An effective vaccine against typhoid and Salmonellosis in animals and humans using Dnak protein (member of Hsp 70 of family) of S Typhi

Salmonellosis is a hyper-endemic disease in India affecting both man and animals alike. Typhoid, caused by *Salmonella* Typhi is still an unsolved problem in the majority of the world. Rapid emergence of MDR strains and limited usefulness of presently available vaccines has made the control of *Salmonellosis* very difficult proposition.Furthermore, in recent years, the realized threat from biological attack has necessitated the development of medical countermeasures to protect against virulent pathogens and *Salmonella* could be a potential bio-threat agent which may lead to high morbidity and even mortality. The currently available vaccines (Vi) are only 55–70% protective, have side effects, thus, licensed for use from age two years and older. Vivotif,a live vaccine, is in the form of capsules,therefore, not suitable for children andis contraindicated in immune compromised host.

As a novel vaccination approach, DIPAS, DRDO has developed Heat shock protein (Hsp) based candidate vaccine molecules rHsp60 (GroEL) and rHsp70 (DnaK) against *Salmonella* and reported these molecules to be highly effective in mouse model.

Highlights of these vaccine candidate molecules:

- **Stimulate both humoral and cell mediated immune responses** unlike Vi vaccine which stimulates predominantly humoral responses.
- **Higher Protection** (80-90%) than Vi (60-70%) in mouse model.
  Publications: Clinical Immunology (2008), 126: 89-96. IF 4.0;
  Vaccine (2011), 29: 6532-6539. IF 3.6
- **Effective even in the absence of adjuvants** which is an absolute requirement for the traditional vaccines with side effects.
  Publication: Mol CellBiochem (2010), 337:213-221. IF 2.6
- Immense potential to be developed as **single vaccine candidate molecule against multiple pathogens.**
  Publication: Vaccine (2013), 31: 2035– 2041. IF 3.6.
- Promising **carrier molecules for enhancing antigenicity of poor antigens**as we reported against *Shigella.*
  Publications: Cellular and Molecular Immunology (2015), 12(6): 757-67. IF 5.2. (Nature publication group);Vaccine (2016), 34: 5376-5383. IF 3.6
- Great potential to be used as animal vaccines for preventing *Salmonellosis* in poultry and cattle as there is > 99.5 % homology with its closely related serovars.

Patents granted:
i) Indian patent : A vaccine effective against typhoid', Patent no. 259393, March 11, 2014
ii) US patent no. US 8241645 B2, granted on August 14, 2012
iii) European patent EP 1931389 B1, granted on July 14, 2010.

In addition to its utmost usefulness to our armed forces, who often have to face vagaries of nature and exposure to unhygienic conditions in the line of their duty, this innovation has great potential to be developed as vaccine for general population, as well as animals, against *Salmonella* and multiple pathogens.