mice to evaluate the host immune responses towards the fusion protein.

**Results**: A functionally active HA1 fusion protein consisting of the HA1 and AcmA protein, linked together by a scFv linker was successfully expressed and purified. The fusion protein has a molecular mass of approximately 50 kDa. Examination of the conditions for binding of the fusion protein to *L. lactis* showed that a mixture of 20 μg of fusion protein with $10^8$-$10^9$ *L. lactis* cells, GM17 as buffer for binding and a binding incubation period of 2 hours are most suitable.

**Conclusion**: *L. lactis* surface displaying HA1 fusion protein could potentially develop as an alternative oral vaccine for preventing influenza virus infection in humans.

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## HLA class II association with visceral leishmaniasis: The road to identifying vaccine candidates

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**Background**: Leishmaniasis, a neglected tropical disease, prevalent in developing countries with 90% of them in Asia (Bangladesh, India, and Nepal), Sudan, Ethiopia and Brazil. The technical challenges and the complexity in the immunity against the parasites clearly contribute to the absence of vaccines. A major challenge in human vaccine design is to overcome variation in immune response in a genetically heterogeneous population. This is largely determined by genetic heterogeneity in processing and presentation of Ag to T cells, the outcome of which is dependent on binding of T cell epitopes to HLA class I and class II molecules that drive CD8 and CD4 T cell responses, respectively.

*In silico* screening for putative epitopes binding to DRB1 molecules can identify multiple epitopes per single parasite antigen. Our quest here is to determine what actually occurs during the course of a complex infection *in vivo*.

**Methods & Materials**: We are using *in silico* prediction tools in an effort to understand more about the processes that direct antigen selection and binding to different DRB1 molecules during natural leishmanial infection. This will be done in concert with analysis of naturally processed leishmanial peptides. A previously conducted GWAS and further sequence based haplotyping on an Indian population has indicated HLA class II as a major genetic risk factor for visceral leishmaniasis(VL) and revealed DRB1*13/14 and DRB1*15/16 as risk and protective alleles, respectively in VL. In a preliminary study, we have obtained data on leishmanial epitopes predicted to bind to DRB1*13/*14 risk vs DRB1*15/*16 protective class II molecules using the *in-silico* predictive tool NetMHCIIpan v2.1.

**Results**: Data for overlapping 9-mer epitopes has been generated for 27 known *Leishmania* antigens (antigens of diagnostic value, vaccine candidates) and we have found peptides exclusively binding to risk as well as protective group and also some differentially binding peptides.

**Conclusion**: Functional validation of these peptides will be done by measuring immune response against these antigens in individuals carrying different allele group from endemic region in India. This will pave the way for appropriate vaccine candidates which can drive the immune response to protective response in genetically susceptible individuals.

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## Australian zoster study: GP and patient views about herpes zoster (shingles), its complications, and the likely acceptance of a zoster vaccine (Zostavax)

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**Background**: Shingles causes considerable morbidity in older persons. Zostavax, a vaccine against shingles, reduces the incidence of shingles by 50% and the burden of illness by two-thirds. Little is known about the factors that contribute to the patient's intention to get Zostavax

**Methods & Materials**: A two stage simple random sampling process was undertaken to identify a random sample of GPs across two urban areas in South Australia to identify the key beliefs about shingles and its complications and the factors that may influence the uptake of the Zostavax.

A random sample of each selected GP's patients aged between 60 and 85 who had visited that GP at least once in the last 2 years was selected and in interviewed by phone.

Principal component factor analysis with orthogonal (varimax) rotation was used to reduce the number of patient characteristics associated with vaccination intention in bivariate comparisons.

Survey weighted responses from GPs and patients were examined for their association with the patients' likelihood to receive the vaccine using the logistic regression

**Results**: Fifty GPs and 1330 patients were interviewed. About half the GPs were very likely to recommend the Zoster vaccine. 82% of the patients knew of someone who had had shingles and 50% believed that it would have a big impact on their life. Just over half would get Zostavax and 89% would, if their GP recommended it.

The main predictor of getting Zostavax was if the patient's GP recommended it (OR 21.6 95% CI 13.8- 33.8). In factor analysis, 58 patient characteristics were reduced to 16 patient factors that explained 73% of variance in patient intention to get Zostavax. After adjustment for other predictors, GP recommendation remained the strongest predictor of patient intention to get the Zoster vaccine.

A number of GP factors interacted with patient predictors to get Zostavax.

**Conclusion**: There is a high degree of awareness of the impact of shingles and reasonable likelihood of vaccine uptake. GP recommendation is likely to be the key influence on patients getting the zoster vaccine.

Strategies to enhance GP recommendation of the Zostavax will have a strong influence on Zostavax uptake

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## Yellow fever vaccination immune responses are measurable up to 38 years after vaccination

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**Background**: In May 2013, the WHO sage announced a yellow fever vaccination policy change stating that revaccination of healthy individuals every 10 years was no longer necessary. In our opinion, this statement was based on scarce research and we therefore sought for a more solid base of evidence for this guideline.

The aim of this study is to assess antibody presence and yellow fever (YF)-specific T cell responses in healthy individuals vaccinated more than 10 years ago.

**Methods & Materials**: From January 2012 to November 2013, 75 healthy individuals vaccinated more than 10 years ago and 30 individuals vaccinated less than 10 years ago were included in this study. Virus neutralizing antibodies were studied using a Plaque Reduction Neutralization Test. The presence and phenotypic profile of YF-specific CD8 + T cells was characterised by tetramer staining. YF-specific CD8 + T cell responses were assessed after stimulation with tetramer specific peptides.

**Results**: Neutralizing antibodies and YF specific CD8 + T cells were present in comparable percentages of long-term (up to 38 years after vaccination) and short-term vaccinees. In two HLA A2 + vaccinees vaccinated 12 and 15 years ago, (0.6-3.0% of CD8 + T cells) were identified and shown to have both classical (CD45RAdimCD27 + ) and effector memory phenotypes (CD45RAhiCD27). In one HLA B27 + individual vaccinated 28 years ago, yellow fever specific T cells were identified after peptide stimulation.

**Conclusion**: Antibodies were present up to 38 years following vaccination. Functional YF-specific T cells with various phenotypes were present up to 28 years after vaccination. The 17D yellow fever vaccine induces a long term humoral and cellular immune response, and our results provide a more solid base of evidence for the WHO guideline change.

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## New vaccine Strategies against *Nesisseria meningitidis* serogroup X

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**Background**: Most meningococcal disease in Africa is caused by serogroups A and W of *N. meningitidis*. Recently, new cases of meningitis caused by *N. meningitidis* serogroup X have been reported in countries from "meningitis belt". No vaccines have been developed against this serogroup. The aim of this work is to show the different R&D strategies under evaluation at Finlay Institute against the pathogen.

**Methods & Materials**: Experimental lots of outer membrane vesicles (OMVx) were obtained by deoxycholate extraction method from *N. meningitidis* serogroup X BuFa 2/97 strain. Physicochemical characterization was carried out to determine the size, morphology and the main antigens in vesicles. Secondly, capsular polysaccharide X (PsX) was obtained by phenol free process and characterized by HPLC, HPAEC-PAD and other analytical techniques. A combined formulation of OMVx plus PsX adsorbed to aluminum hydroxide (OMVx/AL) was developed and evaluated in mice models. Finally, conjugates of PsX to diphteria or tetanus toxoid were obtained. The antigen specific IgG responses induced by these formulations to polysaccharides or OMVx were evaluated by ELISA, and serum bactericidal assay (SBA).

**Results**: OMVx size was between 90-120 nm and OpcA, PorA and RmpM protein were identified. Lots from PsX were obtained by high scale process (100 L). PsX size was estimated in 500 g/mol L and Kd in 0.5.OMVx/Al induced high specific anti-OMVx antibodies response in sera with bactericidal activity. OMVx with PsX also contributes to increase SBA in the group of mice immunized with this formulation as well as the induction of anti PsX antibodies. PsX conjugates also induced high specific titers and SBA.

**Conclusion**: Purification of capsular polysaccharide, combination of OMVx with the PsX as well as the formulation of multivalent OMV vaccines or conjugates from different meningococcal serogroups is the focus of our current work.

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