



# Bilal JAVED

<b>Technology Centre:</b>	MiCRA (Microsensors for Clinical Research and Analysis) Gateway
<b>Academic Mentor:</b>	Dr. Furong Tian
<b>Company Partner:</b>	RELX Group, Ireland
<b>Company Mentor:</b>	Dr. Giovanni Estrada

Dr. Bilal has recently (2020) completed a Ph.D. from Arid Agriculture University - a very well-regarded institute of higher education in Pakistan. During the course of his Ph.D. studies, he has completed a year long pre-doctoral research program at the University of Pennsylvania, Department of Chemistry under the supervision of Professor Dr. Virgil Percec. Throughout his research program at the University of Pennsylvania, he worked on the "Bioinspired synthesis of complex molecular systems". He worked on the synthesis of organic vesicles (dendrimersomes / supramolecular assemblies) for the targeted delivery of drugs. Bilal has published 29 scientific papers in different International Journals such as ACS-Nano, iScience, International Journal of Nanomedicine, Frontiers in Molecular Biosciences, and many more. His published papers have received 431 - Citations, 13 - h-index, and 17 - i10-index over two years.

Bilal has reviewed more than 50 scientific papers from various international journals published by Elsevier, Springer, MDPI, Wiley, Taylor & Francis, Dove Medical Press, and so on. Currently, Dr. Bilal is editing and co-authoring a book for Springer Nature (Heidelberg, Germany). The title of the book is proposed as "Metal Nanoparticles: Microbial and Enzymatic Synthesis and Biomedical Applications". He has recently joined TU Dublin as a Marie Skłodowska-Curie Postdoctoral Research Fellow in addition to focusing on his research project, he's teaching General Biology to undergraduate students.

## Dr. Furong Tian

Dr. Furong Tian has received her Ph.D. degree in Chemistry from Stuttgart University with research completed at the Max-Planck Institute for Metal Research in 2006. She also worked as a visiting Research Scientist in the Radiation Department at Kyoto University and the National Institute for Materials Science in Japan. She was a postdoctoral researcher in the Institute of Inhalation Biology, Helmholtz Zentrum Munchen. In 2013 she joined TU Dublin as a Marie Skłodowska Curie Career-FIT PLUS Research Fellow and worked at the Nano Lab in the FOCAS Research Institute. She has more than 100 international peer-reviewed publications, which have 5500 citations yielding an H-index of 31 and counting. She has collaborated with many of the world's leading academic and research institutes which include; Massachusetts Institute of Technology (USA), Institute of Nano Biomedicine and Engineering at Shanghai Jiao Tong University (China), National Institute for Material Science (NIMIS, Japan), Institute of Lung Biology and Disease at Helmholtz Zentrum Munchen (Germany) and Fundação Champalimaud (Portugal).

## **Dr. Giovani Estrada**

Dr. Giovani Estrada got a Ph.D. in mathematics from the University of Stuttgart, Germany. He has held research positions at the Swiss Federal Institute of Technology (ETH, Zurich), Monterrey Tech (ITESM), Max Planck Institute (MPI-MF, Stuttgart), Royal College of Surgeons in Ireland (RCSI, Dublin), RFR (Paris) and Helmholtz Zentrum Munchen (HMGU, Munich).

Giovani joined Intel Labs Europe in 2013 for a FP7 Marie Skłodowska-Curie project. Giovani's primary focus areas of research are mathematical modeling and multivariate statistics, particularly in the area of biostatistics (e.g. nanotoxicity, the prognosis of breast and gastric cancer), signal processing (e.g. color processing, scale selection), and mathematical modeling of discrete structures (e.g. tensegrity, biochemical pathways).

Dr. Giovani Estrada has published more than 48 scientific research papers and has 2341 citations. He is an expert in computer-based colorimetric analysis. Dr. Estrada is also teaching statistics for different programs at the National College of Ireland.

Dr. Giovani Estrada is acting as the secondment or industrial mentor of Dr. Bilal Javed.

Bilal will be working in collaboration with Dr. Estrada and Dr. Tian on the imaging analysis of the colorimetric immunochromatographic digital lateral flow strips.

The imaging analysis will significantly increase and determine the limit of detection of mycotoxins in food samples. Dr. Estrada will help to design traditional and deep learning imaging processing tools for the immunochromatographic tests with the strips which Bilal will develop during the first two years of his university research while pursuing his Marie Skłodowska Curie Career-FIT PLUS Research fellowship. Dr. Estrada will also provide support for mathematical modeling of risk assessment for the immunochromatographic strip test (ICST) rapid detection and quantification of mycotoxins in food samples.

## **MiCRA**

**MiCRA-Biodiagnostics** is an industry-led research and development facility that focuses on the advancement of biosensor technologies, using materials such as enzymes, nanoparticles, and advanced polymers. MiCRA-Biodiagnostics is located in TU Dublin, Tallaght campus. MiCRA delivers solutions to companies in many sectors including in vitro diagnostics, environmental, food, and pharmaceuticals. Bilal will collaborate with the MiCRA Technology Gateway to develop the prototype of his final developed product and will test the diagnostic potential of the digital multiplex lateral flow immunochromatographic analysis to detect fungal-based toxins in food samples along with the comparative analysis with the standard techniques.

## **RELX Group, Ireland**

**RELX Group, Ireland** helps scientists with breakthroughs in the field of science by discovering new products. RELX is involved in scientific, technical, medical, risk assessment, and business analytics training and assistance. Dr. Estrada is working at risk and business analytics to provide formation-based analytics and detection tools for professional and business customers.

## Host Institution - Technological University Dublin (TU Dublin)

Building on a distinguished past, TU Dublin is Ireland's first technological university where the arts, sciences, business, engineering, and technology converge. TU Dublin provides a practice-based environment. Their impact-focused research aims to benefit communities, society, and the economy; and innovation and enterprise are at the heart of everything. The specialist expertise available at the School of Food Science & Environmental Health (FSEH) along with the combination of knowledge, infrastructure, international reputation, and previous success in developing new mycotoxin detection techniques within the university makes this a particularly good research environment to carry out the proposed research. The high-tech and state of the art research labs at the TU Dublin, FOCAS Research Institute, and MiCRA Technology Gateway provide Dr. Bilal with a range of analytical facilities to execute his multidisciplinary research project with diverse career development options.

## Bilal's project

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### **“Design and Commercialization of Gold Nanoparticle-based Immunochromatographic Digital Multi-color Strips to Detect Mycotoxins in Food Samples”**

Mycotoxins are secondary metabolic products of fungi. They are poisonous, carcinogenic, and mutagenic in nature and pose a serious health threat to both humans and animals, causing illnesses and even deaths. Infants and young children remain the most vulnerable population groups to be affected. The rapid, simple, and cheap detection methods of mycotoxins are highly desirable and in constant demand in the food industry.

The current proposed solution, contains an immunochromatographic strip test (ICST), a smartphone application, and a data analysis system to detect and quantify mycotoxins in fungal contaminants. This project aims to develop a digital multi-colour strip assay for the detection of mycotoxin that can meet these demands in the food industry. Besides, the strip assay of this project is a multiplex immunochromatographic analysis, which can detect three target toxins at once, leading to the lower cost of analysis and higher efficiency compared to single analysis ICST. Most importantly, the “digital” part of this digital multi-colour strip represents the colour analysis system that can give quantitative results of the toxins through a mobile phone application, which is of high portability and features rich-testing.