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Cancer is a stem cell issue

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There is an urgent reason to study stem cells: stem cells are at the heart of some, if not all, cancers. Mounting evidence implicates a clutch of rogue stem cells brandishing 'epigenetic' marks as the main culprits in cancer. Wiping out tumours for good, some biologists believe, depends on uprooting these wayward stem cells.

A team in the Netherlands has uncovered a key protein that could stop these stem cells from becoming malignant. "This is a hot topic in the cancer field," Maarten van Lohuizen of The Netherlands Cancer Institute, Amsterdam told participants at a EuroSTELLS workshop, held in Montpellier, France, 23-24 January. "To be successful in cancer therapy you need to target these stem cells: they are intrinsically resistant to chemotherapy."

Polycomb proteins have emerged as key players in cancer pathogenesis. They are powerful epigenetic regulators that normally silence genes without altering the cell's DNA. Compounds that regulate polycomb could result in novel anticancer drugs that shrink malignant tissue, and prevent cancer recurrence, a common problem with most chemotherapies.

That tumours and stem cells have much in common has been known for many years. Both self-renew and both spawn many different types of cells. But only recently, new techniques have enabled biologists to identify stem cells buried in tumours.

Van Lohuizen has found that stem cells in cancerous tissues are locked

in an immature state in which they carry on multiplying instead of maturing into specific tissues. “Some resistant cancer cells don’t listen to the ‘stop’ signal any more,” he explains. That stop sign is delivered by the polycomb proteins. They silence several genes at once by affecting the way the DNA is compacted into chromatin fibres, without altering the DNA sequence.

Normally, the main role of the polycomb complex is to repress genes during development or when stem cells are needed for tissue maintenance. But an aberrant polycomb spells trouble. In mice where polycomb proteins have been genetically disabled, van Lohuizen has seen that the cells become invasive and trigger cancerous growth. “This may be why gliomas are such lethal tumours, because these stem cells become highly migratory,” van Lohuizen points out.

The hunt is now on for therapeutic agents that target these budding cancer stem cells. The Dutch researcher is optimistic that used in combination with chemotherapy, such compounds will also prevent cancer reigniting after treatment. “We have to be very careful because [these compounds] will also regulate normal stem cell behaviour. It is a fine balance,” he noted.

Source: European Science Foundation