The Role of Amygdalin in Treating Cancer *In Vitro*

Thousand Oaks High School
AP Research Stem

What Is Cancer?

- Abnormal cell division
- Invade healthy cells
- Types differ

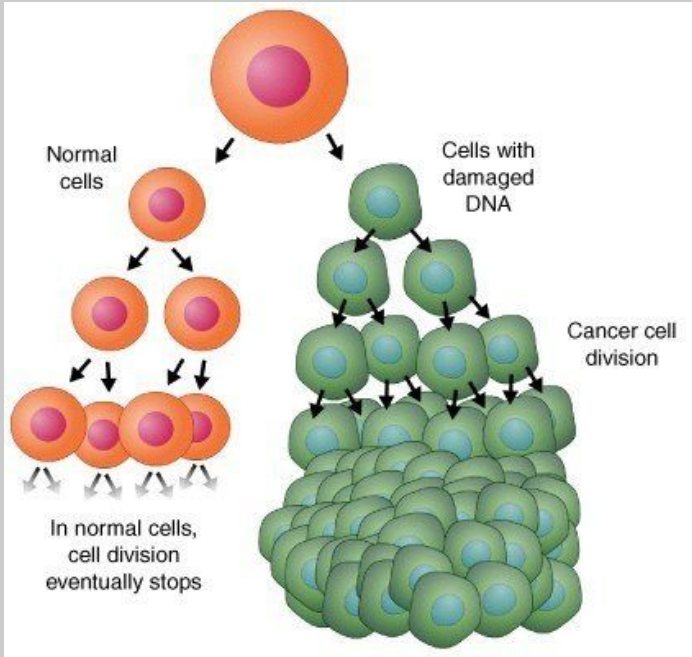

Fig 1. Creation of cancerous cells

	New Cases	Deaths
Lung Cancer	**234,030**	**154,050**
Breast Cancer	**330,080**	**40,920**
Prostate Cancer	**164,690**	**29,430**
Cervical Cancer	**13,420**	**4,170**

Fig 2. Predicted number of diagnoses and deaths in the US in 2018 (American Cancer Society, 2018)

Common Treatments

- Chemotherapy
- Radiation
- Surgery

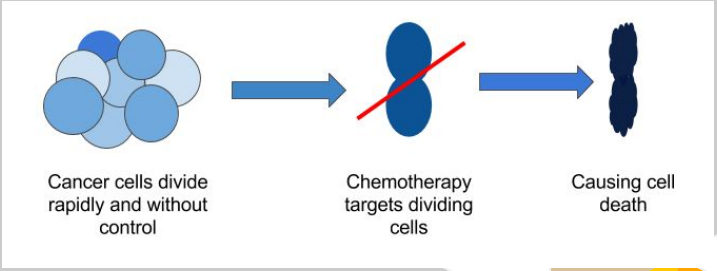

Fig 3. Treatment methods

Alternative Treatment Methods

- Not mainstream medicine
- Performed by doctors with special practice
- Non-harmful to the body

Amygdalin

- $C_{20}H_{27}NO_{11}$
- Found in plants and seeds/pits

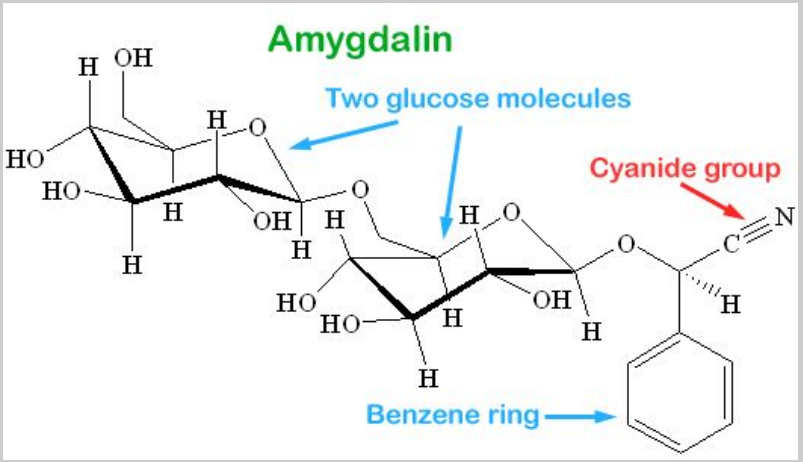

Fig 4. Structure of amygdalin

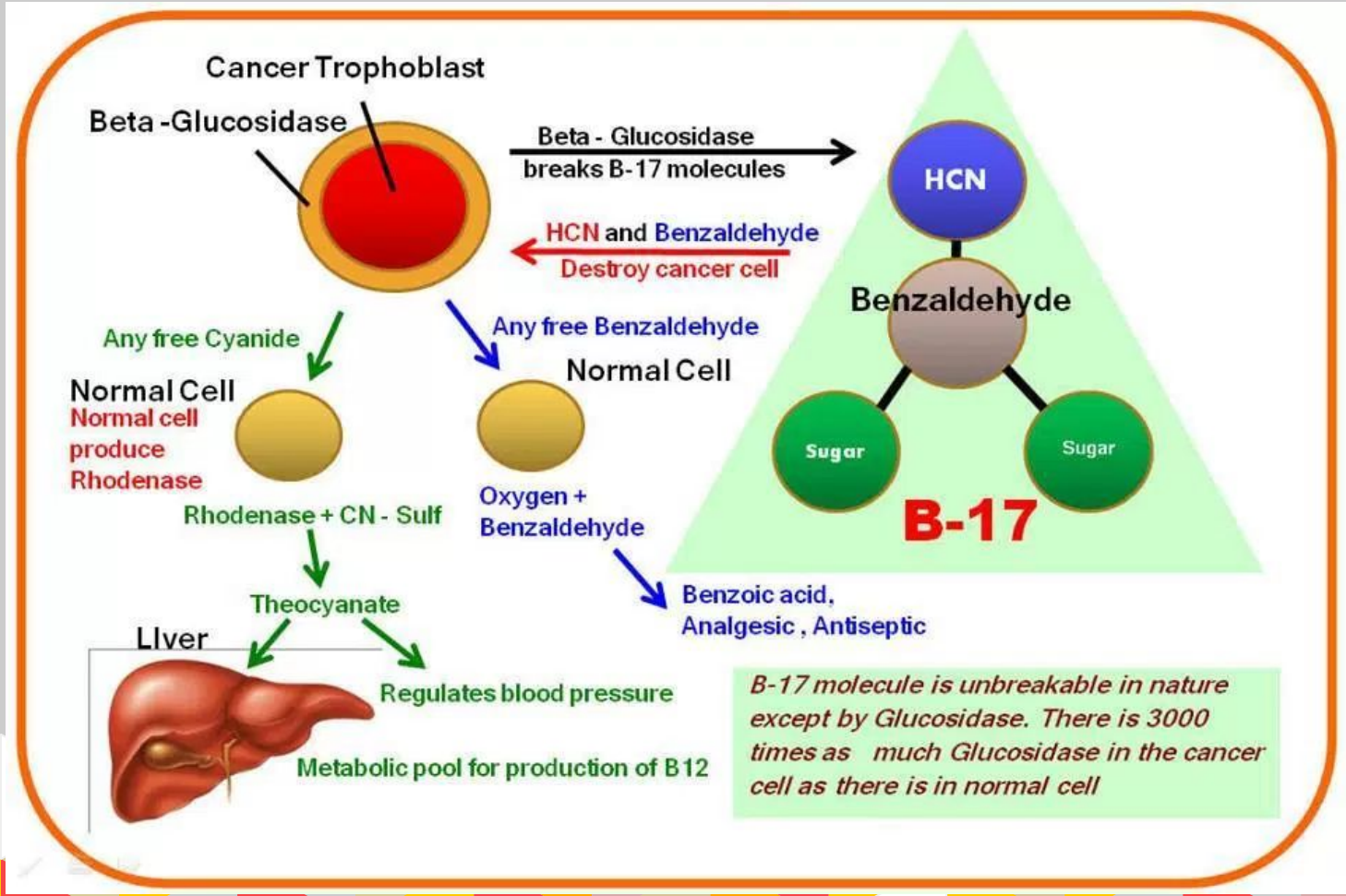

Fig 5. Process in which amygdalin is able to target and attack cancerous cells.

Purpose

Investigate the effectiveness of amygdalin in treating lung, breast, prostate, and cervical cancer *in vitro*.

“

What is the role of amygdalin in treating lung, breast, prostate, and cervical cancer *in vitro*?

Hypothesis

Amygdalin is effective in treating multiple types of cancer *in vitro*.

Null

Amygdalin is not effective in treating multiple types of cancer *in vitro*.

Methods

- Systematic literature review
  - Data collected from published peer reviewed articles
  - Data analysis: Excel
    - SD and t-test

In Vitro

- Solutions
  - Control- 0 mg/ml amygdalin
  - Test- 2.5, 5, 10, 20 mg/ml amygdalin
- 24 hour treatment
- Cell viability

Results

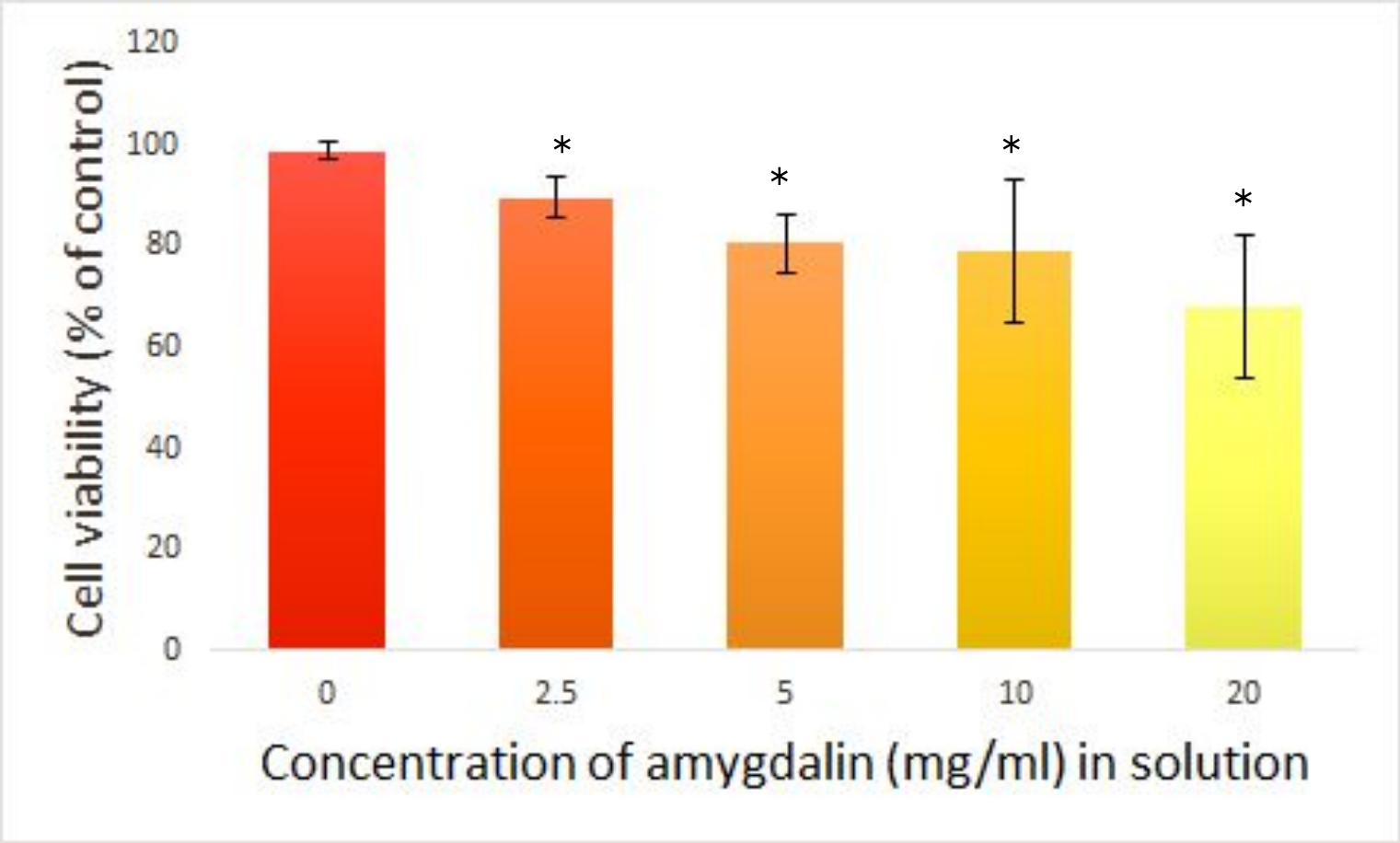

Fig 6. The effectiveness of amygdalin in treating cancer cells (Chen et al., 2012; Moon et al., 2016; Qian, Xie, & Wang, 2015)

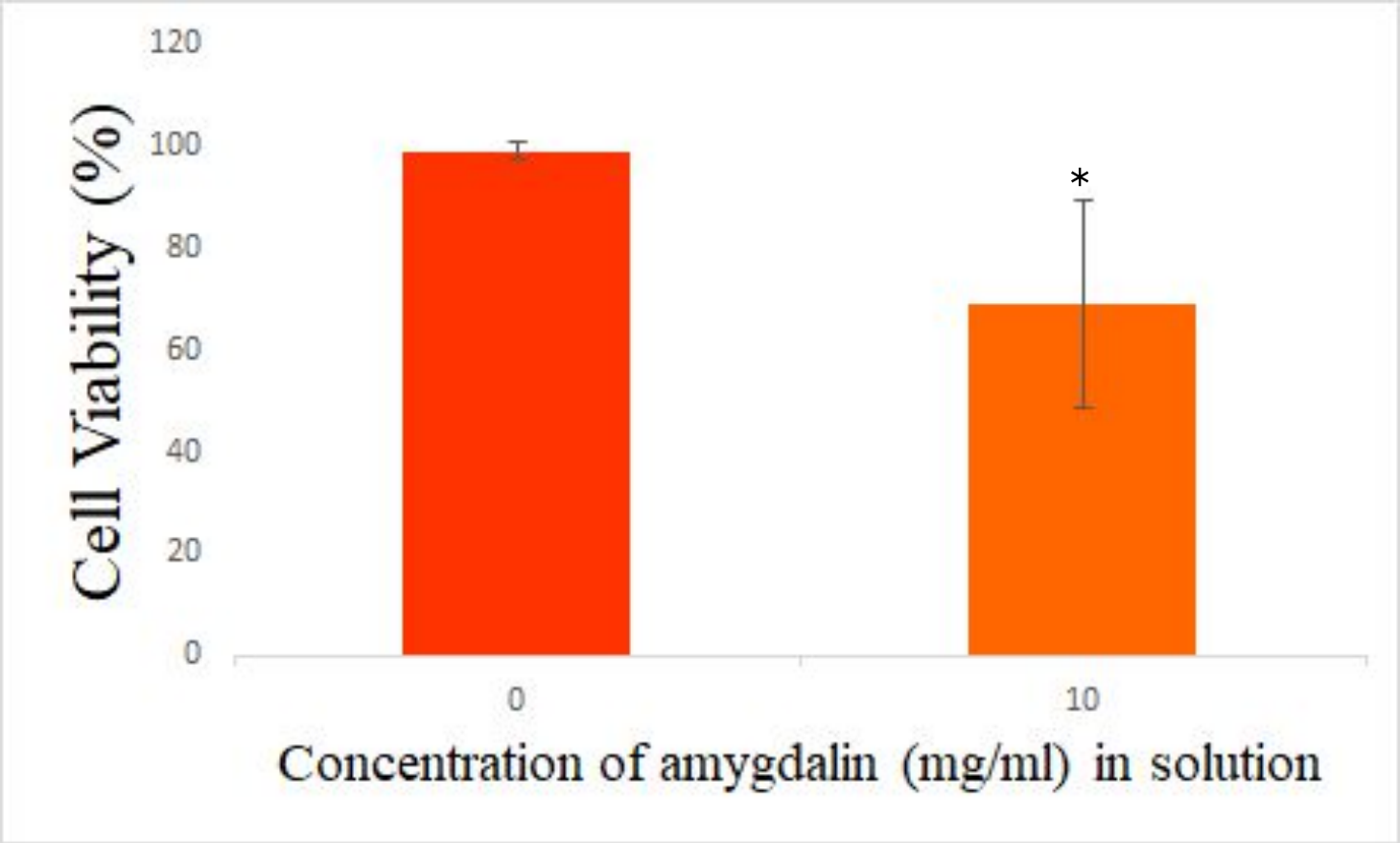

Fig 7. Cell viability after 10 mg/ml treatment(Chen et al., 2012; Kim et al., 2006; Moon et al., 2016; Qian, Xie, & Wang, 2015)

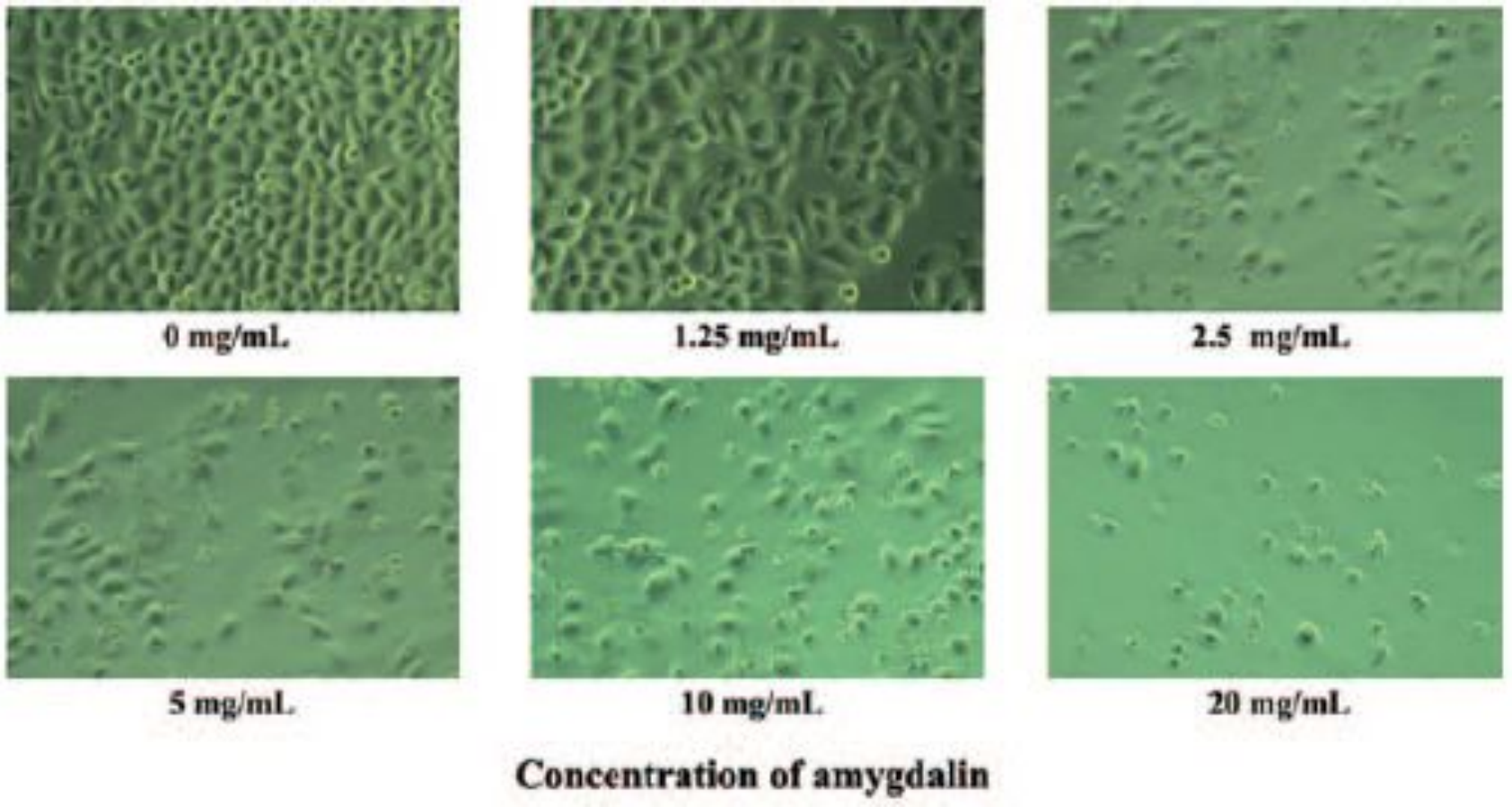

Fig 8. HeLa cells under a microscope after being treated with amygdalin for 24 hrs (Chen et al., 2012).

Sources of Error

- Access to data
- Not able to conduct meta-analysis

Discussion

- Cell viability decreased
- Concentrations of amygdalin
- Shape and size of cancer cells

Conclusion

- Effective treatment
- Concentration increase

=

cell viability decrease

Further Work

More Research → **Clinical Trials** → **Implementation**

- Further *in vitro* studies
- Test subjects with cancer
- Alternative medicine

Acknowledgements

A special thanks to Dr. Dane Mohl at Amgen, Dr. Harry Saunders, Dr. Nikki Malhotra and Ms. Michelle Magnusson for their help throughout this course.

References

Ames, M. M., Moyer, T. P., Kovach, J. S., Moertel, C. G., & Rubin, J. (1981). Pharmacology of amygdalin (laetrile) in cancer patients. *Cancer Chemotherapy and Pharmacology, 6*(1), 51-57. doi:10.1007/bf00253010

Cancer Statistics. (2017, March 22). Retrieved December, 2017, from https://www.cancer.gov/about-cancer/understanding/statistics

Chang, H., Shin, M., Yang, H., Lee, J., Kim, Y., Lee, M., . . . Kim, C. (2006). Amygdalin Induces Apoptosis through Regulation of Bax and Bcl-2 Expressions in Human DU145 and LNCaP Prostate Cancer Cells. *Pharmaceutical Society of Japan , 29*(8), 1597-1602.

Chen, Y., Ma, J., Wang, F., Hu, J., Cui, A., Wei, C., . . . Li, F. (2012). Amygdalin induces apoptosis in human cervical cancer cell line HeLa cells. *Immunopharmacology and Immunotoxicology,35*(1), 43-51. doi:10.3109/08923973.2012.738688

Chitnis, M. P., Adwankar, M. K., & Amonkar, A. J. (1985). Studies on High-Dose Chemotherapy of Amygdalin in Murine P388 Lymphocytic Leukaemia and P815 Mast Cell Leukaemia. *Journal of Cancer Research and Clinical Oncology, 109*, 208-209.

Connor, S. (2011, October 23). 'Magic bullet' of cyanide could kill cancer cells. Retrieved April, 2018, from https://www.independent.co.uk/life-style/health-and-families/health-news/magic-bullet-of-cyanide-could-kill-cancer-cells-698577.html

Cueto, J. D., Ionescu, I. A., Pičmanová, M., Gericke, O., Motawia, M. S., Olsen, C. E., &. . . Sánchez-Pérez, R. (2017). Cyanogenic Glucosides and Derivatives in Almond and Sweet Cherry Flower Buds from Dormancy to Flowering. *Frontiers in Plant Science, 8*, 1-16. doi:10.3389/fpls.2017.00800

Dang, T., Nguyen, C., & Tran, P. N. (2017). Physician Beware: Severe Cyanide Toxicity from Amygdalin Tablets Ingestion. *Hindawi, 2017*, 1-3. doi:https://doi.org/10.1155/2017/4289527

Greek, J., Greek, R., & Shanks, N. (2009). Are animal models predictive for humans? *BioMed Central,4*(2), 1-20. doi:doi:10.1186/1747-5341-4-2

Halenár, M., Medveďová, M., Maruniaková, N., & Kolesárová, A. (2015). Ovarian hormone production affected by amygdalin addition in vitro. *Journal of Microbiology, Biotechnology and Food Sciences, 04*(Special issue 02), 19-22. doi:10.15414/jmbfs.2015.4.special2.19-22

Laetrile/Amygdalin. (n.d.). Retrieved September 08, 2017, from https://www.cancer.gov/about-cancer/treatment/cam/patient/laetrile-pdq

Laetrile / Vitamin B-17 Treatment. (2017, November 27). Retrieved September 08, 2017, from https://www.cancertutor.com/laetrile/

Laetrile / Vitamin B17/ /Apricot Kernels/Cancer Compass~An Alternate Route. (n.d.). Retrieved December 13, 2017, from http://cancercompassalternateroute.com/therapies/vitamin-b17-laetrile/

Lee, H. M., & Moon, A. (2016). Amygdalin Regulates Apoptosis and Adhesion in Hs578T Triple-Negative Breast Cancer Cells. *Biomolecules & Therapeutics,24*(1), 62-66. doi:10.4062/biomolther.2015.172

Luo, H., Li, L., Tang, J., Zhang, F., Zhao, F., Sun, D., . . . Wang, X. (2016). Amygdalin inhibits HSC-T6 cell proliferation and fibrosis through the regulation of TGF-β/CTGF. *Molecular & Cellular Toxicology, 12*(3), 265-271. doi:10.1007/s13273-016-0031-0

Makarevic, J., Rutz, J., Juengel, E., Kaulfuss, S., Tsaur, I., Nelson, K., . . . Blaheta, R. A. (2014). Amygdalin Influences Bladder Cancer Cell Adhesion and Invasion In Vitro. Plos One, 9(10), 1-11. doi:10.1371/journal.pone.0110244

Makarević, J., Rutz, J., Juengel, E., Kaulfuss, S., Reiter, M., Tsaur, I., &. . . Blaheta, R. A. (2014). Amygdalin Blocks Bladder Cancer Cell Growth In Vitro by Diminishing Cyclin A and cdk2. *PLoS ONE,9*(8), 1-9. doi:10.1371/journal.pone.0105590

References (cont.)

Moon, J., Kim, S., Yun, G., Lee, H., Kim, Y., Jeong, G., & . . . Jeon, B. (2015). Inhibition of cell growth and down-regulation of telomerase activity by amygdalin in human cancer cell lines. *Animal Cells and Systems,19*(5), 295-304. doi:10.1080/19768354.2015.1060261

Neal, M. (2011, February 04). World Cancer Day: 340,000 Cases Of Cancer A Year In The U.S. Could Be Prevented. Retrieved February 27, 2018, from https://www.huffingtonpost.com/2011/02/04/world-cancer-day-a-declar_n_818472.html

Qian, L., Xie, B., Wang, Y., & Qian, J. (2015). Amygdalin-mediated inhibition of non-small cell lung cancer cell invasion in vitro. *International Journal of Clinical and Experimental Pathology, 8*(5), 5363-5370. ISSN:1936-2625/IJCEP0006206

Roach, H. (n.d.). Vitamin B17 Apricot Kernels – Laetrile – Amygdalin. Retrieved December 13, 2017, from http://www.lifelongproducts.com/products/vitamin-b17-apricot-kernels/

Sauer, H., Wollny, C., Oster, I., Tutdibi, E., Gortner, L., Gottschling, S., & Meyer, S. (2015). Severe cyanide poisoning from an alternative medicine treatment with amygdalin and apricot kernels in a 4-year-old child. *Wiener Medizinische Wochenschrift, 165*(9-10), 185-188. doi:10.1007/s10354-014-0340-7

Stock, C. C., Martin, D. S., Sugiura, K., Fugmann, R. A., Mountain, I. M., Stockert, E., . . . Tarnowski, G. S. (1978). Antitumor tests of amygdalin in spontaneous animal tumor systems. *Journal of Surgical Oncology, 10*(2), 89-123. doi:10.1002/jso.2930100203

Unproven methods of cancer management. Laetrile. (1991). *CA: A Cancer Journal for Clinicians, 41*(3), 187-192. doi:10.3322/canjclin.41.3.187

Vitamin B-17 vs. Laetrile - Everything You Need to Know. (2017, September 5). Retrieved September 5, 2017, from https://www.cancertutor.com/laetrile/

Xu, X., & Song, Z. (2014). Advanced research on anti-tumor effects of amygdalin. *Journal of Cancer Research and Therapeutics, 10*(5), 3-7. doi:10.4103/0973-1482.139743

Yun-long, L., Qiao-xing, L., Rui-jiang, L., & Xiang-qian, S. (2015). Chinese Medicine Amygdalin and β-Glucosidase Combined with Antibody Enzymatic Prodrug System As A Feasible Antitumor Therapy. *The Chinese Journal of Integrated Traditional and Western Medicine,* 1-4. doi:10.1007/s11655-015-2154-x

The Role of Amygdalin in Treating Cancer *In Vitro*

Thousand Oaks High School
AP Research Stem