Summary Future Food Seed Money awarded projects 2018

"Towards resilient crops: Plant homeosatic mechanisms regulating root survival tipping points during flooding stress"

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When plants become submerged in water, oxygen delivery to the root severely declines, and roots are at risk of dying from hypoxia. Plants deal with this danger through protective mechanisms, predominantly via the plant hormone ethylene which accumulation automatically ensues under water logging conditions. Root survival depends on ethylene countering the adverse effects of hypoxia induced free radical accumulation, energy reduction and pH level increases which together cause a collapse of the stem cells that normally maintain healthy root growth.

Intriguingly, rather than a graded response, root survival displays a tipping point behavior -either surviving or not-, with the percentage of surviving roots depending on ethylene, duration of oxygen deprivation as well as other conditions. In this proposal we will combine experimental measurements with computational modeling to unravel this tipping point behavior. Specifically, we will measure oxygen, pH, and energy levels in plants and incorporate these into a computational model of the plant root. Using this model we will investigate how changes in levels of free radicals, energy and pH affect root tip growth via their effects on major plant root transcription factors and hormones. On a similar note, we will study how changes in root growth dynamics, by affecting overall metabolic requirements, affect these factors. Aim is to disseminate how this network of interactions together causes all-or-none tipping point behavior.

The ultimate goal is to deliver knowledge that will enabling plant breeders to artificially shift tipping points such that survival chances of crop species experiencing flooding are increased.

"Future Food in the Mekong Delta: Improving Food Systems and Food & Nutrition Security in Asian Deltas affected by climate change"

Dr. Guus van Westen, Prof. Annelies Zoomers, Dr. Esther Stouthamer (Faculty of Geosciences), Prof. Rens Voesenek (Faculty of Science), Prof. Veena Srinivasan (Prins Claus Chair UU, Atree), Prof. Joost de Laat (Faculty of Law, Economics and Governance – Uglobe) and Dr Nguyen Hieu Trung (Can Tho Univ. VN)

Densely populated Asian deltas are particularly challenged in achieving sustainable food systems. Climate change results in flooding and salinization, undermining food production. At the same time, population growth, urbanization and rising incomes means that more and different foods are needed. Existing crops and farm practices are threatened, but innovations like new crops or aquaculture may offer new opportunities. On the consumption side, malnutrition has not disappeared while diseases related to overconsumption and obesity are increasing. Thus, delta food systems are being transformed, and need new initiatives in land/water management, production systems, and food policies to achieve food and nutrition security in a just and sustainable way. In the Mekong delta this complex interrelationship between nature, population and food system is particularly relevant. Four related research questions present themselves:

(1) How does climate change affect local food production systems and thus food and nutrition security?

(2) How do social changes and the resulting change in the demand for food (quantity and quality) affect local food systems?

(3) How does the system of land and water governance, as well as food regulation, affect local food systems?

(4) How can land and water governance be adapted to promote equitable and sustainable local food systems?

Answering these questions requires contributions from physical geography and hydrology (subsidence and salinization), plant physiology (rice focus), human geography and economics (surveys on food demand and nutrition).

"Allergy warnings on food products"

Dr. Bregje Holleman (Faculty of Humanities), Dr. Harmieke van Os- Medendorp, Prof. André Knulst (UMC Utrecht), Dr. Marty Blom , Prof. Geert Houben (TNO/ UMC Utrecht)

Healthy and safe eating is important, especially if someone's suffering from a food allergy: allergic consumers can get serious health problems due to consuming food products with unexpected allergens. Therefore it is crucial that food products are labelled correctly, and that consumers can understand and use the allergy information appropriately. EU legislation requires labelling of 14 allergens on food. Precautionary allergen labelling (PAL) is used for allergens that accidentally end up in food products due to contamination or storage. However, there is no regulation regarding the use and wording of PALs: the EU proposes to use ".. may be present", but other wordings such as "may contain traces of", or "processed in a facility which …", are also used often. Exploratory corpus analyses across a variety of food products and retailers suggest that the use of certain PAL wordings is not systematically related to certain food products, but rather, at best, to certain producers or retailers. Recent experiments carried out in a collaboration of the UU Humanities, UMC Allergy department and TNO has shown empirically that consumers consistently attribute different risk levels to different PAL wordings. This difference in meaning may not be intended by the food producers or retailers. Through in-depth interviews, this seed money project digs deeper into the perspective of food producers and retailers regarding the design and content of PALs. Based on this, additional research will be proposed aiming to develop an underpinning for more clear allergy warnings on food products and other communication media to establish safe food choices by allergic consumers.

"Increasing interdisciplinary understanding of individual and psychosocial drivers underlying healthy and sustainable food choices"

Dr. Maartje Poelman (Faculty of Geosciences), Dr. Marleen Gillebaart, Dr. Carlijn Kamphuis (Faculty of Social and Behavioural Sciences), Elizabeth Velema, MSc (Netherlands Nutrition Centre), Dr. Arienne de Jong (Institute for Health and Environment)

Societal and political awareness on how food consumption impacts human health and planet health has steadily increased over the past years. However, in day-to-day life, only few consumers make healthy and sustainable food choices. Moreover, large socio-economic disparities exist, with individuals with a lower socioeconomic position having less healthy and sustainable diets.

To shift these consumption patterns, on a societal level, a big systems change is needed, e.g. regarding food production, food transportation, and food availability. One of the research questions we include in the research proposal for the envisaged external call is: what are the required changes for a successful transition towards healthy and sustainable food choices and food

consumption? On consumer-level, we need to understand how we can encourage consumers' behaviour change towards more sustainable and healthier food choices.

This seed money project will increase our understanding of current individual and psychosocial drivers of healthy and sustainable food choices of adults in the Netherlands, and mechanisms underlying socioeconomic disparities. We will gain these insights by analysing panel data, collected among a representative sample of the Dutch adult population. The project aligns with the Future Food Utrecht transdisciplinary Pathway 'Food Production & Consumption' where the challenge 'how can optimal future diets be facilitated, considering the socio-economic background of societies' is key. During this project, we collaborate with the Netherlands Nutrition Centre and National Institute for Public Health and the Environment (RIVM), as well as with researchers in- and outside Utrecht University.

"Identifying the psycho-social drivers of antimicrobial usage and effects on milk-associated health properties"

Prof. Ronette Gehring, Dr. Gerrit Koop, Dr. Alex Bossers (Faculty of Veterinary Medicine, IRAS), Dr. Betty van Esch ((Faculty of Science, UIPS), Dr. Florien Cramwinckel(Faculty of Social and Behavioral Sciences)

As a society, we are acutely aware that the use of antibiotics selects for resistance with potentially dire consequences for the treatment of infections. What is less well known is how the long-term use of antibiotics alters the composition (amount and types) of commensal bacterial populations in our gut and on our skin. In this project, we will focus on how antibiotic use in dairy production alters the bacterial and nutrient composition of milk and the consequences for the gut health of the consumer. Antibiotics remain essential for treating sick animals, and although antibiotic use (AMU) in milk cows is low, some producers use more than others. We don't really know why there are differences in AMU between producers, but some possible reasons include the environment and quality of the production system. From recent research at Utrecht University we also know that there are psychological barriers to reducing AMU amongst producers and veterinarians. With this project, we will be looking at the differences in gut health effects between milk from producers that use relatively high amounts of antibiotics and those who use low amounts. We will also investigate how these effects relate to the bacterial composition of the milk. And we will be further investigate which psychological factors drive antibiotic use amongst farmers and veterinarians so that we are better equipped to guide the antibiotics towards producing the healthiest milk possible.

"Empowering Chicken Natural Killer cells to eradicate pathogens by establishing their metabolic needs"

Dr. Christine Jansen (Faculty of Veterinary Medicine) and Dr. Saskia van Mil (UMC Utrecht)

Chicken meat is by far the world's main human protein source. However, infectious diseases are one of the major threats to the poultry industry. Pressure to reduce the consequent use of antibiotic drugs in view of increasing antibiotic microbial resistance urges for alternative strategies to protect chickens against infections.

The immune system plays an essential in protecting the host against pathogens. Natural killer (NK) cells play a central role in this immune response. Not only are NK cells directly involved in the first line of defense by killing virus infected cells, they are also essential in the induction of the subsequent adaptive immune responses. We propose that empowering chicken NK cells may lead to chickens that are more resilient and thus less susceptible to infections.

The aim of this project is to develop a novel metabolomics-based assay to get more insight in factors affecting chicken NK cell responsiveness. This assay will characterize metabolites, small molecules that arise as result of cellular processes, during the early stages of NK activation. With our complementing expertise in chicken NK cell biology and metabolomics, we will identify metabolites that are present during the early stages of NK cell activation, a so called “metabolic fingerprint”. This fingerprint will be validated in additional experiments.

In future research this novel assay will be used to screen for compounds inducing the specific fingerprint associated with early NK activation. We expect that this approach will lead to increased NK responsiveness in chickens and ultimately a highly sustainable poultry industry.
