Genome Positioning *as a* Diagnostic Tool *for* Breast & Prostate Cancer

Breast and prostate cancer are currently among the top diagnosed cancers in women and men, respectively. Approximately 1 in 8 women will develop invasive breast cancer[1] and 1 in 7 men will develop prostate cancer[2] during their lifetimes. While these statistics show the prevalence and impact of these cancers on our civilian and military populations, unfortunately there are limitations in how these cancers are diagnosed and treated. Current diagnostic tests for breast and prostate cancers are subjective and cannot differentiate aggressive cancer from indolent cancer.

In response to these limitations, Tom Misteli, PhD, Senior Investigator at the National Cancer Institute, and Geneva employee Karen Meaburn, PhD, Research Scientist at the National Cancer Institute, initiated studies that examined the spatial organization of genes in breast and prostate cancer as compared to normal tissues. Their research proposed that the location of certain genes within nuclei reposition in cancer, making them potential cancer biomarkers.

In studying breast cancer tissues, Drs. Misteli and Meaburn examined 23 genes before discovering ten gene biomarkers that reposition in breast cancer tissues. "We set out to identify genes which are differentially positioned in breast cancer tissues and we explored the possibility that disease-specific spatial organization of genes might be used as a new diagnostic strategy to distinguish malignant from normal tissue," said Dr. Misteli[3]. The team used the same approach to identify gene positioning biomarkers for prostate cancer, and found three different genes with disease-specific repositioning, which can be used to distinguish cancerous prostate tissue from normal/hyperplastic tissue with high accuracy.

The potential use of these gene positioning biomarkers as diagnostic and prognostic markers for breast and prostate cancers has significant implications for the detection, prognosis, and treatment of these diseases. The identification of genes that are localized differently in cancer cells allows the possibility of using spatial gene positioning as a novel diagnostic tool that is highly accurate, quantitative, and minimally invasive.

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Drs. Misteli and Meaburn look forward to further applications of this method, including additional large-scale studies on other cancers to validate their findings and to identify prognostic biomarkers. "If validated in a larger number of samples, we envision that this approach may be a useful first molecular indicator of cancer after an abnormal mammogram," said Misteli. "Our method of cancer diagnosis is not limited to breast cancer and may be applied to any cancer type in which repositioned genes can be identified.[4]" They are now focusing on determining if the spatial positioning of the genome can be used to classify aggressive and indolent breast and prostate cancers, and therefore are potential prognostic markers.

[1] *http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-key-statistics*
[2] *http://www.cancer.org/cancer/prostatecancer/detailedguide/prostate-cancer-key-statistics*
[3] *http://www.nih.gov/news-events/news-releases/genes-position-nucleus-can-be-used-distinguish-cancerous-normal-breast-tissue*
[4] *http://www.nih.gov/news-events/news-releases/genes-position-nucleus-can-be-used-distinguish-cancerous-normal-breast-tissue*