MEDIA RELEASE

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New evidence that stem cells contain immortal DNA

EuroStemCell scientists at the Pasteur Institute in Paris have demonstrated one of the body's most sophisticated ways of regulating the genetic material of stem cells. Their findings, published in Nature Cell Biology(*), show for the first time the mechanism that adult muscle stem cells use to protect their DNA from mutations. Understanding this mechanism has important implications for cancer research, the study of gene regulation, and ultimately growing stem cells of therapeutic potential in the laboratory.

When a cell divides, its DNA is duplicated and each resulting daughter cell inherits one copy of the DNA. Over time, errors arising during the duplication process can lead to mutations and cause cancers. Using sophisticated approaches including video imaging the Pasteur team show that stem cells retain the original DNA strands. Their findings also represent the best visual evidence yet for immortal DNA (**) - a controversial theory first proposed more than 3 decades ago.

A stem cell can produce two different daughter cells when it divides in the body – another stem cell and a specialised cell that will contribute to the tissue. This is called "asymmetric division" and helps stem cells regulate their numbers and retain their capacity to regenerate tissue throughout the life of an organism. According to the immortal DNA hypothesis, when a stem cell divides, only the specialised cell inherits the imperfect copied DNA. The stem cell retains the original "immortal" DNA strand.

Leading the Pasteur team, Shahragim Tajbakhsh says "the immortal DNA theory has captured the imagination of many scientists for decades, but it has been particularly difficult to prove. By tracking skeletal muscle stem cells from mouse muscle fibres, both *in vivo* and in the dish, we have shown that the DNA strands of the double helix are not equivalent, and we have linked this phenomenon with the general asymmetry apparatus of the dividing cell."

He adds "this is an exciting finding, as it seems to defy one of the basic rules of cell biology and genetics: that genetic material is distributed randomly. It appears that the cellular machinery distinguishes old from new when it comes to DNA, and it may use this distinction to protect the body from mutations and cancer. It is

also possible that this mechanism is used to silence gene expression in the stem cell."

(*)Shinin, V., Gayraud-Morel, B., Gomès, D. and Tajbakhsh, S. (2006)
Asymmetric division and cosegregation of template DNA strands in adult muscle satellite cells. Nature Cell Biology. doi: 10.1038/ncb1425

(**) Cairns J. (1975) Mutation selection and the natural history of cancer, Nature.

Notes to Editors:

EuroStemCell is a four-year Integrated Project of the European Union's Sixth Framework Programme. The 27 participating laboratories are from 14 institutes in 8 countries. EuroStemCell's mission is to build the scientific foundations required to take stem cell technology to the clinic. Further information on EuroStemCell is available at www.eurostemcell.org

Glossary
DNA – Deoxyribonucleic acid. The material inside the nucleus of cells that carries genetic information.
Stem cell - unspecialized cell that has the ability to multiply without limit, and can also give rise to specialized cell types in the body.
Daughter cell – one of two cells resulting from the division of a single cell.
Asymmetric division – the division of a stem cell into two unequal daughter cells, only one of which resembles the parent stem cell.
Gene regulation - the cellular control of the amount and timing of appearance of the functional product of a gene (e.g. a protein).

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