ICENI DIAGNOSTICS RESEARCHER SHEDS LIGHT ON GLYCOGEN WITH A FLUORESCENT PROBE

PoLiMeR consortium takes novel ‘Systems Medicine’ approach to Glycogen Storage Diseases

Glucose provides the energy for life and is stored as glycogen in the liver and muscles.

Gaia Fancellu, of Iceni Diagnostics, is using fluorescent probe technology to better understand the structure and metabolism of glycogen – the body’s sugar storage material. Her research is part of a pan-European project using a ‘Systems Medicine’ perspective to investigate Glycogen Storage Diseases. This novel approach opens up possibilities for the rapid development of diagnostic tools and therapies for a wide range of metabolic diseases, including diabetes.

The PoLiMeR consortium (Polymers in the Liver: Metabolism and Regulation) aims to discover new treatments for Glycogen Storage Diseases (GSDs), a collection of rare conditions that are very hard to treat and can be fatal in children.

By studying rare conditions it is possible to gain insights into the underlying mechanisms, but investigating each specific disease dilutes research effort. Instead the project is taking a system-based perspective; it is creating a computational model of the glycogen breakdown process that, once fed with patient data, has the potential to provide the basis for a personalised diagnosis and treatment strategy for each individual.

Gaia joined Iceni Diagnostics, leading developers of glycoscience-based diagnostics, therapies and vaccines, in the summer and her role is to investigate the structure of glycogen. She is to share insights from her work at the PoLiMeR project meeting in Groningen, Netherlands, this week (25-30 November).

Gaia explains: “Glycogen storage diseases, or GSDs, are rare diseases based on specific enzyme deficiencies involved in the breakdown or synthesis of glycogen.”
“I’m working on characterisation of glycogen, a branched polymer, in different ways to understand the real structure of glycogen from healthy people, and compare this with the structure found in cells from patients affected by these diseases.

“I am doing this following a top-down approach. The first step will be based on breaking down glycogen using specific enzymes to determine polymer length, positions and number of branching points at different cleavage points. The results will be analysed by high performance chromatography and mass spectrometry.

“In the second step, I’ll work with fluorescent probes to detect the structure of glycogen based on changes in fluorescence, using spectrophotometer as the reference tool to study the results.”

Gaia investigated Alzheimer’s disease for her Masters in Pharmaceutical Chemistry from The University of Pisa, Italy. She is deploying similar fluorescent probe methodology used in her earlier research to detect the activity of some synthesised compounds on amyloid fibrils, to further her understanding of GSDs.

Fluorescent probes are chemical compounds that act like a molecular rotor, changing colour when its movement is constrained. When the glycogen is broken down there is a change in viscosity in the cell and so a fluorescent probe can provide an indicator for micro environmental changes within a live cell.

Gaia continues: “I’ll be using this same fluorescent probe, in a different environment, to detect any changes in the internal viscosity, wavelength, pH and, ultimately, structure of the glycogen cells.”

Gaia is one of 15 PhD students taking part in PoLiMeR, a €4 million four-year training network that provides innovative research training in personalised ‘Systems Medicine’. Funding for the project has been achieved through Horizon 2020.

Gaia’s work in glycoscience is being complemented by fellow researchers across Europe who are applying mathematical models, genetics and biochemical engineering to the challenge.

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About Iceni Diagnostics
Iceni Diagnostics is developing carbohydrate-based therapeutics and point-of-care diagnostics for infectious diseases.

The company was co-founded by Professor Rob Field CEO, project leader at John Innes Centre, Honorary Professor of Chemistry at UEA and President of the Chemistry Biology Interface Division of the Royal Society of Chemistry, and Professor David Russell CSO, Emeritus Professor of Chemistry at UEA and founder of Intelligent Fingerprinting.

The PoLiMeR consortium (Polymers in the Liver: Metabolism and Regulation)
More information is available at http://polimer-itn.eu/