Priorities for vaccine developments are traditionally viral and bacterial infectious diseases. Meanwhile therapeutical anticancer vaccines are pushing to market authorization. Consistent with the molecular insights into various noninfectious and noncancer (NINC) diseases and the analyses of their pathways and networks present different targets for innovative NINC vaccination strategies. The most prominent example of a NINC vaccine is Alzheimer’s disease. Dementia is the fastest-growing global health epidemic (WHO). A vaccine targeting the amyloid β peptide combined with monophosphoryl
lipid A (see Chaps. 33 and 34) as adjuvant is able to stimulate the brain’s natural defense mechanisms in people with Alzheimer’s disease. In this part you will get perspectives from scientific leaders on some most pressing issues and promising approaches on vaccine development. NINC vaccines will dramatically help to improve public health.

**Hypertension and atherosclerosis.** Systemic blood pressure is determined by the product of cardiac output and total peripheral resistance, finely controlled by multiple mechanisms involving the kidney, the endocrine system, the central nervous system, and the vasculature. One of the important endocrine regulators of blood pressure is the renin-angiotensin system (RAS). Although vaccines for hypertension have focused predominantly on the RAS, in the case of vaccines for atherosclerosis, multiple targets in different cells have become candidates for atherosclerosis vaccine and immunomodulatory treatments.

**Obesity treatment.** Ghrelin is a gastrointestinal hormone that promotes food intake and decreases energy expenditure. Ghrelin is produced predominantly in the gastric fundus and conveys orexigenic signals to the hypothalamus. The suppression of endogenous ghrelin bioactivity with anti-ghrelin vaccines using keyhole limpet hemocyanin as carrier protein or bovine serum albumin was also tested in mice and pigs, respectively. These vaccines were able to decrease body weight gain and fat mass. These anti-ghrelin vaccinations present several limitations when applied to humans, e.g., the risk of immune response.

**Type I diabetes.** The pathogenic immune response is believed to be mediated by T lymphocytes that are reactive to islet β cell self-antigen(s) (autoreactive T cells), whereas a protective immune response may be mediated by T cells that suppress the autoreactive T cells (regulatory T cells). Glutamic acid decarboxylase (GAD) is found in islet cells. GAD is a major autoantigen in autoimmune diabetes and a target for vaccine development. The administration of recombinant human GAD with or without adjuvants did not induce adverse side effects or exacerbate T1DM in man and mice in preclinical studies and a phase I clinical trial.

**Type I allergy.** The next generation of allergy diagnostics and therapeutics will be based on recombinant proteins allowing tailor-made treatment according to the patient’s sensitization profile. Besides the benefits of a highly standardized product, production of recombinant allergens also allows modification of the allergen of interest. Modified allergens with low-IgE binding potential are called hypoallergens. As genetic vaccination represents a highly versatile platform to design advanced types of vaccines, various innovative approaches have been tested in animal models of allergy.

**Rice against allergies.** Japanese cedar pollinosis is the most predominant seasonal allergic disease in Japan and is caused by pollen spread over most areas of Japan in early spring from February to April. House dust mite (HDM) is also a major source of inhalant allergens which cause chronic allergic disease such as bronchial asthma. About 45–80% of patients with allergic asthma are sensitized to allergens in HDM. As a new form of oral allergy vaccine, rice seeds that accumulate hypoallergenic cedar pollen allergens and HDM allergen derivatives can be used as a vehicle to deliver to GALT.