Press Release

Breast Cancer: cancer stem cells explain the existence of different breast cancer types

Milan, 7th January 2010 – Researchers at the IFOM-IEO Campus in Milan have discovered a new mechanism that sheds light on the origin and development of breast cancers: cancer stem cells are responsible for the onset and growth of breast cancers, and the number of cancer stem cells in a tumour determines its aggressiveness. The research was directed by Prof.s Pier Paolo Di Fiore and Pier Giuseppe Pelicci, and was performed by researchers affiliated with IFOM (FIRC Institute of Molecular Oncology Foundation), IEO (European Institute of Oncology) and the University of Milan. The study will be published online today in the renowned scientific journal Cell.

Different types of breast cancer differ greatly in their aggressiveness, clinical course and prognosis. The new study demonstrates that this heterogeneity can be attributed to differences in the number of cancer stem cells in breast tumours. Tumours that contain many cancer stem cells are more aggressive than those that contain only a few stem cells.

Cancer stem cells represent only a small fraction of the total tumour mass. «They are, however, responsible for the formation and development tumours, as they can replicate almost indefinitely» states Pier Paolo Di Fiore, Group Leader at IFOM and Full Professor of General Pathology at the Department of Medicine, Surgery and Dentistry at the University of Milan. «These are the cells that sustain tumour growth – explains Di Fiore. – In the same way that normal stem cells drive the physiological process of tissue generation, cancer stem cells drive the proliferation of tumour tissue. Unfortunately, these cells are often resistant to chemotherapy and radiotherapy, and ultimately can cause failure of these treatments». Cancer stem cells are therefore a real threat, and we need to characterize their biological properties if we are to fully understand the mechanisms of breast cancer.

The researchers began by characterizing the properties of normal stem cells. «Our first job was to develop a method that could be used to isolate sufficient quantities of stem cells, a difficult undertaking given the rarity of these cells» explains IEO scientist Salvatore Pece, one of the main authors of the study and Associate Professor of General Pathology at the Department of Medicine, Surgery and Dentistry at the University of Milan. «This method – continues Pece – allowed us to obtain a complete molecular characterization of normal stem cells and to compare the properties of normal stem cells with those of cancer stem cells. Using this approach we identified a number of specific stem cell markers that can be used to identify breast cancer stem cells». Using these markers, the researchers demonstrated that cancer stem cells are the only cells that are able to form new tumours. In addition, by comparing the different types of breast cancers, it became evident that all breast cancers (from the most to the least aggressive) can be assigned to one of two main groups, based on their stem cell content. Tumours containing the highest number of stem cells are the most aggressive and are associated with a worse prognosis.

«The practical implications of our discovery are potentially very significant – concludes Di Fiore. – Firstly, we can use our discovery to assess the aggressiveness of breast cancers. This information can then be used to decide on the most suitable therapy. Secondly, and more importantly, we can use cancer stem cells as therapeutic targets to develop new drugs, which could conceivably completely eradicate the disease».

The research was published online in the journal *Cell* (Pece et al. *Biological and Molecular Heterogeneity of Breast Cancers Correlates with their Cancer Stem Cell Content*, *Cell* 2010, doi:10.1016/j.cell.2009.12.007) and was possible thanks to support from the **Italian Association for Cancer Research (AIRC),** as well as the **Italian Ministry for Education, Universities and Research (MIUR)**, the **European Community,** the **Ferrari Foundation**, the **Vollaro Foundation**, the **Cariplo Foundation,** and the **Monzino Foundation**

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