**Invention Description**

Safe and effective prophylactic vaccines offer the best health intervention in disease control. One of the most important yet elusive vaccines is that for HIV; a recent vaccine clinical trial reduced the risk of HIV infection by 31 percent among a high-risk group in Thailand, although the reasons for such low efficacy and modest protection remain elusive. Antibodies to gp120/41 proteins have an important immunological correlation to preventing the establishment of HIV infection, but there are major challenges in translating this fundamental knowledge into an effective HIV vaccine.

Researchers at the Biodesign Institute of Arizona State University have developed a completely new approach to HIV vaccines. They have devised a bottom-up synthetic methodology combining 3D protein modeling, computational analyses of gp120/41 epitope sequences, glycan and peptide grafting, novel addressable DNA-nanoscaffolds, and rapid assessment of immune responses. This allows rational design, construction, selection and identification of immunogenic HIV-DNA origami to induce effective anti-HIV antibody responses.

Rational design and the synthetic nature of peptide and glycan grafting, along with the engineering of the DNA-nanostructures, makes the vaccine development more robust and efficient. Furthermore, the inert nature of DNA reduces the chances of non-targeted immune responses.

**Potential Applications**

- HIV vaccines
- Other prophylactic and therapeutic vaccines

**Benefits and Advantages**

- Vaccine development process is robust and efficient
- Rational selection and engineering of epitopes
- Optimal particle size for antigen delivery (can be controlled at 100nm)
- Weak immunogenicity of DNA scaffolding causes minimal harm or interferences