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Ministry of Science and Technology
Government of India
DBT



National Institute of
Advanced Industrial Science
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AIST

DBT-AIST International Laboratory for Advanced Biomedicine

DAILAB

Classroom for Advanced & Frontier Education CAFE

DAILAB CAFÉ

Series 48

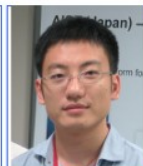
DAILAB-CAFE

Series - 48

Time: July 16, 2020 (3PM (JST))

Speaker: Yue YU

Location: Medical and Biological Engineering Research Group, BMRI, AIST
Contact: yu-yue@aist.go.jp



Optical control of cancer stemness with nanocarbon complexes

Strategies for eradicating cancer stem cells (CSCs) are urgently required, because CSCs are resistant to cancer drugs and cause treatment failure, relapse and metastasis. Here we show that photoactive functional nanocarbon complexes exhibit unique characteristics, such as homogeneous particle morphology, high water dispersibility, powerful photothermal conversion, rapid photoresponsivity and excellent photothermal stability. In addition, the present biologically permeable second near-infrared (NIR-II) light-induced nanocomplexes photothermally trigger calcium influx into target cells overexpressing the receptor potential vanilloid family type 2 (TRPV2). This combination of nanomaterial design and genetic engineering effectively eliminate cancer cells and suppress stemness of cancer cells *in vitro* and *in vivo*. Finally, in molecular analyses of mechanisms, we show that inhibition of cancer stemness involves calcium-mediated dysregulation of the Wnt/ β -catenin signalling pathway. The present technological concept may inspire innovative cancer therapies in future.

Sukant Garg(Me)	Hanouf I	ZHANG HUAYUE
Vipul Kumar(Host)	HE Huifu	YongHyeon Choi
Ashis Dangol	Gayathri	Khadija
Adithya	Ashish KAUL	Sosmitha Girisa
MALLIKA	AnissaSARI	Anand Mukharjee
Supriti	Harsha Choudhary	Bhagya Galappathth
Babita Devi	Sajal Afzal	Abhimani's iPhone
Ranita Ghosh Dastic	Ahmed Elwakeel	Jahnnavy
RENU	Dr. Satish Rao, MAHE,	Nadeem
Sunil Kaul	HENAMAYEE SAHU	LI Xiaoshuai
Monalisa Biswas	Yu Yue	Punitkumar Naik
Krishan Kumar Thak	Maithili	VASISHTA
Rajesh Vikkurthi	S D	Sowmya Prabhu
Lakshitha	MAHE	Nalaka Wijekoon
MEGHA	Parama	Jaspreet Kaur
JIA WANG	Neena	Ashwin Rajeev

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Participants

Nanoparticles to study the cancer stem cells mechanisms



Live online, via 'Zoom', From **AIST, Japan**

DAILAB (DBT-AIST International Laboratory for Advanced Biomedicine) CAFÉ (Classroom for Advanced and Frontier Education) is held once in six weeks and provides a relaxed CAFÉ-like environment for student learning. This is a Classroom setting rather than a lecture on data presentation. Frontier topics are selected for CAFÉ talks that are presented by eminent scientists on an educational level and are skyped to all the participating institutions (DAILAB CAFE and its Satellites). Participating Institutions include AIST (Tsukuba, Japan), IIT Bombay (India), Hanyang University (South Korea), Peking Medical University (China), Brawijaya University (Indonesia), Manipal University (India), IIT-Guwahati (India) and Guru Nanak Dev University (India). Dr. Yue Yu is a member at the AIST (Osaka campus), and is committed in exploring the cancer cell stemness mechanisms using nanocarbon-based technology.

Strategies for eradicating cancer stem cells (CSCs) are urgently required, because CSCs are resistant to anticancer drugs and cause treatment failure, relapse and metastasis. In the present study, Yue et al. has shown that the photoactive functional nanocarbon complexes exhibit unique characteristics, such as homogeneous particle morphology, high water dispersibility, powerful photothermal conversion, rapid photoresponsivity and excellent photothermal stability. In addition, the present biologically permeable second near-infrared (NIR-II) light-induced nanocomplexes photothermally triggered calcium influx into target cells overexpressing the receptor potential vanilloid family type 2 (TRPV2). This combination of nanomaterial design and genetic engineering effectively eliminated cancer cells and suppressed stemness of cancer cells *in vitro* and *in vivo*. Finally, in molecular analyses of mechanisms, they showed that inhibition of cancer stemness involves calcium-mediated dysregulation of the Wnt/ β -catenin signaling pathway. The present technological concept may inspire innovative cancer therapies in future.