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Nanotechnology based delivery systems for peptides and vaccines

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Poor oral absorption and rapid enzymatic degradation are the major hurdles in to deliver peptide drugs orally and vaccines via the mucosa. We developed stable, orally available peptide drugs through the chemical addition of specifically designed lipids and carbohydrates, creating amphiphilic compounds capable to reassemble to form nanoparticles.Fertility is controlled by decreasing the level of circulating Gonadotropin-Releasing Hormone (GnRHor stimulating the down-regulation of GnRH receptors on gonadotrope cells. Using two independent approaches we regulated the action of GnRH on gonadotropic cells, thereby controlling fertility inmice and ram models.
We have also developedan oral vaccine delivery system to prevent infection byGroppA streptococcus (GAS) by encapsulating lipid core peptide (LCP) antigens into the liposomes.We synthesised the LCP constructby attachingC-16 lipoamino acid (Toll-like receptor 2 agonist)toJ-14 (B-cell epitope derived from GAS M-protein)andP25 (CD4+ T helper cell epitope).Blank liposomes were formulated and optimized for charge and lipid content using a thin film formation method.Optimized liposomes were coated with oppositely chargedpolyelectrolytes(positively chargedtrimethyl chitosan (TMC) and negatively charged sodium alginate)in a layer-by-layer approach. These formulations were subsequently characterized by dynamic light scattering (DLS) and transmission electron microscopy (TEM). Spherical-shaped liposomes surrounded by films of TMC and sodium alginate were observed by TEM. DLS analysis of coated liposomes showedmonodispersed particles with a polydispersity index of 0.24,hydrodynamic diameter230 nm andzeta potentialof -40mV. Optimized formulationswill be further investigated for theirefficiency of uptake by intestinal immune cells and ability to induce mucosal IgA and systemic IgG responses.

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