evidence derived from human studies. Although the European research base and expertise in nutrition and food science is unique, it is still highly fragmented and in some areas and countries below the critical mass needed for a sustained and competitive future.

A European Nutrition and Food Research Institute should therefore be established to secure the present European skills for a productive development of food and nutrition research. The mandate of this institute should be:

1. to provide a platform for harmonization and standardization in nutrition and food research and technology, data storage and handling, and disclosure of nutrition and food research specific information as a basis for more sustained research in a collaborative setting with experts from all over Europe;
2. to establish based on these standards a sustainable European Nutrition and Health Cohort with sub-cohorts in all participating countries, becoming a critical open-access internet resource for research in health, food and prevention of related diseases;
3. to provide a standardized infrastructure to support and perform large multi-centre nutritional interventions throughout Europe;
4. to provide a vital research environment stimulating innovation in nutrition and food science; and
5. to provide a platform for continuous education for all stakeholders, including experts in R&D and from SMEs.

The European Nutrition and Food Research Institute can be organised either as a central institute or as a virtual institute, with federated national hubs focusing on specific aspects, yet with an increasing degree of coordination. This hub structure links academic research institutes in Member and Associated States and creates a knowledge and education centre for transfer into various stakeholder groups (academia and industry) within the EU Member States and abroad (underdeveloped and developing countries).

Within the European Nutrition and Food Research Institute, all essential components needed to perform nutrition studies including genetics, transcriptomics, proteomics, metabolomics, functional assays, imaging technologies, food composition and food intake quantification approaches are elaborated, with the obvious inclusion of epidemiology, physiology, food technology, perception, sensory aspects, marketing, economics and ethics. The research methods will be tailored to the specific research needs and are embedded in an environment of standardized protocols and procedures, annotations, modular databases, networking and integrated bioinformatics. The Institute should host these facilities as an integrated toolbox and should be committed to establish and maintain a nutritional phenotype repository and database as a publicly available data and

knowledge depository to enable integration and interrogation of data from multiple studies. As part of the institute, a flexible IT-grid should be implemented allowing distributed networking and owner-controlled data sharing between all European nutrition research centres.

Highly trained and qualified researchers are a necessary condition to advance science and to sustain investments in research. Therefore, the Joint Programming Initiative aims to initiate and coordinate joint training activities to strengthen the transfer of knowledge from the joint research projects within the domains contributing to 'a healthy diet for a health life' among universities, public health research organizations, industrial health sector, clinical sector, etc.

Existing and new knowledge from the nutrition and health domain, such as research output, research methodologies, research tools, conceptual knowledge and practical experiences, will be translated into high-quality educational materials suitable for distance learning by individuals as for international courses and workshops. Joint collaboration on the translation of research output to training modules guarantees that new and existing knowledge is shared and will contribute to capacity building and enhancement of future European collaborative research activities. Regarding the research infrastructure, this requires a joint e-learning platform functioning as an online repository of e-modules within the nutritional and health domain, education and training of future nutritional researchers (BSc/MSc), starting researchers (PhD students), young professionals (e.g., as in ENLP) and professional life-long learners.

The effectiveness and flexibility of training courses and curricula development will be enhanced by developing professional, evidence-based, distance learning modules of high educational quality, consisting of, for example, interactive exercises, tailored feedback, and (a)synchronous collaborative learning activities. The use of current technological and multimedia possibilities will contribute to sustainable dissemination of knowledge, advancing the innovation of learning and the translation of knowledge to practice. In addition to these, the network will ultimately set standards for European curricula and degrees in nutrition, balancing the scientific disciplinary specializations relevant to scientific advancement (as represented in the JPI) including the knowledge translation from these domains to applications in nutritional practice and health policy.

The European Nutrition and Food Research Institute should be built on established and vital science networks derived from EU-funded FP7 and FP8 programmes and extent into countries so far not or only partly involved in pan-European activities. The Joint Programming Initiative would allow a sustainable continuation of the initiatives, respecting national strengths and federating these into an Institution that can harmonize nutrition, food and health research to benefit the European research landscape, the food industry as well as the public.

<u>Actions</u>

- Formulate a vision paper with goals, structure, content and governing for such an institution.
- Establish a promotion group that takes the concept into various stakeholder circles and organisations for discussions (JPI, ETP, national funding agencies) and onto the political level of the European parliament and the commission.
- Analyse critical infrastructure needed and develop strategies for research pooling.
- Standardise study procedures and study designs for a harmonised data collection in all relevant disciplines.
- Establish processes for secondary analysis of open-access data.

Create a European knowledge hub on research activities in the food, nutrition and physical exercise areas that relate to human health

It is an essential prerequisite for joint programming and all research carried out within the three thematic areas to know programs already implemented in the member states. Although there are some national research activities with high international visibility, the large number of projects carried out on national levels with the diversity of underlying structures, organisations and financial frameworks is largely unknown to stakeholders (even on national levels). In addition to EU framework and infrastructure programs it is essential to collect information and build an inventory on national funding programmes that target agricultural and upper food chain research as well as food/ingredient research in view of human health and identify areas in which coordinated programmes would create an added value. This inventory should go beyond the FAHRE project and needs a standardised assessment tool for defining the core and boundaries of the research areas assigned to the food, nutrition, lifestyle and health research. This inventory should combine the information provided by the member states as a "top-down" approach but also by the scientists as a bottom-up approach along the three thematic areas as described above in the research challenges. This could provide the most effective way of identifying ongoing activities that easily can be translated into joint programs that go across national borders. As part of the knowledge hub activities, continuously analysing critical infrastructure needs and the development of improved strategies for research pooling should be implemented. Processes for secondary analysis of open-access data should as well be established. The knowledge hub of the JPI should also include information on foresight reports and activities and on the Strategic Research Agendas of relevant European Technology Platforms and joint reports of European Technology Platforms (e.g. BECOTEPS white paper) to ensure the highest level of transparency and knowledge transfer into the JPI and the member states.

Improve education, training and scientific career perspectives in the food, nutrition, lifestyle and health areas

The JPI activities go beyond the classical borders of scientific disciplines. Diversification and specialisation are intrinsic features of modern sciences. Yet, solving problems as in the area of human health, nutrition, food and lifestyles requires trans-disciplinary competence and a better understanding of the different science cultures (biosciences, social and cultural science). It is mandatory for success of the JPI in its three thematic areas that proper education and training of experts and junior scientists is assured. A special concern is that highly specialised sciences with high impact publications have established ranking and incentive systems in place whereas the multidisciplinary approaches and likewise the translation areas in most cases can not measure up with these. To make the research areas covered in the JPI also attractive for the best students and scientists, the reputation of the science disciplines need to be improved and a proper "mind-setting" is a prerequisite for successful joint programming when going across the classical borders of science disciplines. This also applies to science career perspectives and the mobility of the European researchers in the thematic areas. It should therefore be one of the most important goals of the JPI *A healthy diet for a healthy life* to foster this new mind-setting and to enable the best education and training for a new generation of scientists needed. Although the European Institute of Nutrition and Food Sciences (goal 2020) would be the ideal setting to ensure this to happen, the JPI should meanwhile take measures to compile an inventory of necessary skills and knowledge, exploit the various programs available in Europe and define a pan-European project for continuous education in the research areas targeted to scientists in academia and experts in industrial R&D.

Improve communication, knowledge and technology transfer

The impact of the JPI *A healthy diet for a healthy life* will, to a large degree, depend on the effectiveness of communication and the exploitation of the outcomes of research programmes. Best practices in communication and the exploitation of innovative communication techniques will be promoted and supported. Transfer of knowledge and technology is the driver for innovation and is a key focus for improvement.

Within the overall context of this JPI, communication is important among its themes, within the management and administration structures and with and between individual stakeholder communities. Transfer of technology and knowledge to all stakeholders whilst ensuring IP protection, are necessary tools for establishing and promoting cross-disciplinary research and the transfer into various application areaas. A relationship of trust and mutual confidence between individuals and organisations is a prerequisite for successful knowledge and technology transfer.

In addition to being a key requirement of effective management and administration, communication is important to optimise interactions between themes, to enable stakeholders to gain the maximum benefit from ongoing activities and to ensure that policymakers, opinion formers and the general public are regularly updated. It is essential to understand that the effective communication of food-related issues depends on designing different patterns of communication aimed at capturing the diverse sensitivities and priorities of stakeholders involved in the knowledge process. Validated strategies will be adopted to ensure optimal impact across the members of the food chain and the general public.

Other European initiatives on food and health

As a new initiative, the JPI has brought together experts from various science disciplines to work on a common vision and to define the measures that need to be taken to reach the goal to improve consumer´s health in Europe, create a coordinated and vital European research arena and improve the competitiveness of European industries and academia. By its representatives at the scientific advisory and management levels the JPI works in a network spanning across all member states and all relevant science areas. Yet, knowledge import about national as well as European and other international activities into the JPI as well as knowledge export from the JPI are crucial for the “added value” intended and for preventing duplication of efforts. The JPI is therefore committed to interact as good as possible with all European initiatives and programs (as listed below) for optimal information flow and with the highest level of transparency.

European initiatives on food and health include:

- The European Commission established an Expert Group on Food and Health Research in 2008 to share current practice on integration or coordination of research programmes on food and health.
- In May 2007, The EC adopted the White Paper ‘A strategy on nutrition, overweight and obesity-related health issues’ focusing on action that can be taken to reduce the risks associated with poor nutrition and limited physical exercise.
- The EU Platform on Diet, Physical Activity and Health was set up in March 2005 to provide a forum for stakeholders at European level, whereas the High-Level Group on Nutrition and Physical Activity strengthens the role of governments in counteracting overweight and obesity.
- EFSA has proposed the EU Menu project, which was supported by almost all Member States. This project aims at collecting comparable food consumption data in all European countries.
- The European Food Information Council (EUFIC) is a non-profit organisation, which provides science-based information on food safety & quality and health & nutrition to the media, health and nutrition professionals, educators and opinion leaders, in a way that consumers can understand. In response to the public's increasing need for credible, science-based information on the nutritional quality and safety of foods, EUFIC's mission is to enhance the public's

understanding of such issues and to raise consumers' awareness of the active role they play in safe food handling and choosing a well-balanced and healthy diet (www.eufic.org).

- In 2005 the ETP Food for Life was launched.
- In the area of food, the ERA-NET SAFEFOODERA has issued two calls for research projects. An ERA-NET SUSFOOD will be launched soon.
- Collaboration with other JPIs, including FACCE (Agriculture, food security and climate change), or Alzheimer and neurodegenerative diseases.
- Green Paper Promoting Healthy Diets and Physical Activity (2005). The paper recognises that unhealthy diets and lack of physical activity are the leading causes of avoidable illness and premature death in Europe, and that the rising incidence of obesity is a major public health concern for the countries of the European Union. The Council called on the Member States and the Commission to devise and implement initiatives aimed at promoting healthy diets and physical activity. It accordingly called for the development of strategies entailing a multi-stakeholder approach with action being taken at local, regional, national and European levels. The aim is to gather information with a view to giving a European dimension to the battle against obesity, in terms of support for and coordination of the existing national measures.
- WHO European Charter on Counteracting Obesity, 2006. The WHO European Ministerial Conference stated that obesity is a global public health problem and acknowledging the role that European action can play in setting an example and thereby mobilising global efforts. Recommended to continue to be focused on preventing obesity in people who are already overweight and thus at high risk, and on treating the disease of obesity as well as to introduce timely identification and management of overweight and obesity in primary care, provision of training for health professionals in the prevention of obesity issuing clinical guidance for screening and treatment.
- European Parliament Resolution on the Commission's Green Paper, 2007. Through this Resolution the Commission reinforced the messages and intended to trigger debate on initiatives geared towards preventing obesity.
- WHO European Action Plan for Food and Nutrition Policy 2007-2012. The WHO sets out practical steps for governments especially related to progress in reversing overweight and obesity in children and obesity that should be achievable in most countries in the next 4-5 years reversing the trend by 2015 at the latest.
- High Level Group on Nutrition, 2007. High-level national civil servants from Member States share best practices to facilitate effective exchange of policy ideas and practices between Member States and to improve liaison between the EU Platform for Action on Diet, Physical Activity and Health and representatives of national governments, enabling relevant public-private partnership possibilities to be quickly identified and agreed upon.
- European Parliament Resolution on the Commission's White Paper, 2008. Call on the Commission to promote best medical practices and studies comparing and evaluating the effectiveness of different interventions, including psychosocial research.
- Progress Report on the EU strategy, 2010. The European Commission will assess in 2010 the various measures taken by industry and determine whether other approaches are also required following an internal political evaluation within the Directorate General for Health and Consumer Protection (SANCO).

<u>European programmes and projects on food and health include</u>:

- The EU-funded project FAHRE will map key players in the food and health sector in Europe by the end of 2010. It will also identify gaps in and overlaps between research needs and give advice for achieving better coordination.
- Other relevant, present and former, Framework Programmes including NuGO (European Nutrigenomics Organisation), LIPGENE, DIOGENES, Earnest, Health Grain, EuroPrevall, EFCOVAL and EuroFIR.
- Thematic Area 1 of the EU platform European Technology and Aquaculture platform (Product Quality, Consumer Safety & Health) is devoted to contributing to the development of a healthy diet for consumers. The platform was established in November 2007 and established as a non-profit Trust registered in Belgium in February 2009.