

4. ARTIFICIAL PANCREAS AND DIABETES TECHNOLOGY (TECNODIABETES) RESEARCH GROUP

The research group on Artificial Pancreas and Diabetes Technology (Tecnodiabetes - www.tecnodiabetes.com) was started in 2004 by Prof. Jorge Bondia within the Complex Systems Control group from the Institute of Automation and Industrial Informatics (Instituto ai2) of the UPV. The group has more than 15 years experience in the field of systems and control engineering applied to glucose control in type 1 diabetes, a chronic condition where patients need to face daily a complex decision making process to control their glucose levels in order to avoid deleterious complications. After a decade of intensive research launched by technological advances in continuous glucose monitoring, closed loop glucose control systems (aka artificial pancreas) appeared on the market in 2017 although further developments are needed to alleviate patient intervention at meals and exercise. Besides, diabetes education is a pillar of diabetes management, especially at diagnosis during childhood, although resources are scarce. New technological tools are needed to improve efficiency of diabetes education. Along its trajectory, the research lines developed by the Tecnodiabetes group have been motivated by the different challenges of technological development, which include type 1 diabetes modeling, methods for the characterization of intra-patient variability and glucose prediction under uncertainty, improvement of accuracy of continuous glucose monitors, control algorithms for the artificial pancreas (both single –insulin-only– and dual-hormone –insulin+glucagon, insulin+pramlintide–), disturbance observers for automatic compensation of meals and exercise without patient intervention, integration of additional signals from wearable devices into artificial pancreas systems, methods for patient supervision, and tools leveraging simulation with empathic interfaces (videogames, robotics) in pediatric diabetes education.

The Tecnodiabetes research group is a multidisciplinary team of control engineers, computer scientists, mathematicians and endocrinologists in collaboration with Universitat de Girona, Hospital Clínic de Barcelona, Hospital Clínico Universitario de Valencia and Hospital Francesc de Borja de Gandia (the Spanish Artificial Pancreas and Diabetes Technology Consortium, co-ordinated by Prof. Bondia). Since 2018, the research team joined the Centro de Investigación Biomédica en Red de Diabetes y Enfermedades Metabólicas Asociadas (CIBERDEM), Madrid, Spain (group CB17/08/00004, <https://www.ciberdem.org/grupos/grupo-de-investigacion?id =24457>). CIBERDEM is an Excellence Diabetes Research Center from the Instituto de Salud Carlos III, Ministerio de Ciencia, Innovación y Universidades including 30 research groups. The group obtained approval for the first time in Spain by the Spanish Agency of Medicines and Health Products (AEMPS) of an artificial pancreas prototype for its clinical validation. The team has been awarded 6 national coordinated projects in the field of the artificial pancreas, addressing both engineering and clinical research. International collaborations with top-level research groups are regular, including Harvard University, University of Padova, Imperial College London, Illinois Institute of Technology, University of Óbuda, University of Virginia, and Steno Diabetes Center Copenhagen, among others. Prof. Bondia has participated as an expert in the Scientific Review Panel of Juvenile Diabetes Research Foundation (JDRF) in the USA and JDRF Australia in calls related to the artificial pancreas. He is also member of the Spanish Diabetes Society and its Working Group on Diabetes Technology. Prof. Bondia has been identified as an opinion leader in the field by Seagrove Partners, LLC in its “International Diabetes Device 2021 Blue Book”.

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