Project title:
Algal expression of cross protective avian influenza and infectious bronchitis viral epitopes for mucosal immunization of avian species.

Abstract
Avian influenza viruses (AIV) and infectious bronchitis viruses (IBV) are important poultry pathogens capable of evading host immune responses by utilizing mechanisms that lead to the generation of reassortants, antigenic drifts, and variants. Control of these pathogens is dependent on vaccine-based strategies that are hampered by the limitations of production and application of multivalent vaccines. However, there is evidence that cross-reactive epitopes exist (epitopes capable of stimulating broad cross-protective immune responses against different subtypes and variants of these viruses). Many of these cross-reactive epitopes are cryptic and/or subdominant. This proposal is aimed at shifting to dominance of cryptic viral epitopes to induce multivalent cross-protective immune responses by Epitope Multiplication and Presentation (EMP). EMP involves presenting multiple copies of the targeted naturally-cryptic epitopes on synthetic molecules in a manner that simulates pathogen associated molecular patterns (PAMPs). PAMPs stimulate the specific pattern recognition receptors (PRRs) of professional antigen presenting cells (PAPCs), allowing proper activation and polarization of specific immune responses consistent with the Danger Theory (Matzinger, 2002). Successful novel EMP-based molecule design and testing will lead to research on novel formulation and delivery systems to increase utility in field applications, i.e. for commercialization of the product. We have opted to use algal expression and oral delivery of the immunizing multivalent EMP molecule. Algae are non-toxic and proper presentation of the EMP-molecules can be ideal for economic multiple species immunization against the target pathogens. Work with Chlamydomonas, the intended host for expression, reveal several advantages for use as a vaccine expression and oral delivery platform. These include cost reduction, ease of scale up, reduction of animal handling and stress during delivery, reduction of the requirements of storage and transport, and facilitation of immunization of both commercial and wild bird populations. The abundance of sea water and unexploited shores in Egypt, in addition to the advantages mentioned above, make application of this technology using sea water algae ideal, logistically and economically, for use in national and international pathogen control programs. Work with algal expression of EMP molecules will pave the way for successful control of other important veterinary and zoonotic diseases, like foot and mouth disease, MERS, and dengue.