

## Using crystallography tools to improve vaccine formulations

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This work summarizes developments attained in oral vaccine formulations based on the encapsulation of antigens inside porous silica matrices. These vaccine vehicles protect the proteins from the harsh acidic stomach medium, allowing them to reach the Peyer's patches, inducing immunity. Focusing on the pioneer research conducted at Butantan Institute, in Brazil, the results report the optimization of the antigens' encapsulation yield, as well as their homogeneous distribution inside the meso and macro porous network. The characterization plus modelling of pure antigens having different dimensions and their complexes, like silica with hepatitis B virus like particles and diphtheria anatoxin, were performed by Small Angle X-ray Scattering (SAXS), X-ray Absorption Spectroscopy (XAS), X-ray Phase Contrast Tomography (XPCT) and neutron and X-ray imaging. The association of these techniques with complementary ones provided a clear picture of the proposed vaccines. Mice with variable high and low humoral responses presented significant levels of antibodies, proving the efficacy of the proposed oral immunogenic complex.

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