Title	**CpG 寡脫氧核苷酸、包含其之免疫組成物以及以其製備用於誘發免疫反應之藥物的用途**
	CpG-Oligodeoxynucleotide, immunogenic composition inducing the same, and use of preparing medical for inducing immune response by the same
Key summary	本案所開發的 **CpG-2722** 寡脫氧核苷酸，在人與不同的物種中均有良好的免疫調節力。醫學方面的應用包括，作為細胞**(**如樹突狀細胞等**)**治療的免疫調節劑，癌症治療葯物的合併使用劑，以及人或動物用的疫苗佐劑。
	The CpG-2722 oligodeoxynucleotide developed in this study has good immune stimulatory activity in humans and different species. Medical applications of this CpG-2722 include used as immunomodulators for cell (such as dendritic cells) therapy, combinational use with other drugs for cancer therapy, and used as vaccine adjuvants.
Targeted indication	**Adoptive cell therapy, Cancer Immunotherapy, Vaccine adjuvant for human and animals.**
Status	**Pre-clinical study with animal model**
Key features	● **CpG-2722 has good immunostimulatory activity in different species.** ● **CpG-2722 can promote the expression of various cytokines and increase the number of dendritic cells, M1 macrophages, and CD8 T cells in tumors.** ● **Both CpG-2722 can inhibit tumor growth when used alone.** ● **When CpG-2722 and anti-PD-1 are used in combination, their anti-tumor activity is further enhanced.**
Market	**Adoptive cell therapy, Cancer immunotherapy, Vaccine adjuvant for human and animals.**

Mode of Action	**CpG-ODN triggers innate immune responses including cytokine production and the uptake and presentation of tumor antigen in dendritic cells and other innate immune cells. These adjuvant effects, particularly the production of IL-12 and type I IFNs, facilitate a Th1 response of T cells and expansion of tumor-specific T cells for tumor killing.**
Experimental results	• **CpG-2722 has potent activity in inducing expression of various cytokines in immune cells.** • **In head and neck cancer animal models, both CpG-2722 increases the expression of various cytokines such as IL-12, IFN-β and IFN-γ, and increase the number of dendritic cells, M1 macrophages, and CD8 T cells in tumors.** • **In head and neck cancer animal models, both CpG-2722 and anti-PD-1 antibody can inhibit tumor growth when used alone, and when these two are used in combination, their anti-tumor activity is further enhanced.** • **A CpG-1018 has been used as an adjuvant in a FDA approved Hepatitis B vaccine. In general CpG-oligodeoxynucleotides (CpG-ODNs) have a safety profile for using in human bodies. Nevertheless, because the CpG-2722 has different nucleotide sequences with other CpG-ODNs, its toxicity and safety to humans needs further investigated.** • **CpG-ODNs can be synthesized automatically with machine.**
Intellectual property	**1. Taiwan patent (TW I653240)** **2. US patent (US 10246715)** **3. Mainland China patent (CN109593765)**

Selected Publication	**1. Yeh DW, Lai CY, Liu YL, Lu CH, Tseng PH, Yuh CH, Yu GY, Liu SJ, Leng CH, Chuang TH (2017). CpG-oligodeoxynucleotides developed for grouper toll-like receptor (TLR) 21s effectively activate mouse and human TLR9s mediated immune responses. Sci Rep. 2017 Dec 11;7(1):17297.** **2. Chuang YC, Tseng JC, Yang JX, Liu YL, Yeh DW, Lai CY, Yu GY, Hsu LC, Huang CM, Chuang TH. (2020) Toll-Like Receptor 21 of Chicken and Duck Recognize a Broad Array of Immunostimulatory CpG-oligodeoxynucleotide Sequences.Vaccines (Basel). 8(4):639.** **3. Chuang YC, Tseng JC, Huang LR, Huang CM, Huang CF, Chuang TH. (2020) Adjuvant Effect of Toll-Like Receptor 9 Activation on Cancer Immunotherapy Using Checkpoint Blockade. Front Immunol. 11:1075.** **4. Tseng JC, Yang JX, Liu YL, Su YW, Lee AY, Chen YW, Liu KJ, Luo Y, Hong YR, Chuang TH. (2021) Sharpening up tumor microenvironment to enhance the efficacy of immune checkpoint blockade on head and neck cancer using a CpG-oligodeoxynucleotide. Cancer Immunol Immunother. 2021 Sep 28. doi: 10.1007/s00262-021-03062-8.**
Business opportunity	**Adoptive cell therapy, Cancer immunotherapy, Vaccine adjuvant for human and animals.**