Fakulta chemickej a potravinárskej technológie STU v Bratislave
a
Slovenská spoločnosť pre biochémiu a molekulárnu biológiu, člen FEBS a IUBMB
si Vás dovoľuje pozvať na prednášku:

RNDr. MARIE HRMOVEJ, DrSc.

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na tému:

Plant Transport Proteins Underlying Elemental Soil Toxicity Tolerance
&
Catalytic Mechanisms Of Enzymes Involved in Plant Development.

Prednáška sa uskutoční 4. 12. 2019 o 15:00
na FCHPT STU v Bratislave, Radlinského 9, v posluchárni CH 16

ABSTRACT OF THE LECTURE

The goals my projects are to address the fundamental questions how plant proteins mediate biological functions. The knowledge is useful to engineer proteins that could work optimally under a variety of plant growth conditions. In this lecture I will focus on two research areas:

(i) PLANT TRANSPORT PROTEINS UNDERLYING ELEMENTAL SOIL TOXICITY TOLERANCE

Transport of nutrients and toxins in plants is critical for their survival. Transport in living systems is mediated by transporter proteins that direct water and nutrients in cells and remove toxins. However, until now only a handful of plant transporters has been characterised for the benefit of edible crop plants. This is no mean feat, since transporters are embedded in plasma membranes, which makes them difficult to handle. To understand how these proteins work, we have designed an integrated platform encompassing computational, biophysical and biochemical tools. We then used molecular biology, electrophysiology and bioinformatics to describe the function of the barley borate transporter HvBot1, that underlies boric acid toxicity tolerance. Using this platform, we have discovered that HvBot1 relies on the presence of sodium in its structure and that the origin of the transport function is related to the presence of hydrated sodium in a specific location of the transporter.
This creates an energy barrier that permits an efficient exclusion of borate ions from plant cells back to soil, possibly through a quantum tunneling process. This work was published in **Plant Cell**, the highest-ranking journal in the plant science field.

Nagarajan Y, Rongala J, Luang S, Sing A, Shadiac N, Hayes J, Sutton T, Gilliham M, Tyerman SD, McPhee G, Voelcker NH, Mertens HDT, Kirby NM, Lee J-G, Yingling YG, Hrmova M (2016) A barley efflux transporter operates in a Na+-dependent manner, as revealed through a multidisciplinary platform. *The Plant Cell 28, 202–218; IF=10.6].*

(ii) CATALYTIC MECHANISMS OF ENZYMES INVOLVED IN PLANT DEVELOPMENT

In the 2nd part of my presentation I will describe a new enzyme catalytic mechanism – catalysis being a process, which speeds up chemical reactions – which could impact on biofuels production, food and materials processing, and on drug discovery. The foundation for this project was laid down in our earlier work but, we could not explain catalytic mechanism that mediates product ejection from the active site. The solution to this came up recently, when our team has combined high-resolution X-ray crystallography, enzyme kinetics, mass spectrometry, nuclear magnetic resonance spectroscopy, and multi-scale 3D molecular modelling to show these super-fast processes. Using this platform, we have discovered a new phenomenon during initial and final stages of enzyme catalysis. We revealed that the enzyme formed a cavity, which allowed for the trapped glucose product to escape, allowing for the next round of catalysis. We could simulate these nanoscale movements, which has opened the door to new knowledge on enzyme dynamics that was inaccessible before. This discovery involved specialists from Australia, France, Thailand, Spain, Chile, Slovak Republic and China. This work was published in 2019 in Nature Communications, one of the highest-ranking journals in the science field.

Streltsov VA, Luang S, Peisley A, Varghese JN, Ketudat Cairns JR, Fort S, Hijnen M, Tvaroška I, Ardá A, Jiménez-Barbero J, Alfonso-Prieto M, Rovira C, Mendoza F, Tiessler-Sala L, Sánchez-Aparicio S-E, Rodríguez-Guerra J, Lluch JM, Maréchal J-D, Masgrau L, Hrmova M (2019) Discovery of processive catalysis by an exo-hydrolase with a pocket-shaped active site. Nature Communications 10, 2222; [IF=12.4].