

Overview and the Hallmarks of Cancer

Professor Kerry Bone's Reading Assignment



Module 1.4 – Cellular Mechanisms and Targets

1. Beyond Bad Luck: Induced Mutations and Hallmarks of Cancer

Kelly-Irving, M., Delpierre, C., & Vineis, P. (2017). Beyond bad luck: induced mutations and hallmarks of cancer. *The Lancet Oncology*, 18(8), 999-1000.

2. Cancer Stem Cells Get Energy From Protein, and It's Proving to Be Their Achilles' Heel

University of Colorado Anschutz Medical Campus. (2018, November 12). Cancer stem cells get energy from protein, and it's proving to be their Achilles' heel. *ScienceDaily*. Retrieved March 13, 2019 from www.sciencedaily.com/releases/2018/11/181112131515.htm

3. Cancer Genome Landscapes

Vogelstein, B., Papadopoulos, N., Velculescu, V. E., Zhou, S., Diaz, L. A., & Kinzler, K. W. (2013). Cancer genome landscapes. *science*, 339(6127), 1546-1558.

Highlights from Vogelstein Paper

- Most human cancers are caused by two to eight sequential alterations that develop over the course of 20 to 30 years.
- Each of these alterations directly or indirectly increases the ratio of cell birth to cell death; that is, each alteration causes a selective growth advantage to the cell in which it resides.
- The evidence to date suggests that there are ~140 genes whose intragenic mutations contribute to cancer (so-called Mut-driver genes). There are probably other genes (Epi-driver genes) that are altered by epigenetic mechanisms and cause a selective growth advantage, but the definitive identification of these genes has been challenging.
- The known driver genes function through a dozen signaling pathways that regulate three core cellular processes: cell fate determination, cell survival, and genome maintenance.
- Every individual tumor, even of the same histopathologic subtype as another tumor, is distinct with respect to its genetic alterations, but the pathways affected in different tumors are similar.

- f. Genetic heterogeneity among the cells of an individual tumor always exists and can impact the response to therapeutics. In other words, even within a person's tumor, not all tumor cells are the same.
- g. In the future, the most appropriate management plan for a patient with cancer will be informed by an assessment of the components of the patient's germline genome and the genome of his or her tumor.
- h. The information from cancer genome studies can also be exploited to improve methods for prevention and early detection of cancer, which will be essential to reduce cancer morbidity and mortality.

4. Study of Mutation Order May Change Understanding of How Tumors Develop

Institute for Advanced Study. (2019, January 15). Study of mutation order may change understanding of how tumors develop: Paper envisions new direction in cancer research. *ScienceDaily*. Retrieved March 13, 2019 from www.sciencedaily.com/releases/2019/01/190115111925.htm

5. Universal Cancer Test: One Test to Diagnose Them All?

University of Queensland (2018, December 5). Universal Cancer Test: One Test to Diagnose Them All?. *Technology Networks*. Retrieved March 13, 2019 from <https://www.technologynetworks.com/diagnostics/news/universal-cancer-test-one-test-to-diagnose-them-all-312844>

Advanced Reading

1. Introduction: Cancer as an Epigenetic Disease

Issa, J. J. (2017). Introduction: Cancer as an Epigenetic Disease. *Cancer journal (Sudbury, Mass.)*, 23(5), 255-256.

2. Is DNA Methylation the New Guardian of the Genome?

Hoffman, R. M. (2017). Is DNA methylation the new guardian of the genome?. *Molecular cytogenetics*, 10(1), 11.