

# Engineering nano-carriers against snake venoms

Joint project with

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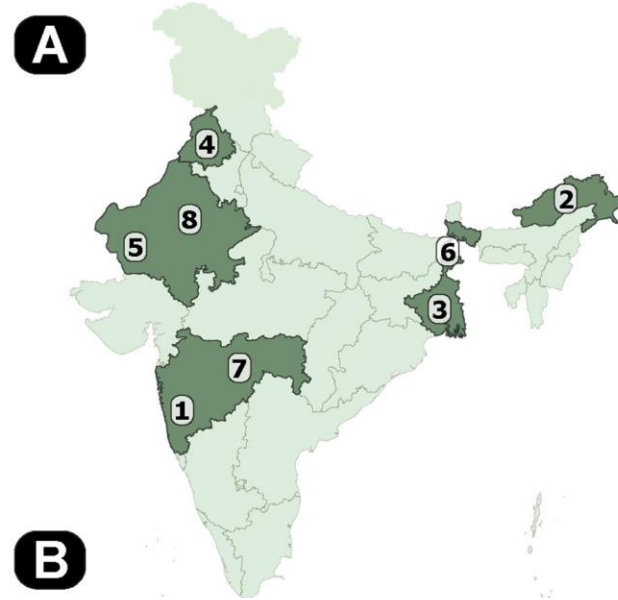
<http://www.be.iisc.ac.in/~rachit/>

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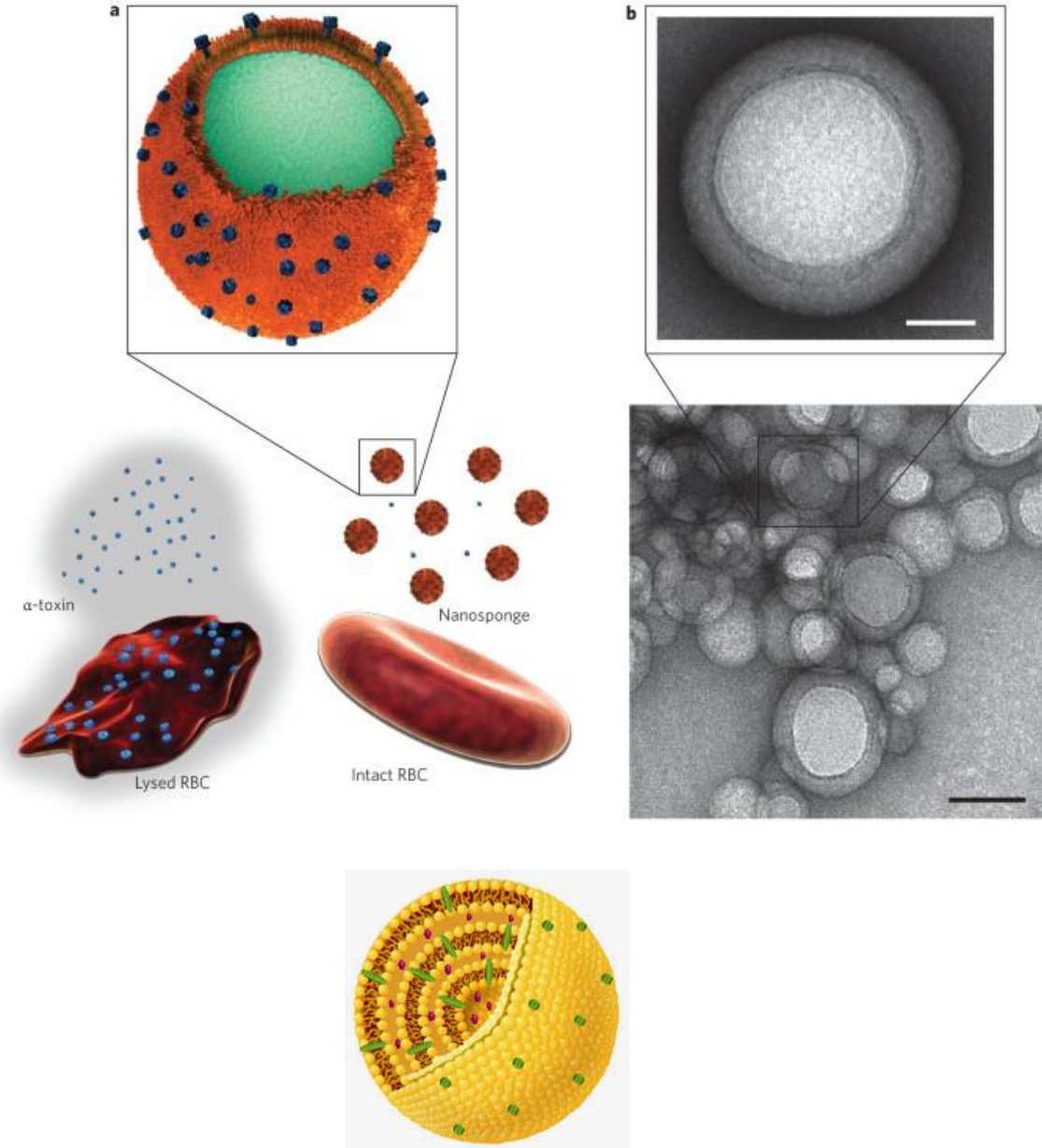
# Snakebites

- Over 200,000 people in India are annually affected/die due to snakebites, which is more than anywhere else in the world
- Several distinct snake species are involved
- Snake venoms are complex and contain a mixture of toxins having diverse mode of action
- Commercial Indian antivenoms have poor venom neutralisation efficacy



# Need and overall system

- Severe need to design an effective and broad antivenom formulations
- Bioengineering strategies are needed to design systems that can bind and neutralize the venom
- Nano-decoys mimicking cell membranes and venom receptors will be synthesized to rapidly absorb the toxins and prevent cell and tissue damage



# Learnings and major techniques

Students working on this project will develop following expertise:

- Problem solving ability and time management!
- Engineering materials for biological applications
- Designing nanoparticles with various polymers and lipids (liposomes)
- Encapsulating drugs and strategies for sustained and controlled release of drugs
- Material characterization techniques such as AFM, zeta potential, charge
- Microscopic techniques such as fluorescence imaging, Scanning and transmission electron microscopy
- Mammalian and bacterial cell culture, animal handling
- Understanding the various mechanisms of action for snake toxins

## Further reading

Hu, Che-Ming J et al. “A biomimetic nanosponge that absorbs pore-forming toxins.” *Nature nanotechnology* vol. 8,5 (2013): 336-40

Chen Y, Zhang Y, Chen M, et al. Biomimetic Nanosponges Suppress In Vivo Lethality Induced by the Whole Secreted Proteins of Pathogenic Bacteria. *Small*. 2019;15(6):e1804994

Senji Laxme RR, Khochare S, de Souza HF, Ahuja B, Suranse V, Martin G, et al. (2019) Beyond the ‘big four’: Venom profiling of the medically important yet neglected Indian snakes reveals disturbing antivenom deficiencies. *PLoS Negl Trop Dis* 13(12): e0007899