

Engineering nano-carriers against snake venoms

Joint project with

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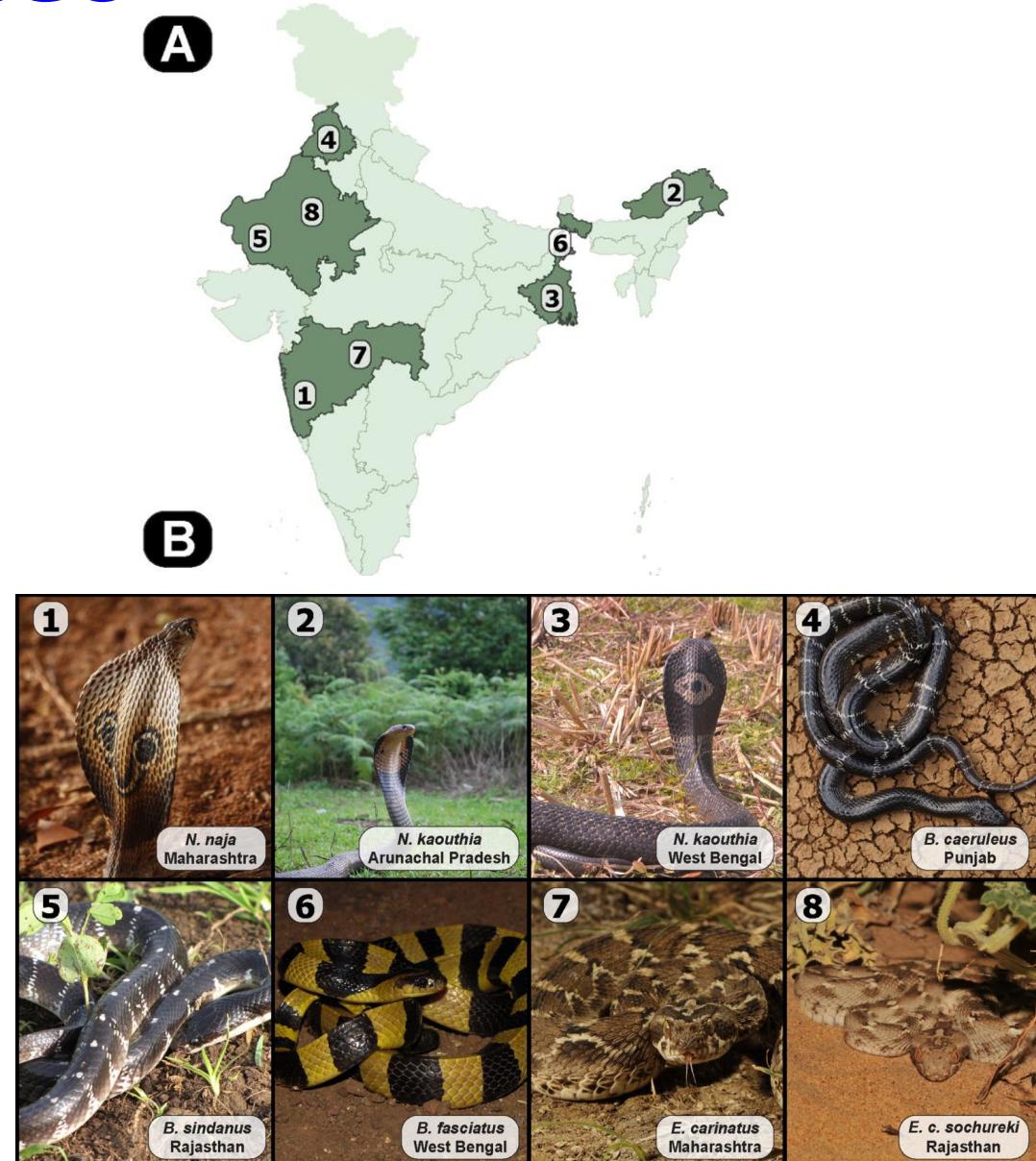


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Indian Institute of Science

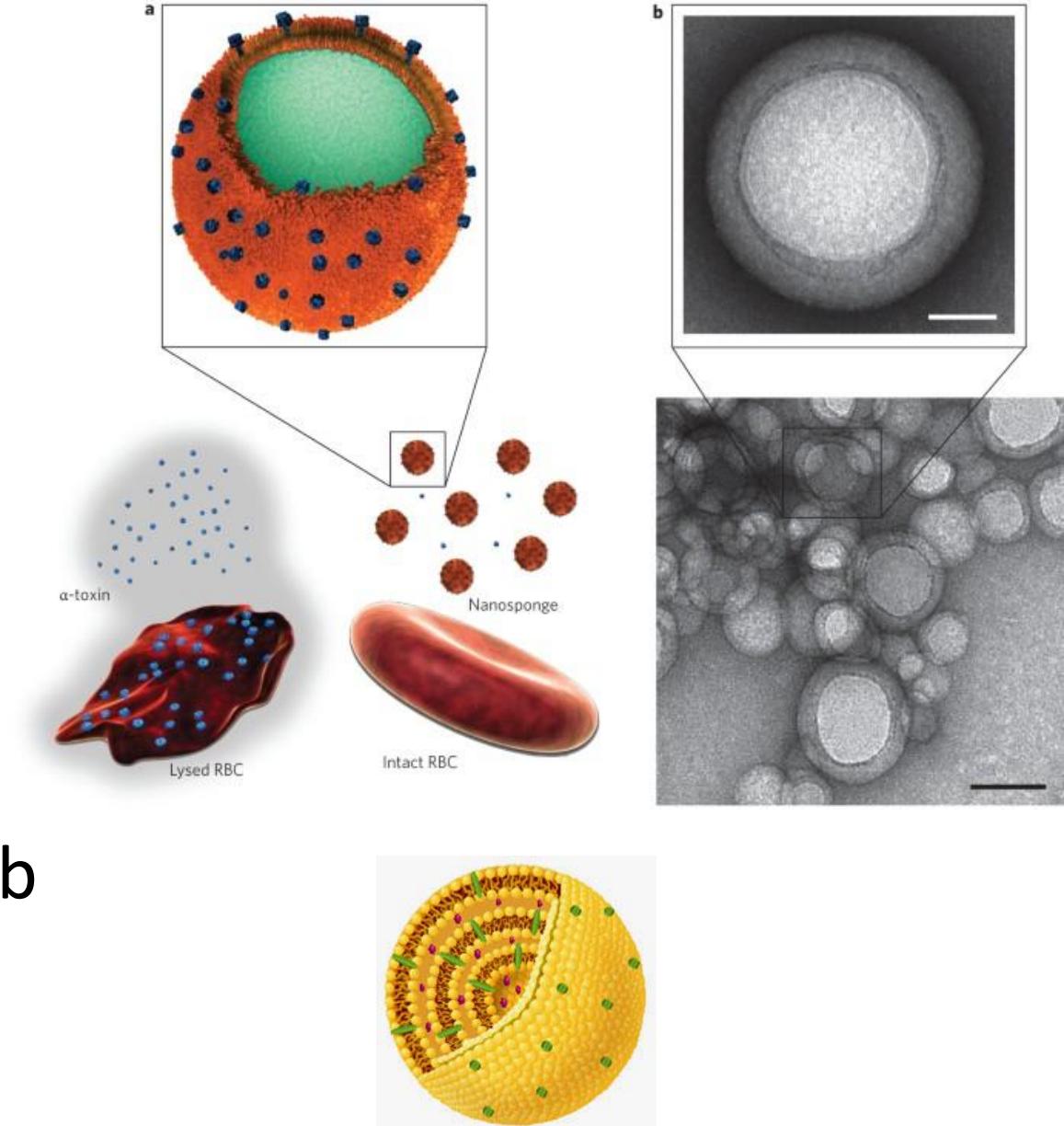
Snakebites

- 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 nanospunge that absorbs pore-forming toxins.” *Nature nanotechnology* vol. 8,5 (2013): 336-40

Chen Y, Zhang Y, Chen M, et al. Biomimetic Nanospanges 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