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TRACCE PROVA SCRITTA

Estratto verbale n. 2 del 10 giugno 2024

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TRACCIA 1

Please, convert the text into a piece of news for a broad audience:

Multilayered Bioorthogonal SERS Nanoprobes Selectively Aggregating in Human Fluids: A Smart Optical Assay for β-Amyloid Peptide Quantification

Abstract

Alzheimer's disease (AD) is a debilitating neurological condition characterized by cognitive decline, memory loss, and behavioral skill impairment, features that worsen with time. Early diagnosis will likely be the most effective therapy for Alzheimer's disease since it can ensure timely pharmacological treatments that can reduce the irreversible progression and delay the symptoms. Amyloid β-peptide 1-42 (Aβ (1-42)) is considered one of the key pathological AD biomarkers that is present in different biological fluids. However, Aβ (1-42) detection still relies on colorimetric and enzyme-linked immunoassays as the gold standard characterized by low accuracy or high costs, respectively. In this context, optical detection techniques based on surface-enhanced Raman

spectroscopy (SERS) through advanced nanoconstructs are promising alternatives for the development of novel rapid and low-cost methods for the targeting of Aβ pathological biomarkers in fluids. Here, a multilayered nanoprobe constituted by bioorthogonal Raman reporters (RRs) embedded within two layers of gold nanoparticles (Au@RRs@AuNPs) has been developed and successfully validated for specific detection of Aβ (1-42) in the human cerebrospinal fluid (CSF) with sensitivity down to pg/mL. The smart double-layer configuration enables us to exploit the outer gold NP surfaces for selective absorption of targeted peptide whose concentration controls the aggregation behavior of Au@RRs@AuNPs, proportionally reflected in Raman intensity changes, providing high specificity and sensitivity and representing a significant step ahead of the state of the art on SERS for clinical analyses.

TRACCIA 2

Please, convert the text into a piece of news for a broad audience:

Dysplasia and tumor discrimination in brain tissues by combined fluorescence, Raman, and diffuse reflectance spectroscopies

Identification of neoplastic and dysplastic brain tissues is of paramount importance for improving the outcomes of neurosurgical procedures. This study explores the combined application of fluorescence, Raman and diffuse reflectance spectroscopies for the detection and classification of brain tumor and cortical dysplasia with a label-free modality. Multivariate analysis was performed to evaluate classification accuracies of these techniques-employed both in individual and multimodal configuration-obtaining high sensitivity and specificity. In particular, the proposed multimodal approach allowed discriminating tumor/dysplastic tissues against control tissue with 91%/86% sensitivity and 100%/100% specificity, respectively, whereas tumor from dysplastic tissues were discriminated with 89% sensitivity and 86% specificity. Hence, multimodal optical spectroscopy allows reliably differentiating these

pathologies using a non-invasive, label-free approach that is faster than the gold standard technique and does not require any tissue processing, offering the potential for the clinical translation of the technology.

TRACCIA 3 *(traccia estratta)*

Please, convert the text into a piece of news for a broad audience:

Imaging Approaches to Investigate Pathophysiological Mechanisms of Brain Disease in Zebrafish

Zebrafish has become an essential model organism in modern biomedical research. Owing to its distinctive features and high grade of genomic homology with humans, it is increasingly employed to model diverse neurological disorders, both through genetic and pharmacological intervention. The use of this vertebrate model has recently enhanced research efforts, both in the optical technology and in the bioengineering fields, aiming at developing novel tools for high spatiotemporal resolution imaging. Indeed, the ever-increasing use of imaging methods, often combined with fluorescent reporters or tags, enable a unique chance for translational neuroscience research at different levels, ranging from behavior (whole-organism) to functional aspects (whole-brain) and down to structural features (cellular and subcellular). In this work, we present a review of the imaging approaches employed to investigate pathophysiological mechanisms underlying functional, structural, and behavioral alterations of human neurological diseases modeled in zebrafish.

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Il presente avviso ha valore di notifica.

La Responsabile del Procedimento
Dott.ssa Donatella D'Alberto

Firmato digitalmente da:
DONATELLA D'ALBERTO
Università degli Studi di Firenze