Clues to breast cancer hidden inside stem cells

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Stem cells and how to boost them is hot on the research agenda. But stopping them could be critical too, as evidence implicating stem cells in cancer is mounting.

In the human breast, up to 20 per cent of all tumours are now suspected to originate in stem cells. Now scientists from the Icelandic Cancer Society and the Faculty of Medicine, University of Iceland have grown three-dimensional breast cell cultures to reveal unexpected subtleties about these stem cells that could explain why they spawn malignancies.

These stem cells, Valgardur Sigurdsson remarked during the EuroSTELLS Conference in Venice, Italy (19-21 March), could become targets for cancer treatment, leading to new therapies that wipe out cancer at its source. The hope is that they might also become useful tools to test new drugs.

"People have long suspected there should be a stem cell population in the human breast gland," said Sigurdsson who is part of the ESF-funded team led by Thorarinn Gudjonsson. A 'virgin' breast, before pregnancy, is very different to a fully functioning, milk-producing breast. With lactation, the breast becomes fully differentiated, and once this stage is over, it involutes. This cycle of proliferation, differentiation and apoptosis also happens in every menstrual cycle and in a more dramatic form during pregnancy. "This caught our attention, and has driven our research," Sigurdsson pointed out.

Breast cancer almost always occurs in the luminal epithelial compartment, which is also where milk is produced. Perhaps it is not surprising then, that stem cells reside in this compartment. In 2002, Thorarinn Gudjonsson, successfully isolated cells from the human breast with stem cell properties.

Gudjonsson immortalised these cells and grew them in three dimensional matrix that mimics the real, living tissue. Biologists have long relied on 2-dimensional cell cultures as the basic tool of their trade. But there is a big difference between a flat layer of cells and culturing cells in three-dimensions. The Icelandic researchers, realizing just how much a cells context matters, used the 3-D cell culture pioneered by Mina Bissell, at the Lawrence Berkeley National Laboratory in California. "We can build up a 3-D breast structure similar to what you have in vivo," says Gudjonsson.

"You can analyse cell-cell interactions and signaling pathways in these cells during morphogenesis and in cancer progression." The Icelandic researchers are now focusing their efforts on how endothelial cells convey signals to stem cells in normal breast formation and in cancer. In collaboration with another Icelandic research team, the Gudjonsson lab is now unraveling the role of tyrosine kinase receptors and their downstream signaling events.

The benefits of these 3-D assays are manifold. "This is a useful system for drug screening and testing new drugs as well as for understanding cancer progression," says Gudjonsson.

Source: European Science Foundation