Abstract: Vaccination remains one of the most successful biomedical interventions for preventing viral diseases. While early vaccines were developed by attenuating the infectious agent in cell cultures or by inactivation, new delivery platforms are on the rise thanks to the advent of genetic engineering. The COVID-19 pandemic stimulated the rapid adoption and a massive deployment of these platforms. Viral vector vaccines elicit antigen expression within cells and induce a robust cytotoxic T cell response, unlike protein subunit vaccines conferring mainly humoral immunity. mRNA vaccines also deliver the antigen inside the cells while offering more manageable and faster manufacturing possibilities. Unlike DNA-based vaccines, mRNA does not enter the nucleus, and thus, the probability of disrupting gene expression in the recipient cell is diminished. This thesis aims to offer an overview of current approaches in vaccinology and discuss the various platforms in use. The thesis will also present recent advances in the development of prophylactic vaccines against infections with human immunodeficiency virus-1 (HIV-1) and hepatitis C virus (HCV) and also will focus on a recently proposed strategy for vaccine development based on non-cognate ligands mimicking epitopes recognised by broadly neutralising antibodies (bNAbs).

Keywords: vaccines, prophylactic vaccination, virus, viral antigen, HCV, HIV, mimotope, broadly neutralising antibody