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Exploitation of stable nanostructures based on the mouse polyomavirus for development of a recombinant vaccine against porcine circovirus 2

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Abstract

The aim of this study was to develop a suitable vaccine antigen against porcine circovirus 2 (PCV2), the causative agent of post-weaning multi-systemic wasting syndrome, which causes significant economic losses in swine breeding. Chimeric antigens containing PCV2b Cap protein sequences based on the mouse polyomavirus (MPyV) nanostructures were developed. First, universal vectors for baculovirus-directed production of chimeric MPyV VLPs or pentamers of the major capsid protein, VP1, were designed for their exploitation as vaccines against other pathogens. Various strategies were employed based on: A) exposure of selected immunogenic epitopes on the surface of MPyV VLPs by insertion into a surface loop of the VP1 protein, B) insertion of foreign protein molecules inside the VLPs, or C) fusion of a foreign protein or its part with the C-terminus of VP1 protein, to form giant pentamers of a chimeric protein. We evaluated these strategies by developing a recombinant vaccine against porcine circovirus 2. All candidate vaccines induced the production of antibodies against the capsid protein of porcine circovirus after immunization of mice. The candidate vaccine, Var C, based on fusion of mouse polyomavirus and porcine circovirus capsid proteins, could induce the production of antibodies with the highest PCV2 neutralizing capacity. Its ability to induce the production of neutralization antibodies was verified after immunization of pigs. The advantage of this vaccine, apart from its efficient production in insect cells and easy purification, is that it represents a DIVA (differentiating infected from vaccinated animals) vaccine, which also induces an immune response against the mouse polyoma VP1 protein and is thus able to distinguish between vaccinated and naturally infected animals.