



## **PRESS RELEASE**

### **IIT Mandi researchers develop nano-capsules that can simultaneously detect and treat tumour cells**

**MANDI, 14<sup>th</sup> June 2019:** A research team from Indian Institute of Technology Mandi has developed complex nano-dimensional capsules that can be used for multimodal imaging and treatment of tumours. Their work paves the way for better understanding and development of theranostic techniques for cancer and other diseases.

**The research work was undertaken by a team lead by Dr. Amit Jaiswal, Assistant Professor, School of Basic Sciences, IIT Mandi and was recently published in the *Journal of ChemNanoMat*.**

Theranostics is an emerging field in medicine, especially in oncology, and combines “diagnostics”, the detection of abnormalities and maladies, with “therapeutics”, treatment of the malady. It involves the use of a single multifunctional agent that can diagnose ailments, deliver drugs and monitor treatment efficacy. The promise of theranostics is that it could enable treatment options that are individual-specific, which can conceivably result in better prognoses. This research does not imply a cure for cancer.

Obviously, the development of theranostic techniques hinges on the development of agents that can serve multiple functions of detection and treatment. *“Nano-materials – materials that are approximately few thousand times smaller than the thickness of a single human hair – have brought the concept of theranostics closer to reality”, says Dr. Amit Jaiswal.* The unique size scale of the particles can result in enhanced-permeability-and-retention (EPR) effect in tumour targeting and treatment.

Dr. Jaiswal and his team have developed a 'smart' nano-material that can serve as an effective theranostic agent. Their plasmonic nano-capsules have functionalities that make them useful in diagnosis through a technique called Surface-Enhanced Raman Spectroscopy, or SERS, in addition to carrying a cancer drug in it, which can be released simultaneously. Their nano-capsules comprise a solid gold core, which is surrounded by a porous gold layer, the two layers forming what they term, a "gold nanorattle". This nanorattle has electromagnetic hotspots, in addition to being able to bind to a Raman-active compound called BDT, and together serve as a Raman reporter, the diagnostic part of the functionality. This ensemble is further encapsulated, first by a solid silica layer, which keeps the underlying BDT from leaching out. Surrounding this is a porous silica layer, into which is loaded, the chemotherapy drug, Doxorubicin, or DOX – the therapeutic part of the theranostic agent. DOX is also a fluorescent compound, which enables easy monitoring of its uptake by cancer cells, through fluorescence spectroscopy.

The team is excited about this development. The smart core-shell type nanocapsules “enable an extraordinary nanotheranostic platform that can perform bimodal SERS and fluorescence-based bioimaging, and at the same time function as an efficient drug delivery vehicle for therapeutic applications”, the researchers write in their recently published paper. The nanostructured capsules developed by Dr. Jaswal and his research students, Mr. Shounak Roy,



Ms. Ankita Sarkar and Ms. Monika Ahlawat, can potentially extend the existing paradigms in therapeutic procedures by allowing imaging to be performed not only before and after, but also during a treatment regimen.

Theranostic nanomedicine is a promising biomedical technology and can conceivably herald the era of personalized medicine. Challenges, however, remain, including understanding the toxicity issues involved in using nanosized materials in biological domains, and specific targeting issues, which must be addressed before theranostics can transition from the lab to clinical practice. Dr. Jaswal's work offers a launchpad in India for more extensive research that can eventually enable the transition.

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#### **About IIT Mandi**

Since the first batch of 97 students joined in July 2009, IIT Mandi has grown to host 1,300 students including 300 PhD, 46 MS research scholars, besides 110 Faculty and 150 staff. IIT Mandi's fully residential campus in Kamand boasts 1.2 lakh sq.m. of completed buildings with 95,000 sqm currently under construction. IIT Mandi has been ranked No. 20 in the Engineering Institutions Category in the [India Rankings 2019](#) released by National Institutional Ranking Framework, Ministry of Human Resources Development, Govt. of India. In the Outreach and Inclusivity metric of NIRF, IIT Mandi is 1st among all 23 IITs.

Since 2010, IIT Mandi's faculty has bagged nearly 180 projects worth more than Rs. 85 crore. A notable mention is the Advanced Materials Research Centre (AMRC), created in 2013 with an investment of about Rs. 50 crore, housing advanced instruments for characterization of materials. The Institute also hosts a 'Class 100 Clean Room' facility, a world-class research centre that is first-of-its-kind in India. In 2017, the Department of Biotechnology, Government of India, selected IIT Mandi to lead the prestigious Rs. 10 crore FarmerZoneTM Project.

The unique, project-oriented B.Tech curriculum is centred around its 4-year long Design and Innovation stream. It is poised to become the first IIT to offer a B.Tech in Data Science & Engineering. There are many active MoUs with TU9 in Germany since May 2011. About 25 students from WPI, U.S., have been visiting IIT Mandi every year since 2013, along with 2 WPI faculty.

Launched in 2016, IIT Mandi's Catalyst is the first Technology Business Incubator in Himachal Pradesh. EWOK (Enabling Women of Kamand Valley) is another innovative program run by IIT Mandi, which focuses on imparting Skills training to rural women to enable them to start village-scale business.

#### **Media contact for IIT Mandi:**

**IIT Mandi Media Cell - [mediacell@iitmandi.ac.in](mailto:mediacell@iitmandi.ac.in) / Landline: 01905267832**

Bhavani Giddu - Footprint Global Communications

Cell: 9999500262 / Email: [bhavani.giddu@footprintglobal.com](mailto:bhavani.giddu@footprintglobal.com)

Akhil Vaidya – Footprint Global Communications

Cell: 9882102818 / Email ID: [akhil.vaidya@footprintglobal.com](mailto:akhil.vaidya@footprintglobal.com)

Samriddhi Bhal - Footprint Global Communications

Cell: 7905887524 / Email: [samriddhi.bhal@footprintglobal.com](mailto:samriddhi.bhal@footprintglobal.com)

Palak Sakhuja - Footprint Global Communications

Cell: 9582338333 / Email: [palak.sakhuja@footprintglobal.com](mailto:palak.sakhuja@footprintglobal.com)



Sairam Radhakrishnan - Footprint Global Communications  
Cell: 9840108083/ Email: [sairam.radhakrishnan@footprintglobal.com](mailto:sairam.radhakrishnan@footprintglobal.com)