

# Uncontrollable growth of cancer cells: Self-sufficiency in growth signals

Dr. Kyle Biggar

An influential paper named "The Hallmarks of Cancer" examined the state of cancer research and made some predictions for the future of cancer therapy. Importantly, this paper distinguished ten characteristics (or hallmarks) that are common to all cancer cells and that are being individually explored throughout this Londoner series. This article focuses on the uncontrollable growth of cancer cells, a hallmark of cancer, the reasons as to why we think this occurs and current treatment strategies.

Normal cells require external growth signals (called growth factors) that tell them when to grow and replicate, while other signals tell them when to stop growing or even when to die. As soon as these growth signals are absent, cells stop growing. However, unlike normal cells, cancer cells are able to ignore these external signals and can instead regulate their own growth and survival. Once this happens, cells begin to grow uncontrollably and can spread within the body. In this manner, cancer cells are able to overcome the natural barriers that exist to restrict the normal cell growth, gaining unlimited growth and cell replication potential and, hence, immortality.

The growth of a tumour is not a straightforward and unrestricted process. As the mass of cancer cells increases, it must also be able to overcome several body defense mechanisms. For example, as the population of cancer cells increases, it must begin to contend with a lack of adequate nutrient and oxygen supply and waste elimination through existing blood vessels and the removal of potentially damaged cells.

Traditional chemotherapy treatments work by having a wide range of activity in the body. Specifically, they act by effectively killing cells that multiply rapidly - a hallmark of cancer cells. Unfortunately, they can also harm cells that multiply rapidly under normal circumstances (such as cells in bone marrow, digestive tract and hair follicles). These drugs prevent cell



The Li Lab from Western University.

growth through various actions that include damaging DNA and inhibiting cell replication. In this way, research in Dr. Shawn Li's lab at Western University is determining new mechanisms of how cancer cells respond to chemotherapy-induced DNA damage by looking at new ways to develop targeted therapies that can focus on only cancer cells, making them more sensitive to chemotherapy.

Targeted cancer therapies are created to interfere with

specific inner-workings of cancer cells that allow them, and not normal cells, to grow and spread in different ways. Many of these therapies focus on proteins that are involved in cell signaling pathways, which govern basic cellular functions and activities that include cell growth, cell multiplication and cell migration. By blocking the ability of cancer cells to grow and reproduce uncontrollably, targeted cancer therapies can provide a way to stop cancer

progression. A first step in the development of targeted therapies is being able to identify proteins that act differently in cancer cells than in healthy cells.

The Li lab is working to develop new targeted therapeutics for cancer treatment. Indeed, many labs around the world are working towards this common goal. However, the Li lab's research is unique because its approaching the issue of chemotherapy sensitivity by targeting a relatively

unexplored natural chemical alteration made to proteins referred to as lysine methylation. Researchers are finding that lysine methylation plays a role in many different cancer types. Current efforts are

working to alter lysine methylation on specific proteins to impair the ability of a cancer cell to repair DNA damage. This has the potential to make cancer cells more susceptible to some chemotherapeutics. The Li lab's research has already led to important findings about the usefulness of making these changes to protein lysine methylation in both breast and prostate cancers, and has led to the development of new therapeutics. In the long term, research exploring targeted therapies, such as those being developed at Western University, will likely drive future cancer research.

*The 2015 Hallmarks of Cancer Series is brought to you by the Elgin-Middlesex Canadian Cancer Society Volunteer Research Information Outreach Team (RIOT). All of the past Londoner articles in this series can be found at riotteam.blogspot.ca*



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