One Step Closer to Finding the Cure to Breast Cancer: A Literature Review About Computational Modeling of Breast Cancer Cell Signaling for In Silico Therapeutics

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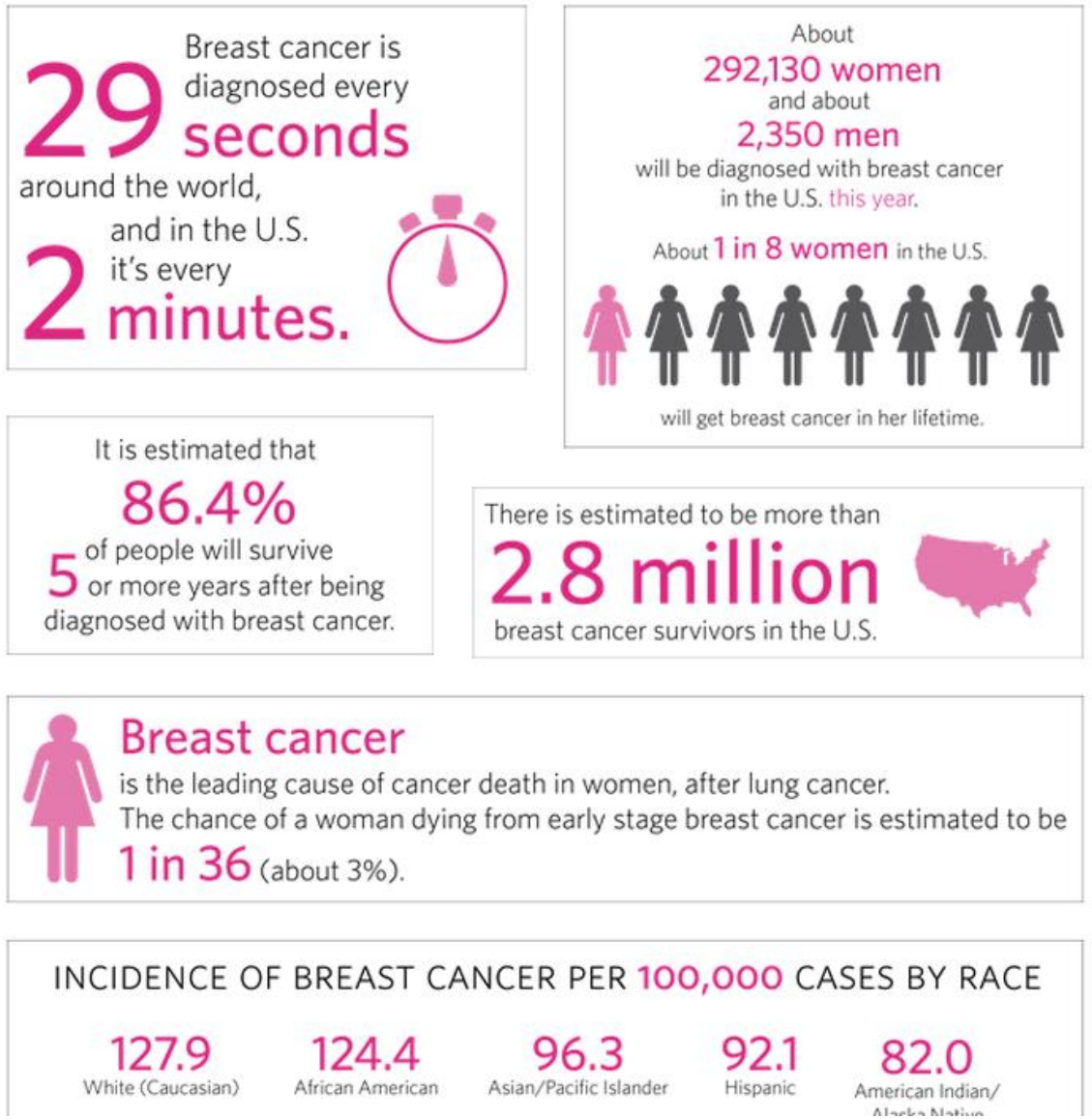
Why This Topic?



The Benefits of the Combination of Technology and Biology

- *In silico* modeling is a driving force behind cancer systems biology

(Deisboeck, T., Zhang, L., Yoon, J. *et al. In silico* cancer modeling: is it ready for prime time?. *Nat Rev Clin Oncol* **6,** 34–42 (2009). https://doi.org/10.1038/ncponc1237)

- Without this, no one would know what these two growth factors would look like in real life
- Allows researchers to refine their experimental programs with an aim to reduce costs and increase research efficiency

(Trisilowati, D. G. Mallet, "*In Silico* Experimental Modeling of Cancer Treatment", *International Scholarly Research Notices*, vol. 2012, Article ID 828701, 8 pages, 2012. https://doi.org/10.5402/2012/828701)

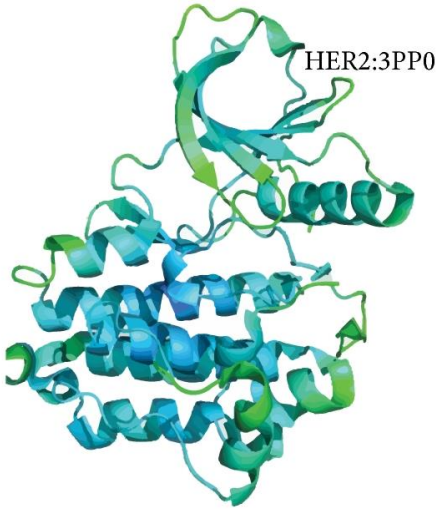
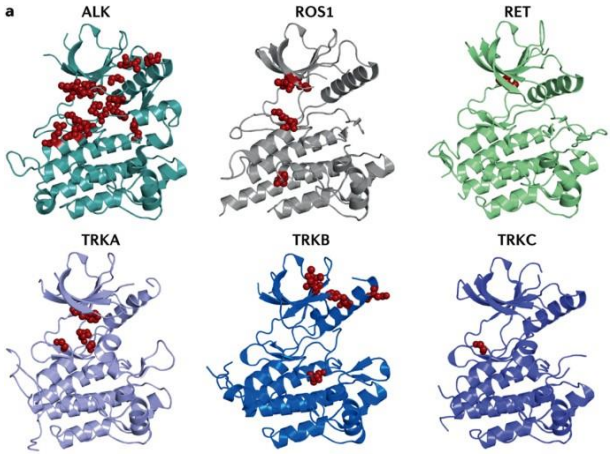


Figure 1: in silico model of HER2

Figure 2: in silico model of TrKa



The Benefits of the Combination of Technology and Biology

- sloppy models: multiparameter models, whose behavior depends only on a few *stiff* combinations of parameters, with many *sloppy* parameter directions largely unimportant for model predictions. (http://www.lassp.cornell.edu/sethna/Sloppy/)

- in silico: using technology to form computerized simulations of biological models.

- TrKa: nerve growth factor kinase receptor that plays a critical role in various neuronal and non-neuronal cell types by regulating cell survival, differentiation, and proliferation. ("Nerve Growth Factor Receptor TrkA Signaling in Breast Cancer Cells Involves Ku70 to Prevent Apoptosis" by PubMed)

- An in silico model can help in displaying the phosphorylation of a protein that is in breast cancer and how it can be a potential treatment

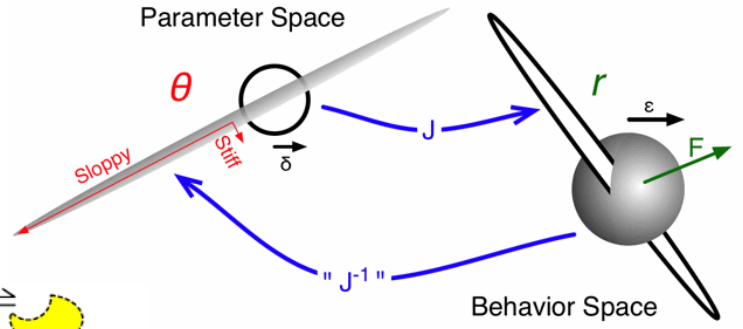


Figure 3: **Sloppy models**

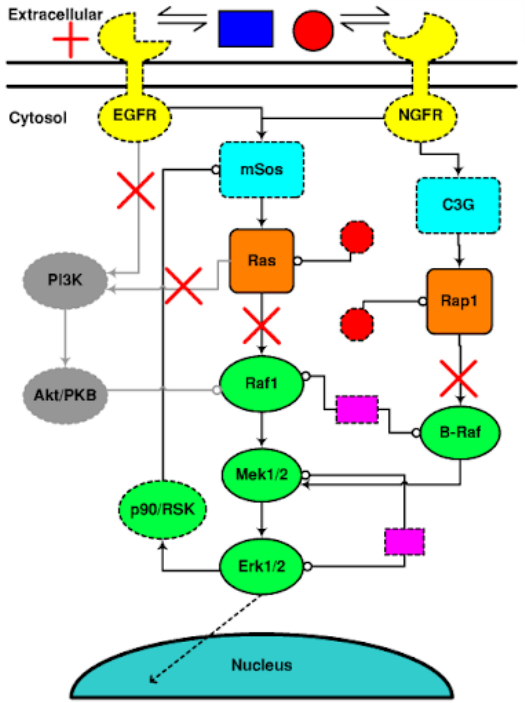


Figure 5: a display of how fast a protein can phosphorylate/dephosphorylate

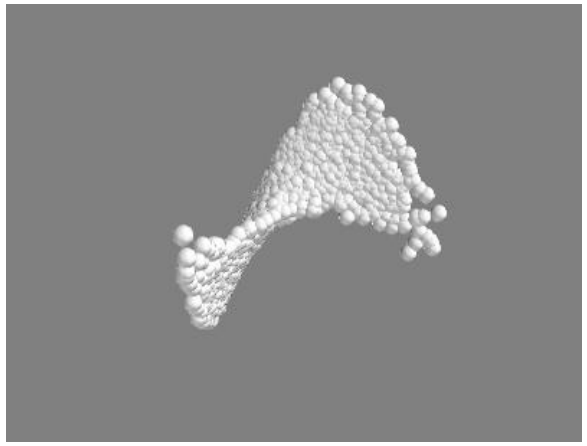


Figure 4: This is a hyper-ribbon and it is an example of an in silico model

Previous Experimentation That Helped in Forming this Project

- 390 novel anticancer drug pairs that are likely to diminish cancer cell signaling and display a potential cancer treatment.

("Quantification of Pathway Cross-talk Reveals Novel Synergistic Drug Combinations for Breast Cancer" by Samira Jaeger, Ana Igea, Rodrigo Arroyo, Victor Alcalde, Begoña Canovas, Modesto Orozco, Angel R. Nebreda and Patrick Aloy)

- higher rate of breast cancer recurrence among HER2+ compared with HER2-negative (HER2−) tumors
- TrkA could be another treatment for breast cancer.

("TrkA overexpression in non-tumorigenic human breast cell lines confers oncogenic and metastatic properties" by Kelly Kyker-Snowman, Robert M Hughes, Christopher L Yankaskas, Karen Cravero, Swathi Karthikeyan Berry Button, Ian Waters, David Marc Rosen, Lauren Dennison, Natasha Hunter, Josh Donaldson, Eric S Christenson, Konstantinos Konstantopoulos, Paula J Hurley, Sarah Croessmann, Ben Ho Park)

Results Obtained from This Project

- HER2: another nerve growth factor that can be used through the process of herceptin and can help block receptors and stop signaling in cancer cells
- patients with high levels of TrkA had a more favorable overall survival prognosis

("Breast cancer and therapeutic deployment of growth factor receptors" by Gajanan V. Sherbet)

- both Trka and HER2 can work together to stop cancer cells and that the creation of an in silico model of the process of both working together to block cancer cell signaling can be seen with the naked eye

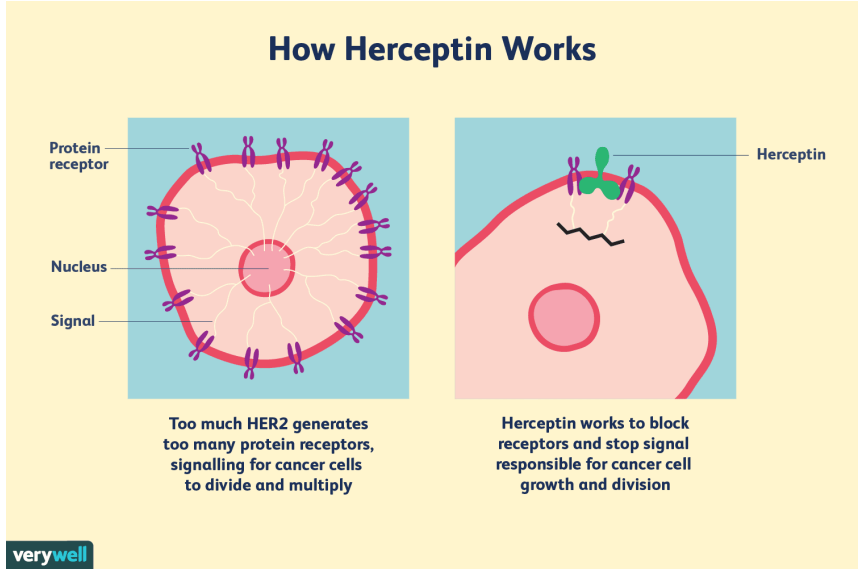


Figure 5: HER2 can be used through the process of herceptin in that a herceptin can help block receptors and stop signaling in cancer cells

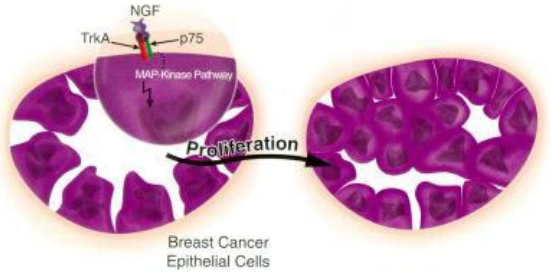


Figure 6: Trka is a possible treatment because it aids in cell growth

Thank You for Listening!