

The many things that Lamin B2 can do

For the first time, nuclear protein lamin B2, which plays an important role in maintaining the structure and function of the nucleus, has been found to determine the morphology and function of the nucleolus, a roundish entity found inside the nucleus. The nucleolus makes ribosomal ribonucleic acid (rRNA) and ribosomes. Like in the case of the nucleus, the lamin B2 protein is found at the border of the nucleolus, which is again a new finding.

In contrast to normal cells that contain one or two spherical and regular-shaped nucleoli, cancer cells may have as many as 10. Cancer cells are highly proliferative in nature and require more protein synthesis for survival. The demand for additional protein is met by large-sized nucleoli that are distorted in shape or by nucleoli that are found in abundance. Cancer cells can also have a large number of nucleoli that are large-sized.

Peering deep into cells using a super-resolution microscope, a team led by Kundan Sengupta from the Indian Institute of Science Education and Research (IISER), Pune found that in addition to their location at the border of the nucleus, lamins were found right near the boundary of the nucleolus. "We were able to locate lamin B2 at the border of nucleolus as we isolated the nucleolus from the cell and used antibody staining to identify lamin B2," he says. "Since lamins' role in controlling the shape and function of the nucleus is known, we wanted to determine if they played a similar role in the nucleolus' case."

Using a molecular approach, they reduced the levels of lamin B2 in colorectal cancer cell lines. "In about 75% of the cancer cells, the nucleoli lost their shape and came together to form a large aggregate," says Ayantika Sengupta from IISER and the first author of a paper published in Molecular and Cellular Biology. The aggregate occupied more volume than when the nucleoli were separate entities. When the lamin B2 was restored to its normal level, the nucleoli regained their original shape. "This strongly suggests that lamin B2 controls the shape of the nucleolus," she says.

Besides controlling the shape, lamin B2 also controls the function of the nucleolus. When the lamin B2 level was depleted in the cancer cells, there was an increase in the levels of ribosomal RNA precursors. Lamin B2 also modulates the entry and exit of a multifunctional RNA binding protein (nucleoli). This protein too forms an aggregate in the absence of lamin B2.

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