

Nvolve Biomarker Project Report: HER2 Gene

HER2

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Biomarkers are genes that provide information about cancer and can lead to the progression of tumors in the body. These genes are integral to the understanding and identification of cancer for treatment the disease. There are many different functions and forms of biomarkers for each cancer. For this study, the researchers are specifically interested in breast cancer. After researching biomarkers associated with breast cancer, the group chose to investigate the HER2 gene and its role in cancer progression. HER2 breast cancer is considered extremely aggressive and accounts every 1 of 5 breast cancers in patients.



After understanding the preliminary features of biomarkers in breast cancer, the group analyzed the HER2 gene and its progression of tumor growth. HER2 is a gene that codes for the production of HER2 proteins which most commonly build receptors on breast cells. These proteins dictate how breast cells grow and divide. Mutations of the HER2 gene create mutations in the HER2 proteins and therefore the HER2 receptors. This causes amplification and overexpression of the gene which causes aggressive, uncontrolled division of breast cancer cells and possible metastasis in the body.

Introduction:

Biomarkers are genes that provide information about cancer and can lead to the progression of tumors in the body. These genes are integral to the understanding and identification of cancer in order to treat the disease. There are many different functions and forms of biomarkers for each cancer. For this study, the researchers are specifically interested in breast cancer. After researching biomarkers associated with breast cancer, the group chose to investigate the HER2 gene and its role in the amplification of breast cancer. Through exploration of many literature articles, the group understood how HER2 mutations cause overexpression of the gene which allows for aggressive breast cancer growth and may lead to metastasis in the body.

Methods:

1. Select a partner and do background research on biomarkers
2. Research literature papers about biomarkers
 - a. Use key terms such as biomarkers, breast cancer genes, and breast cancer signatures
 - b. Take notes on literature articles
3. Select gene of interest and investigate gene
 - a. Take notes on known characteristics and function of gene
 - b. Explain how it works in breast cancer
4. Write report and design infographic with new found knowledge regarding biomarkers and gene of interest to present findings
5. Check-in with a coach at least four times throughout research via video call with the camera on

Results:

After understanding the preliminary features of biomarkers in breast cancer, the group analyzed the HER2 gene and its progression of tumor growth. HER2 is a gene that codes for the production of HER2 proteins which most commonly build receptors on breast cells. These proteins dictate how breast cells grow and divide. Mutations of the HER2 created mutations in the HER2 proteins and therefore also the HER2 receptors. This causes amplification and overexpression of the HER2 gene which causes uncontrolled division and growth of breast cancer cells. Eventually, this ball of cancer cells creates a breast cancer tumor.

Discussion:

The cellular mechanisms of the HER2 gene allow for the progression of aggressive breast cancer growth. Mutations of the HER2 gene cause the overexpression of HER2 which leads to further gene amplification and cancer progression. This unfortunately creates the opportunity for very quick and deadly tumor development.

Glossary:

1. Biomarker: A biological molecule found in blood, other body fluids, or tissues that is a sign of a normal or abnormal process, or of a condition or disease. (Cancer.gov, 2011)
2. Gene Amplification: an increase in the number of copies of a gene sequence. (Genome.gov, n.d.)
3. Pathogenesis: the origination and development of a disease (Merraim-Webster, n.d.)
4. Overexpression: excessive expression of a gene (as that caused by increasing the frequency of transcription) (Merriam-Webster, n.d.)

5. Receptor: a chemical group or molecule (such as a protein) on the cell surface or in the cell interior that has an affinity for a specific chemical group, molecule, or virus (Merriam-Webster, n.d.)

References:

1. Ménard, S., Tagliabue, E., Campiglio, M., & Pupa, S. M. (2000). Role of HER2 gene overexpression in breast carcinoma. *Journal of Cellular Physiology*, 182(2), 150–162.
[https://doi.org/10.1002/\(SICI\)1097-4652\(200002\)182:2<150::AID-JCP3>3.0.CO;2-E](https://doi.org/10.1002/(SICI)1097-4652(200002)182:2<150::AID-JCP3>3.0.CO;2-E)
2. Gutierrez, C., & Schiff, R. (2011). HER 2: Biology, Detection, and Clinical Implications. *Archives of Pathology & Laboratory Medicine*, 135(1), 55–62.
<https://doi.org/10.1043/2010-0454-RAR.1>
3. *HER2 Status: Tests, Treatments, and More*. (2020, September 21). Breastcancer.Org.
<https://www.breastcancer.org/symptoms/diagnosis/her2>
4. *What to know about HER2-positive breast cancer*. (n.d.). Mayo Clinic. Retrieved November 16, 2021, from <https://www.mayoclinic.org/breast-cancer/expert-answers/faq-20058066>
5. *Receptor | Definition of Receptor by Merriam-Webster*. (n.d.). Retrieved November 16, 2021, from <https://www.merriam-webster.com/dictionary/receptor>
6. *Pathogenesis | Definition of Pathogenesis by Merriam-Webster*. (n.d.). Retrieved November 16, 2021, from <https://www.merriam-webster.com/dictionary/pathogenesis>
7. *Gene Amplification*. (n.d.). Genome.Gov. Retrieved November 16, 2021, from <https://www.genome.gov/genetics-glossary/Gene-Amplification>
8. *Definition of biomarker—NCI Dictionary of Cancer Terms—National Cancer Institute* (nciglobal,ncicenterprise). (2011, February 2). [NciAppModulePage].
<https://www.cancer.gov/publications/dictionaries/cancer-terms/def/biomarker>
9. *Medical Definition of OVEREXPRESSION*. (n.d.). Retrieved November 16, 2021, from <https://www.merriam-webster.com/medical/overexpression>