

## Role of BioSAXS in the fight against coronavirus: from viral protein characterization to vaccine development.

Biological small angle scattering is a key method in biophysics and structural biology. It provides information on the size, shape, flexibility, and oligomeric composition of biological macromolecules. SAXS measure the sample directly in solution, in a quasi-native environment and is complementary to high resolution methods such as X-ray crystallography and Cryo-EM. In particular, structural changes triggered by modifications of the sample conditions (change in temperature, pH, salt or ligand concentration) can be monitored in screening or time-resolved experiments.

BioSAXS contributed to the description of the SARS-CoV-2 virus and to the development of vaccine and potential drugs. Its role in the fight against coronavirus will be illustrated with several projects carried out on the P12 beamline of EMBL Hamburg. SAXS was employed, for example, to characterize the topology of proteins involved in RNA replication for different coronavirus<sup>1</sup>. SAXS helped characterize the spike protein and its interaction with synthetic nanobodies that could neutralize the virus<sup>2</sup>. Beyond the study of the viral components, SAXS is also used to characterize and design the lipid nanoparticles that carries messenger RNA in new generation vaccine<sup>3,4,5</sup>.

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