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LAB TALK

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Cyto-friendly system for targeted cancer imaging

Scientists at the Amrita Centre for Nanoscience and Molecular Medicine (ACNSMM), India, have developed a novel nano-biolabel (based on protein protected gold nanoclusters containing ~25–28 atoms) that emits intense near-infrared light suitable for detecting cancer by molecular receptor targeted imaging.
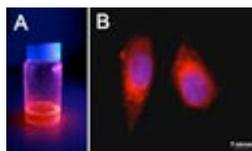

(http://images.iop.org/objects/ntw/journal/9/2/11/image1.jpg)

Developing non-toxic fluorescent nano-biolabels (http://images.iop.org/objects/ntw/journal/9/2/11/image1.jpg)

Identifying cancer, with single-cell specificity, by imaging differentially expressed molecular receptors using fluorescent nanocrystals is one of the most promising biomedical applications of nanotechnology.

Bright and tunable

The Amrita group has produced sub-nanometric atomic clusters of gold by stabilizing a few tens of gold atoms (~25–28) within a biopolymer matrix of bovine serum albumin protein. X-ray photoemission spectroscopy and electron microscopy studies carried out in collaboration with Prof. T Pradeep's lab at IIT, Chennai, showed that these gold nanoclusters have an intermediate composition between bulk and molecular regimes. The otherwise overlapped metallic energy bandgap is modified to include discrete electronic states and leads to semiconductor-like phenomena, such as fluorescence.

Although such atomic clusters are generally unstable for any practical applications, the researchers have successfully optimized the reaction conditions for conjugating with molecular receptor specific targeting ligands to identify cancer biomarkers on a malignant cell membrane.

(http://images.iop.org/objects/ntw/journal/9/2/11/image2.jpg)
Biolabels (http://images.iop.org/objects/ntw/journal/9/2/11/image2.jpg)

"The development of non-toxic fluorescent nano-biolabels using molecular clusters of metals like gold is a novel concept that opens up new opportunities in biomedical research, particularly in the area of cancer detection and therapy," commented Prof. Manzoor Koyakutty, who led the research at the Amrita Centre.

The cancer specificity is demonstrated using a nasopharyngeal oral cancer cell line KB, which over-expresses folate receptors compared with that of the control.

"The team is currently investigating the *in vivo* application of these novel fluorescent clusters for simultaneous cancer imaging and therapy including gene-silencing of mutated signaling pathways in cancer," said Prof. Shantikumar Nair, director of the Amrita Centre for Nanoscience and Molecular Medicine.

Full details (http://www.iop.org/EJ/abstract/0957-4484/20/6/065102/) of the study can be found in the journal *Nanotechnology.*

About the author

Archana Retnakumari and Sonali Setua are PhD researchers in Prof. Manzoor Koyakutty's team at the Amrita Centre for Nanoscience and Molecular Medicine (ACNSMM). Dr Deepthy Menon and Dr Prashant are assistant professors working in the same group and investigating various aspects of cancer nanomedicines. Habeeb Muhammad is a PhD student working in Prof. Pradeep's lab at the DST Unit on Nanoscience, Indian Institute of Technology, Chennai. Prof. Shantikumar Nair is the director of ACNSMM and dean of research, Amrita Vishwavidhyapeetham University. The work was supported by the Department of Biotechnology, government of India (RNAi program co-ordinated by Dr R R Sinha) and the Department of Science and Technology, government of India under National Nanotechnology Initiative (Chair: Prof. C N R Rao).