Viruses are the etiological cause of important diseases worldwide, and, despite decades of drug research and development, they are still a top global health problem. These considerations make virus detection, the study of their mechanisms of action and the consequent identification of new antiviral drugs extremely important for medical healthcare.

Although very simple if compared to eukaryotic cells, viruses are characterized by heterogeneous structures and mechanisms of action and are prone to high rate of mutation, making their study very diversified and difficult. At a molecular level, few proteins forming a virus “hijack” numerous host structures both at an extracellular and intracellular level, compete out physiological ligands and take control of a whole eukaryotic cell.

Unfortunately, the systematic study of countless virus/host interactions is quite complex, time-consuming and expensive, calling for new high-throughput methodologies. To this aim, in the last years, proteomic, genomic and computational biology approaches have been exploited in the field of virology providing an incessant torrent of “omics” data functional to the definition of the closely related viral “interactome”, “infectome” and “diseaseome”.

Surface plasmon resonance (SPR) is a handy-user, reliable, and high-throughput optical technique to evaluate biomolecular interactions. Launched less than 20 years ago, its use in virology has seen tremendous growth and this trend is predicted to continue as the technology becomes more accessible and its applications more diverse. Briefly, SPR allows the evaluation of biomolecular interactions by detecting reflected light from a prism-gold film interface. A receptor specific for a particular analyte is chemically immobilized onto the gold film. When the sensor is exposed to a sample containing the analyte, its binding to the receptor can be monitored as a real-time graph of the response units (RU) against time (sensorgram) (Figure 1) [1]. Due to its peculiar architecture, in respect to conventional techniques such as fluorescent, enzyme- or radio-labelled assays, SPR adds to label-free transduction of the shift of the resonance angle and providing label-free transduction of the binding reaction.

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The molecule immobilized onto the gold film is named ligand whereas the analyte is the putative partner injected into the microfluidic system. In the presence of an interaction, the refractive index at the metal surface change, resulting in the shift of the resonance angle and providing label-free transduction of the binding reaction.

Figure 1: Schematic representation of an SPR apparatus.
In conclusion, SPR may ideally integrate computational and experimental chemical systems biology approaches starting from the finely detailed characterization of relevant macromolecular interactions, that will help in drawing ‘connectivity maps’ providing better tools for drug discovery in respect to traditional ‘monotarget-centric’ drug screening. New drugs developed in these contexts may function as global inhibitors, simultaneously disabling multiple networks of virus biology.

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