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Cancer and stem cells

A strand apart

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More evidence that tumours, like healthy organs, grow from stem cells

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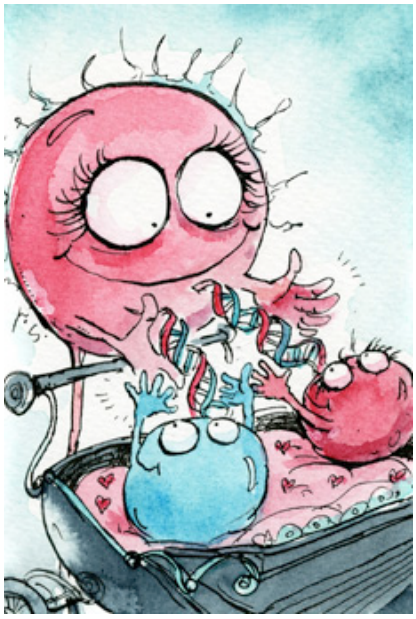

THE notion that tumours are chaotic masses of anarchic cells has been falling by the wayside recently. Many researchers now think, by contrast, that cancers actually resemble normal, well-regulated organs in several important ways. One of these is that they are believed to have a small population of stem cells which keep them going when other cells die or are killed off. The existence of such cancer stem cells is still a matter of debate. But this week the discussion may have taken an important turn. Brid Ryan, Sharon Pine and Curtis Harris, of America's National Cancer Institute, reported that some lung-cancer cells do, indeed, seem to behave like stem cells during the process of cell division.

Unlike normal cells, stem cells can divide in two different ways. They may do so symmetrically, thereby producing identical daughter cells, each of which resembles the mother cell. Or they may do so asymmetrically, and give rise to two very different daughters. In such cases, one of the daughters is identical to the original stem cell, while the other takes on new characteristics and can then differentiate into whatever cell type the tissue it inhabits requires.

During asymmetrical divisions, some stem cells take an extra step to preserve the integrity of their DNA. Part of the process of cell division involves the duplication of a cell's chromosomes, so that each daughter can have a full set of these strands of DNA. Instead of sending old and new chromosomes into the daughter cells at random, the dividing stem cell carefully shuttles all of its old chromosomes into the daughter that remains a stem cell. The newly synthesised DNA, which may contain errors, is put into the daughter that is destined to differentiate. That way, any mutations which have arisen during DNA replication will not affect the all-important stem cell population.

Until now, the main evidence supporting the cancer-stem-cell hypothesis has been the observation that many different types of tumour contain a small group of cells, identifiable by special types of protein found on their surfaces, that can form new tumours with high efficiency. (By contrast, the cells that comprise the bulk of most tumours lack these surface proteins and are poor at creating new tumours.)

Dr Ryan, Dr Pine and Dr Harris reasoned that if such cells really are stem cells then they should be able to undergo both symmetrical and asymmetrical divisions, just like the stem cells in healthy tissue. They looked in samples taken directly from patients with lung cancer, and also in lung-cancer cells from laboratory cultures. In both cases, when they grew the cells in the presence of a chemical that infiltrates newly synthesised DNA, they could see that the unlabelled template strands of DNA went into one daughter cell and the new strands went to the other. Moreover, the daughter that retained the old DNA also retained the cell-surface proteins that mark the putative cancer stem cells.

The team, who presented their results at a joint meeting of the American Association for Cancer Research and the International Association for the Study of Lung Cancer in Coronado, California, this week, are now investigating whether their putative cancer stem cells are more resistant than run-of-the-mill cancer cells to chemotherapy or radiation, as research on other putative stem cells has suggested. What they do know is that when they grow these cells in culture, they can push them toward either asymmetrical or symmetrical division by controlling the density of cells and the amount of oxygen available. If they can find a similar way to control the cells' fate in patients' tumours, they may have opened a new avenue for cancer therapy.