Editorial

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A Multipurpose Preclinical and Clinical Diagnostic Tool

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Editorial

Dual polarization interferometry (DPI) is an optical biosensor technique that is based on the use of an evanescent light field [1]. It can probe the molecular layers present and/or the molecular interactions taking place on the surface of an optical waveguide. The principles of DPI are based on two polarized light beams that travel through two waveguides (a sensing waveguide and reference waveguide) to create fringe patterns. For an example, a protein that is located above the sensing waveguide changes the speed of light, leading to a different interference pattern. These changes are interpreted by an Analight system to give information on surface bound thickness, refractive index, density and mass. These parameters will change as a result of protein-protein or protein-ligand interactions, and their analysis allows various mechanistic stages of the binding process to be discriminated [2]. In comparison, the widely used surface plasmon resonance (SPR) technique, utilizes only a single polarization, i.e., transverse magnetic (TM) polarization, and can only provide information on the relative changes in the mass of the layer(s) on the sensor surface. On the other hand, nuclear magnetic resonance (NMR), X-ray crystallography, and neutron reflectivity (NR) techniques only just provide information about structural changes [3]. The highly sensitive and accurate DPI technique, takes the advantage of measuring both TM and transverse electric (TE) polarizations The technique not only detects structural changes but also monitor binding events of a non-labelled protein kinetically by real time measuring of changes in thickness, density, and, mass. DPI has been applied successfully to the study of a variety of different biomolecular interactions, e.g., protein/protein, protein/ligand and lipid/ membrane interactions [4]. Malfunctions in proteins, causing their aggregation, or altering the way that they interact with other proteins or lipids, can lead to specific disease states, and DPI, provides a route to investigating some of these key mechanisms. Moreover, DPI as a platform with the capacity for measuring binding interactions and conformational changes, can be used to examine biomolecular interactions in a lipid environment.

DPI is used as one of the most advanced, accurate and sensitive diagnostic tool in drug discovery, antibody analysis, nanomolecular studies and early stage detection of diseases. DPI can detect the minor structural differences in both transitory and stable structures of prions that influences their pathological properties. DPI distinguishes between different strains of prions, as well as between normal and abnormal isoforms, and illuminates the characteristics of prion diseases [5]. Recently, the real-time kinetic of Aβ1-42 binding to the extracellular domain of β-amyloid receptor LilrB2 was measured by DPI. This revealed that high-molecular weight oligomers of Aβ1-42 have a higher affinity to receptor with a faster receptor association than monomer Aβ1-42 or low-molecular weight oligomers of Aβ1-42 [6]. It has been shown that the interaction of oligomeric Aβ and LilrB2 stimulates cofilin signaling leading to impaired synaptic plasticity and dementia in Alzheimer's disease [7]. Using this method, the results of a study showed that truncated heptamer penetratin does not efficiently cross the cell membrane and is not a suitable vehicle for *bioactive drugs* [8]. Penetratin is a 16-mer cell-penetrating peptide that is derived from the third helix of Drosophila Antennapedia homeodomain (AntpHD). Penetratin can penetrate cellular and nuclear membranes without triggering cellular degradation and is considered as a drug delivery tool [9]. In another study, took the advantage of DPI was used to determine the inhibitory effect of gossypol on apurinic/apyrimidinic endonuclease (APE1) that is a DNA repair endonuclease. The results showed that gossypol directly interacted with APE1and inhibited cell proliferation as an anti-cancer compound [10]. Song et al. in 2013 used DPI to determine the affinity of estrogen receptor α (ERα) to estrogen response elements (EREs) in DNA. Mutations in ERE change the binding affinity of ERα to ERE and lead to misregulation of downstream genes. In this study, different ERE sequences were immobilized on the chip surface and binding affinities of ERα to these sequences were examined [11]. Upregulation of estrogen signaling pathway promotes breast cell growth and tumor progression. However, downregulation [12] of this pathway is linked to a less frequent form of breast cancer known as triple negative breast cancer.

In conclusion, a developed DPI method can be used in early diagnosis and monitoring of cancer as a sensitive and harmless technique by detecting low concentration biomarkers. A DPI biosensor that is linked to the the desired capture probes of DNA, oligonucleotides complementary to miRNAs, or

antibodies against proteins of interest can detect very low abundant biomarkers of interest.

References

1. Cross GH, Reeves AA, Brand S, Popplewell JF, Peel LL, et al. (2003) Quantitative optical biosensor for protein characterisation. Biosens Bioelectron 19: 383-390.
2. Cross GH, Freeman NJ, Swann MJ (2008) Dual Polarization Interferometry: A Real-Time Optical Technique for Measuring (Bio) molecular Orientation, Structure and Function at the Solid/ Liquid Interface. Handbook of Biosensors and Biochips, p: 32.
3. Escorihuela J, Martinez MA, Lopez Paz JL, Puchades R, Maquieira A, et al. (2015) Dual-polarization interferometry: a novel technique to light up the nanomolecular world. Chem Rev 115: 265-294.
4. Ivask A, Kahru A, Virta M (2007) Handbook of Biosensors and Biochips. John Wiley & Sons, Ltd.
5. Thompsett AR, Brown DR (2007) Dual polarisation interferometry analysis of copper binding to the prion protein: evidence for two folding states. Biochim Biophys Acta 1774: 920-927.
6. Hu T, Wang S, Chen C, Sun J, Yang X (2017) Real-Time Analysis of Binding Events between Different Aβ1-42 Species and Human Lilrb2 by Dual Polarization Interferometry. Anal Chem 89: 2606-2612.
7. Kim T, Vidal GS, Djurisic M, William CM, Birnbaum ME, et al. (2013) Human LilrB2 is a β-amyloid receptor and its murine homolog PirB regulates synaptic plasticity in an Alzheimer's model. Sci 341: 1399-1404.
8. Watson GM, Kulkarni K, Brandt R, Del Borgo MP, Aguilar MI, et al. (2017) Shortened penetratin cell-penetrating peptide is insufficient for cytosolic delivery of a Grb7 targeting peptide. ACS Omega 2: 670-677.
9. Dupont E, Prochiantz A, Joliot A (2011) Penetratin story: an overview. Methods Mol Biol 683: 21-29.
10. Qian C, Li M, Sui J, Ren T, Li Z, et al. (2014) Identification of a novel potential antitumor activity of gossypol as an APE1/Ref-1 inhibitor. Drug Design, Development and Therapy 8: 485-496.
11. Song HY, Sun W, Prabhakar S, Aung KM, Su X (2013) Study sequence rules of estrogen receptor α-DNA interactions using dual polarization interferometry and computational modeling. Anal Biochem 433: 121-128.
12. Wang L (2017) Early Diagnosis of Breast Cancer. Sensors 17: 1572.