Vigyan Patrika

Biopatrika

Tiny communications: A method of survival by cancer cells

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Work done in the lab of Prof. Shiladitya Sengupta at Harvard Medical School.

Dr. Tanmoy Saha is from a small village of West Bengal. He did his Ph.D from Indian Institute of Science Education and Research Pune in Chemical Biology. His research work at IISER has been published in many reputed scientific journals and his thesis was added for best thesis from the institute. To pursue translational research, Dr. Saha joined the department of medicine at Brigham and Women's Hospital at Harvard Medical School, in the USA. At Harvard Medical School Dr. Saha is working on cellular communication by which cancer cells modulate its environment and promote survival, metastasis and immune escape. Dr. Saha is also working on drug delivery methods where drugs will be loaded in a vehicle by which we can deliver the chemotherapy drugs selectively at the tumor site. He is looking to open his independent research group soon and establish scientific collaboration between India and the USA.

How would you explain your research outcomes to the non-scientific community?

Cancer cells hijack mitochondria, the power source, from immune cells and use them for their benefit related to higher growth rate and avoiding the immune system. Let's consider the human body as a castle invaded by an enemy (cancer cells). The enemies hijack the entire kitchen (mitochondria) used to prepare food for soldiers (immune cells) in the castle. The enemies make a small tunnel to hijack the kitchen, so the soldiers (immune cells in our body) die because of starvation. On the other hand, the enemies are accumulating more power by producing more food for themselves. So here the enemies (cancer cell) hijack the kitchen (mitochondria) by tunnel (nanoscale communication) to defeat the soldiers (the immune cells) in a castle (human body). In technical terms the research outcome explains the mode of immune evasion of cancer cells by nanotube mediated mitochondria hijack from immune cell to cancer cell.

How do these findings contribute to your research area?

This is a completely new mechanism, how the cancer cells escape from the immune cell surveillance. This discovery opens up new areas for drug discovery to inhibit the process. Also, this is a reason for failure of immunotherapy in most of the patients. The article has got tremendous attention from the general and researcher community. An Editorial from *Science Signaling* journal and one News and Views have been released by *Nature Nanotechnology* on the article.

What was the exciting moment during your research?

Back in 2018 when we first saw the nanotube formation by electron microscope. It was incredible to observe the tiny tubes, which are almost 100 times smaller in diameter than a human hair, connecting cancer and immune cells. Another exciting moment was when we understood the change in metabolism because of the mitochondria transfer. Fun fact is, we did some experiments related to metabolism and I was trying to analyze the data for a few days. Then I finally interpreted the data while taking a bath (it's true!) and then I realized that this finding is going to have a big impact on science.

What do you hope to do next?

We have found the mechanism by which cancer cells can avoid the destruction of immune cells. Now I am working on blocking the process. In simple terms I am trying to block the tunnel by which the enemies (cancer cells) are hijacking the kitchen (mitochondria). That will help to keep the soldiers (immune cells) active and they will be able to protect the castle.

Where do you seek scientific inspiration?

My biggest inspiration is nature. From childhood the small natural facts around us inspired me to find scientific reasoning. After I started my research career, I got inspired by some of the great scientists, my supervisors and friends. Most importantly my students, those fresh minds, are the backbone of my inspirations.

How do you intend to help Indian science improve?

I am involved in mentoring Indian students through the SAP program in a few universities and I am going to extend that to more universities so that we can train more students with cutting edge science. I am going to set up research collaborations with several labs and industries in India. Also I am looking for opportunities to deliver talks in high school and colleges to inspire the next generation in the scientific career path.

Reference

Saha, T., Dash, C., Jayabalan, R. et al. Intercellular nanotubes mediate mitochondrial trafficking between cancer and immune cells. Nat. Nanotechnol. (2021). https://doi.org/10.1038/s41565-021-01000-4

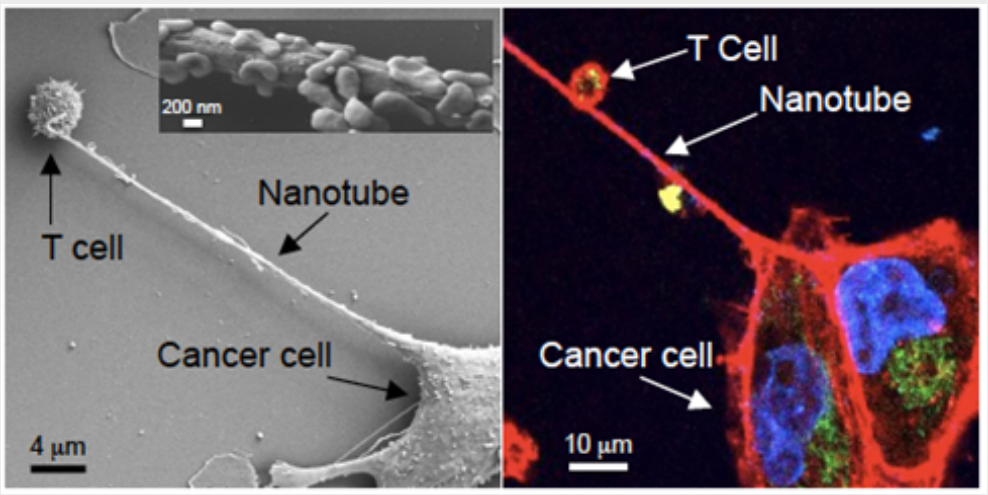

Figure 1. Left) Field emission scanning electron microscopy (FESEM) image shows the formation of a nanotube between a breast cancer cell and an immune cell. Inset) cell organelle on the nanotube. Right) Confocal microscopy image shows mitochondria (labeled with green fluorescence dye) traveling from a T cell to a cancer cell through the intercellular nanotube. DNA in the mitochondria was labeled with blue dye.