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From genome to structure and beyond

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The genomic era has completely changed the vaccinology landscape. Starting from the genomic repertoire of microbial pathogens it is possible to identify novel antigens expected to induce a potent immunoresponse. Identified antigens can be expressed in different forms, as recombinant proteins, as fusion proteins, in multimeric forms on nanoparticles or into outer membrane to resemble their natural conformation. Immune response induced by the expressed antigens is then analyzed using novel *in vitro* and *in vivo* models and immunogenicity and stability improved by structure-based design. Moreover, to accelerate product development, an in-depth analysis of the physical-chemical properties of the antigens is applied starting from early development with the aim to identify the critical attributes to be monitored and controlled during vaccine production and lifecycle, to ensure safety and efficacy of the vaccine product. It is expected that the availability of new and powerful technologies, the rational based design of new vaccines from antigen discovery to formulations, product characterization, immunogenicity in animal models and in humans, registration and lifecycle plans, and proactive interaction with Regulatory Agencies, will result in a fast-track path. The rapid evolution in the field and the new learnings may address most of the present and future challenges in vaccine design and development.