



Smartphone analysers for on-site testing of food quality and safety

Issue 4 – December 2018



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Welcome to the fourth FoodSmartphone e-Newsletter!

Dear reader and FoodSmartphone follower,

'Time flies' is what people say, and that is exactly my current feeling in the Marie Curie European Training Network FoodSmartphone. By now the project is already half-way in its lifetime and many of us are a bit stressed because of all technical and financial reporting duties associated with the upcoming midterm review. Fortunately these duties are always compensated by the pleasant things in life: cross-cultural experiences, cross-fertilisation in collaborative research thanks to our meaningful secondments, explaining FoodSmartphone at your primary school or previous university in your home country, achieving your first exciting scientific results and presenting them in your first open-access peer-reviewed paper and/or at leading conferences, either as a poster or as an oral presentation. When you read the early stage researcher stories in the weekly blogs at www.foodsmartphone.blog you may conclude that a Marie-Curie training network is mainly a travel agency or a bureau of tourism. In reality, that is just a minor part of the cake and the individual research projects dominate their lives. Definitely, mobility is a great asset for researchers but it is also fair to say that our early stage researchers are looking forward very very much to be re-joined with their relatives and friends during the upcoming holiday period.

As always, keep updated with their progress by signing up on our website and/or by following us on twitter (@FoodSmartphone) and tweet us using the hashtag #FoodSmartphone. Feel free to contact us at foodsmartphone@foodsmartphone.eu with any suggestions for improvement of this e-Newsletter, for future collaboration or dissemination opportunities, or just for a friendly chat.

For now I wish you pleasant Season holidays, wherever you go!



Michel Nielen,
coordinator

The downside of mobility: people come... and go!

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Our WP2 leader, **Monique Bremer**, left the RIKILT institute and the FoodSmartphone project by the end of November 2018. After 16 years serving RIKILT in a variety of research projects she found a new exciting opportunity within Wageningen University and Research as a project coordinator at Shared Research Facilities (SRF). SRF is part of the newly formed group of Corporate Value Creation & Cooperation. We are very grateful to her efforts as daily supervisor of ESR1 and as FoodSmartphone WP2 project leader. As an interim solution Arjen Gerssen from RIKILT has taken over her responsibilities.



Being a PhD student in a Marie Curie project is quite demanding, both scientifically and personally. Unfortunately we had to face a few consequences from that reality. ESR2, **Vincent O'Brien**, left the project and the RIKILT institute by the end of March 2018 and found a new job in his home country Ireland. ESR9, **Sahl Sadeghi**, left the project and the group at Linköping University



by the end of October 2018 and found a new job at a private company in Sweden. ESR7, **Raheel Ahmad**, left the project and the CSIC institute in Barcelona by the end of November 2018 in order to return to his home country. All these ESRs showed the courage and ambition to move to a different country and to join our project and we are very grateful for their efforts, their promising results, and for sharing their stories and joining us in the first place. We wish them all the very best for their future lives and careers!



Consequently we re-opened positions again for new ESRs who are eager to join the FoodSmartphone project and to catch-up with the older 'project mates'. We are very pleased that the first recruitment has been completed successfully and would like to introduce the new ESR2 ('ESR12') **Ariadni Geballa Koukoura** from Greece, who joined the RIKILT institute September 1st 2018. Ariadni was born and raised in Athens and graduated at the School of Pharmacy of the National and Kapodistrian University of Athens. She did her bachelor thesis in the field of pharmaceutical nanotechnology and continued her master study in pharmaceutical analysis and quality control and developed an LC-MS method for drugs in human breast milk which was published in literature. Within her individual FoodSmartphone project Ariadni will study the interfacing of ligand binding assays with direct ionisation mass spectrometry. The other vacancies were still open at the time of this newsletter.



FoodSmartphone progress versus research objectives



The major science and innovation gaps to be addressed by the FoodSmartphone project relate to high-speed and novel biorecognition of food contaminants, novel optical and electrochemical detection schemes in conjunction with smartphones, simplified microfluidic sample handling solutions that enable non-expert operation, advanced software architecture and the development of application demonstrators for food quality and safety issues of concern, viz. for antibiotics, pesticides, allergens, mycotoxins, food spoilage and marine toxins. In newsletter no. 3 we introduced the specific challenges and initial progress per research work package. Here we briefly summarise a few highlights from recent scientific dissemination. The first peer-reviewed open access papers from FoodSmartphone showed up in literature: ESR3, Jordi Nelis, published a review paper in *Biosensors* having the rather intriguing title "The Smartphone's Guide to the Galaxy: In Situ Analysis in Space". Anybody thought about what smartphone-based sensing devices can bring us in our future space missions? I certainly did not, but it is definitely very exciting to glimpse into the future ahead of us! You may find the full story at [doi:10.3390/bios8040096](https://doi.org/10.3390/bios8040096). ESR1, Gina Ross, published a review paper in *Anal. Bioanal. Chem.* entitled "Consumer-friendly food allergen detection: moving towards smartphone-based immunoassays". In this paper it is concluded that well validated consumer-friendly assays will eventually pave the way to the future of citizen science. The full story is available at doi.org/10.1007/s00216-018-0989-7. ESR10, Andrii Kuzmyn, submitted a research paper manuscript to *ACS Appl. Mat. Interf.*, entitled "Bioactive antifouling surfaces by visible-light-triggered polymerization". In this work he designed and developed hierarchical bioactive surfaces which are crucial in optical and electrochemical biosensing in order to prevent fouling and the generation of false positive signals. Following a favourable peer review, also this paper will become open access available. As a kind of X-mas present ESR1, Gina Ross, was informed last week that her first research paper entitled "Rapid Antibody Selection using Surface Plasmon Resonance for High-speed and Sensitive Hazelnut Lateral Flow Prototypes" was accepted for publication in *Biosensors*. Based on the association data from SPR an ultrafast (<30 s) dipstick assay was developed for hazelnut allergens having both visual and semi-quantitative smartphone readouts.



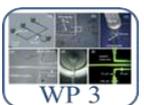
WP 1

Biorecognition concepts. A lot of recent progress in WP1 that culminated in three deliverable reports covering "DNA-directed ligand immobilisation", „Aptamer-based biorecognition" and "Binders for food spoilage organisms", with major contributions from ESR7, Raheel Ahmad, ESR11, Safiye Jafari and ESR4, Javier Lou Franco, respectively.



WP 2

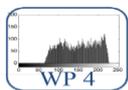
Optical and electrochemical sensing. A record-breaking strip test based on carbon nanoparticle labelling developed by ESR1, yields test results in less than 30 seconds. That's is exactly the timeframe we are aiming for with smartphone-based ligand binding assays. ESR8, Klaudia Kopper showed a lot of progress in her electrochemical transducer for pesticides.



WP 3

Integrated sample preparation devices. As mentioned above ESR10, Andriy Kuzmyn, succeeded in developing novel antifouling layers for biosensors and recently submitted his manuscript for publication and a milestone deliverable report on "nonfouling microsieves". ESR9, Sahl Sadeghi together with the team at Linkoping, made a lot of progress in the production of low-cost microfluidic lab-on-chip (LOC) unibody devices. Similar technology was successfully applied to the embedding of the microfluidic paper-based enzyme assay developed by ESR6, Aris Tsagkaris.

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Data handling and software tools. ESR5, Yunfeng (Jack) Zhao, further improved his 3D-printed prototype smartphone attachment and associated software algorithms for the reliable reading of dipstick immunoassays. In addition, he performed an update of the scoping exercise in order to identify any changes in the future needs of the other ESRs.

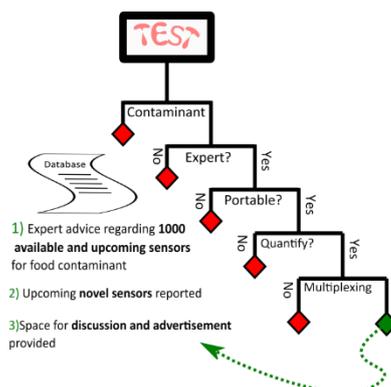


Demonstration of FoodSmartphone applicability and benchmarking. This work package is actually to be started on January 1st, 2019. Nevertheless, some of the ESRs already demonstrated initial applicability of their assays. For example, the rapid allergen dipstick has been applied to cookies, the antibiotics assay to diluted milk, etc.

Feature: preview of the TEST tree

“The End-user Sensor Database”: Easy accessible information on sensors for food contaminant screening for everyone.

A joint effort by ESRs 3, 4, 5 and 6: Technological advancement in the construction of Point of site (POS) devices can potentially induce a paradigm shift in the testing of foodstuffs for contaminants bringing more power to the consumer to scan and test their own food. However, complex sensor classification and purely scientific dissemination of information regarding novel sensors can obscure POS cognizance for the larger public. In order to promote a more commodious approach for all stakeholders we propose a novel end-user orientated system for biosensor classification i.e. “The End-user Sensor Tree” or TEST. The system is based on an online decision tree that uses end-user orientated criteria. These criteria are used to build a decision tree which gives access to e-docs containing tailored expert advice regarding upcoming and commercially available sensors. Moreover, space is provided for spinoff companies to promote their new sensors as well as space for consumer feedback to generate an interaction platform. TEST is currently developed for sensors targeting aquatic toxins, mycotoxins, pathogens and pesticides and includes almost 1000 different detection methods. At the moment access to the site is restricted but open access to all the information will be available soon!



Quotes from FoodSmartphone ESRs on www.FoodSmartphone.blog



ESR1: Georgina Ross , RIKILT, Wageningen University & Research, The Netherlands: *MSCA funded PhDs offer excellent travel opportunities; being able to travel to other countries to present research is a wonderful privilege which allows us, as scientists, to extend our network outside of our host countries.*



ESR12: Ariadni Geballa Koukoulou, RIKILT Wageningen University & Research, The Netherlands: *The first thing that surprised me in the Netherlands, was how flat and well organized it looks from the sky! No wonder why everybody cycles here...*



ESR3: Jordi Nelis, Queens University, Belfast, United Kingdom: *I really consider my time at CSEM as a great success and I left with a working assay, knowledge on electrochemistry and new friends. Thus I would like to thank everyone at CSEM again for accommodating me! It was a super nice trip and great to meet a team with such a great team spirit and enthusiasm. Sharing ideas and making them come possible. That's the way to do science!*



ESR4: Javier Lou Franco, Queen's University, Belfast, United Kingdom: *The incorporation of a few new members to our lab group has been very important in this matter, as we've been able to combine our expertise in different fields to push each other's research forward.*



ESR5: Yunfeng Zhao, Queens University, Belfast, United Kingdom: *The summer in Prague was charming with opulent sunshine, decent food, historic but active city, and vibrant FoodSmartphone people coming from all over the Europe.*



ESR6: Aristeidis Tsagkaris, University of Chemistry and Technology, Prague, CZ: *I look forward for my next presentation because a study outcome has to be communicated to reflect any scientific impact. Even though knowledge is individually*

gained, presenting your effort to others helps to think out of the box and find new alternatives.



ESR7: Raheel Ahmad, CSIC, Barcelona, Spain:

Not a blog quote but a bye-bye message: *I've resigned from my current position as ESR7 from FoodSmartphone project at Nb4D/CSIC Spain, owing to unforeseen circumstances and personal issues. It was a hard decision to make but I believe it's a right decision which I have made according to the situation. I would like to take a moment and thank each and every one of you for consistent help and support which made me learn a lot and made my stay easy here. I had an amazing experience with you all that will remain with me forever. I wish better life to all of you and hope to stay in touch.*



ESR8: Klaudia Kopper, CSIC, Barcelona, Spain:

It has been really nice having Safiye here for her secondment, I think we both enjoy having someone to talk to about the challenges we are facing in our scientific and personal lives.



ESR9: Sahl Sadegi, Linköping University (LIU), Sweden:

Not a blog quote but a bye-bye message: *I hope you are all doing well, as you probably know I resigned from the project and started a job and also changed field of research. I am sorry that my leaving might affect the outcome of research for some of you. Unfortunately, I couldn't see any chances to achieve something meaningful out of my research and I had to change it. However I will be around should you need anything. I wish you all great success in your studies and career development.*



ESR10: Andriy Kuzmyn, Aquamarijn, The Netherlands:

The life in the Netherlands is super organized everything is set into an agenda. You may have scheduled casual dinner with a friend two three months upfront.



ESR11: Safiye Jafari, CSEM, Switzerland:

My first year as a FoodSmartphone ESR passed so quickly and it has been a roller coaster ride so far. The secondment opportunities though have been those great moments which make me feel very lucky being part of the project. The aim of these secondments is not only to learn completely new skills and improving student's career development but also to cultivate soft skills like adaptability and communication by working in a different research group.

Forthcoming events / meetings



[Advanced Food Analysis course](#)

February 4-8, 2019, Wageningen, The Netherlands

[FoodSmartphone Midterm Review Meeting](#)

February 27-28, 2019, Wageningen, The Netherlands

[3rd FoodSmartphone Summer School on Software Design and Exploitation](#)

June 2019, Belfast, United Kingdom

[Recent Advances in Food Analysis \(RAFA2019\)](#)

5-8 November 2019, Prague, Czech Republic

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