HRVATSKO MIKROSKOPIJSKO DRUŠTVO

POZIV NA 265. SASTANAK

Hrvatskog mikroskopijskog društva, koji će se održati u prostorijama **Instituta „Ruđer Bošković“, Bijenička cesta 54,** predavaonica **I. krila**
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u
utorak, 25. listopada 2022. u 16:00 sati
u organizaciji Vide Strasser

uz sljedeći

D n e v n i r e d:

1. **Predavanje stipendista 4. hrvatskog mikroskopijskog kongresa:**
   - **Tea Zubin Ferri:** The importance of SEM BSED in paintings and wooden polychrome cross-sections analysis
   - **Marko Šoštar:** Rac1 dynamics in *Dictyostelium* cells: A combined experimental and theoretical approach

2. **Razno**

Tajnica:
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Predsjednica:
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The importance of SEM BSED in paintings and wooden polychrome cross-sections analysis

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Microscopy analysis on painting or polychrome cross-sections represents the first and most important step in archaeometry research of an artwork. Today microscopy and micro-analysis techniques provide a wide range of investigation possibilities in terms of elemental and molecular spectroscopy analysis aimed to determine the painting materials (pigments, binders, and fillers). Usually, in order to observe all the layers (support, ground layer, underdrawings, paint layers, varnish) constituting a painted artwork, a tiny sample is embedded in transparent epoxy or polyester resin and polished, so the whole analysis can be performed directly on the cross-section. Optical microscopy observation is the very first step. With the provision of UV, IR, and polarized light, additional useful information about the composition of the layers could be immediately collected (like the presence of gilding, modern varnishes etc.), and the assessment for chemical composition analysis can be done. The most appropriate following step is the analysis of the layers by means of electron microscopy using the detector for back-scattered electrons which provides exceptional information about the composition of each layer and, often, reveals layers and details not observed by optical microscopy analysis (Fig.1). Such analysis instantly provides visual data about the different composition of the painting materials, especially those containing metal oxides (due to their higher atomic number), the shape of the filler particles or cracks and detachment between layers. In accordance with this, it can be stated that in order to perform a complete microscopy analysis of a painting or a polychrome sample, optical microscopy observations on the cross-sections should be followed by SEM BSED observations. If the SEM analysis is skipped, it is possible to overlook important characteristics of the painted layers that can lead to wrong or incomplete assumptions, especially when the analysis is accomplished as a part of research aimed to provide information about the technique and the author or to prove the authenticity of an artwork.

Keywords: wooden polychrome cross-sections, optical microscopy, SEM BSED

Rac1 dynamics in *Dictyostelium* cells: A combined experimental and theoretical approach

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Small Rho GTPases regulate and coordinate a variety of processes driven by the actin cytoskeleton. We are particularly interested in examining and understanding their role in cell motility. As a model organism, we use *Dictyostelium discoideum* amoebas, which are capable of the fastest reorganization of the actin network among eukaryotic cells, and can reverse polarity within one minute. This makes them suitable for testing conceptual models that connect Rho signalling with cell morphodynamics during motility. Here, we present combined experimental and theoretical approaches to investigating the intracellular dynamics of the small GTPase Rac1 and its effector DGAP1. Because *Dictyostelium* cytoskeleton remodels rapidly, in order to monitor its constitutive and regulatory proteins in living cells it is crucial to use fluorescent biosensors able to follow these fast dynamics and capable to endure prolonged imaging at high recording rates. We developed a fluorescent probe highly specific for the active form of Rac1 with a low cytoplasmic background signal, which enables to resolve small variations of Rac1 activity in the cell cortex. Spatio-temporal distributions of fluorescently labelled active Rac1 and DGAP1 were recorded in living cells by point-scanning confocal microscopy, processed by QuimP software, and analyzed by principle component analysis. We observed the occurrence of three main types of patterns: standing waves, travelling waves and stably polarized states. Besides these common patterns, we noticed that the dynamics of Rac1 activity and DGAP1 were mostly anti-correlated, with the exception of rare stationary patterns with overlapping distributions. We also discuss approaches to mathematical modelling of the observed dynamics and compare the results of a reaction-diffusion model to experimentally obtained distributions of Rac1 activity and DGAP1 localization. Our reaction-diffusion model with simple mass action kinetics was able to reproduce almost all experimentally observed dynamical patterns.

Keywords: small GTPases, actin cytoskeleton, cell motility, reaction-diffusion model