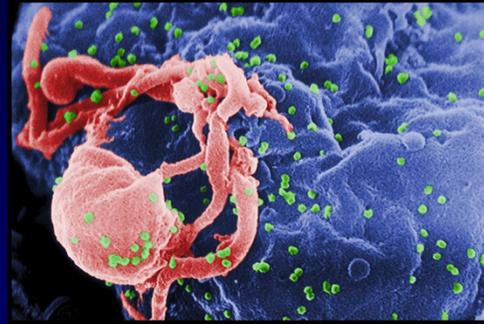


Research of immunotherapy to treat cancer is essential

Holly Cardillo
Bioengineering
Class of 2015



Title: Research of immunotherapy to treat cancer is essential

Speaker: Holly Cardillo

Introduction:

Relevance: Each year ACS publishes their projected cancer statistics (Cite Cancer Journal). In 2012 – estimated 1.6 million new cases, which would fill 15 Beaver Stadiums. In addition, 35% of these cases will be deadly, which will fill 5 Beaver Stadiums. The numbers are just plain frightening. An estimated 38-45% of people will be diagnosed with invasive cancer in their lifetime. Cancer accounts for 1 in every 4 deaths and is the second leading cause of death in children. Penn State is home to the largest student run philanthropy in the world to combat this disease – too many of us have been affected by this terrible disease.

Credibility: As a bioengineering major, I am especially interested in treating this horrendous disease as effectively as possible and ultimately curing it

Background: Chemotherapy is the most common treatment to battle cancer.

Thesis: Research and development of immunotherapy to treat chemo-resistant cancer is essential to the future of medicine.

Picture: <http://truthalliance.net/Portals/0/Archive/images/news/2012/04/HIV-budding-Color.jpg>

Citation: Siegel, Rebecca, MPH, Deepa Naishadham, MA MS, and Ahmedin Jemal, DVM PhD. "Cancer Statistics." *A Cancer Journal For Clinicians* 62.1 (2012): 10-29. *Wiley Online Library*. American Cancer Society, 4 Jan. 2012. Web. 20 Feb. 2013.



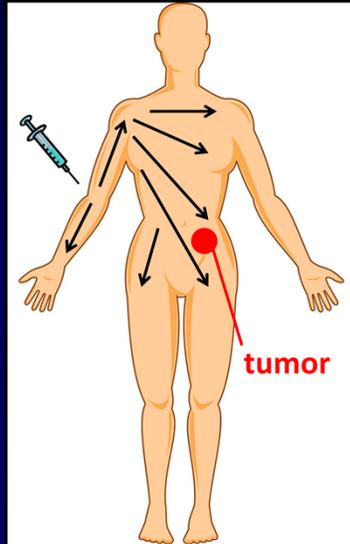
Outline: Summary

1. Most common treatment
2. What immunotherapy is and how it works

Picture 1: http://a57.foxnews.com/global.fncstatic.com/static/managed/img/Health/660/371/chemo_drug_640.jpg?ve=1

Picture 2: <http://www.astrosurf.com/luxorion/Bio/t4-3d.jpg>

Chemotherapy's inability to target cancerous cells reduces its efficiency as a cancer treatment.



Main Point 1: Chemotherapy's inability to target cancerous cells reduces its efficiency as a cancer treatment.

According to cancer researchers in the United Kingdom, "Chemotherapy in the body does not target cancerous cells, but instead targets dividing cells."

Cancer cells divide at a greater rate than normal body cells

More cancer cells are attacked than normal

Normal body cells dividing also attacked (Cite UK Research)

Most common: Hair, Bone Marrow, Lining to Digestive

Killed or mutated

Transition: Attacking of healthy cells has many repercussions in the body.

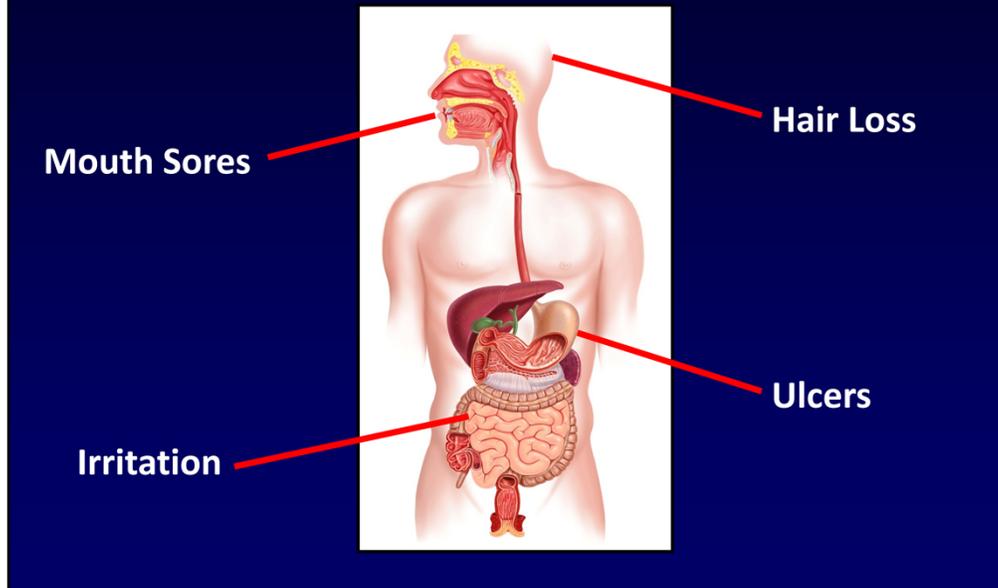
Picture 1: <http://www.advancedrejuvenationclinic.co.uk/treatments/> (body)

Picture 2: <http://www.health.state.mn.us/divs/idepc/dtopics/stds/images/syringe.jpg> (syringe)

Picture 3: <http://www.iayork.com/MysteryRays/2008/07/30/tumor-immunity-and-prognosis/>

Citation: "How Chemotherapy Works." : *Cancer Research UK* : *CancerHelp UK*. Cancer Research UK, 17 Aug. 2011. Web. 20 Feb. 2013.

Destruction and mutation of healthy cells have many negative side effects.



Main Point 1 (cont.): Destruction and mutation of healthy cells have many negative side effects.

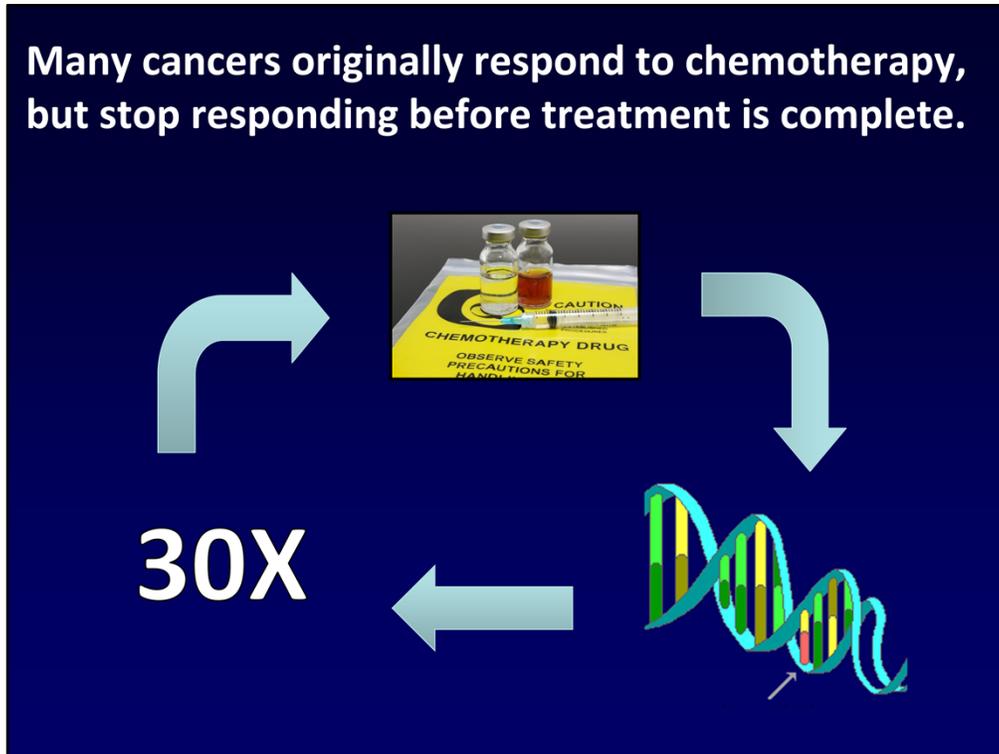
According to Dr. Zeey Blumenfeld, "Destruction and mutation of healthy cells have many negative side effects." Effects depends on age:

1. Stunting in growth
2. Hair loss, bone marrow toxicity, sores
3. In women (and men) – fertility (Cite Blumenfeld) can be destroyed
Waiting 2 years post chemo
Effects and Relapse

Transition: In a culture dish, most any cancers can be cured with heavy doses of toxins. In a human body, however, too many healthy body cells would be destroyed and the patient would likely die.

Picture: <http://www.mesothelioma.com/treatment/conventional/chemotherapy/>

Citation: Blumenfeld, Zeev, MD. "Chemotherapy and Fertility." *Best Practice & Research Clinical Obstetrics & Gynaecology* 26.3 (2012): 379-90. *Science Direct*. Elsevier, June 2012. Web. 20 Feb. 2013.



Main Point 1 (cont.): Many cancers originally respond to chemotherapy, but stop responding before treatment is complete

“Chemotherapy is most often given in doses with periods of rest in between to allow time for repair of normal body cells,” according to Fred Hutchinson who is from the Cancer Research Center and who investigated why so many becoming resistant through out course of treatment:

1. Resistance occurs in ~80% of breast, lung, colon and prostate
2. Results published were shocking (cite *Nature Medicine*)
3. Hutchinson showed mutations occurring from dousing fibroblasts (connective tissues) result in overproduction of WNT16B
4. Mutations were up to 30x more than normal
5. Protein was found that in large amounts promotes cancer cell proliferation and invasion of surroundings

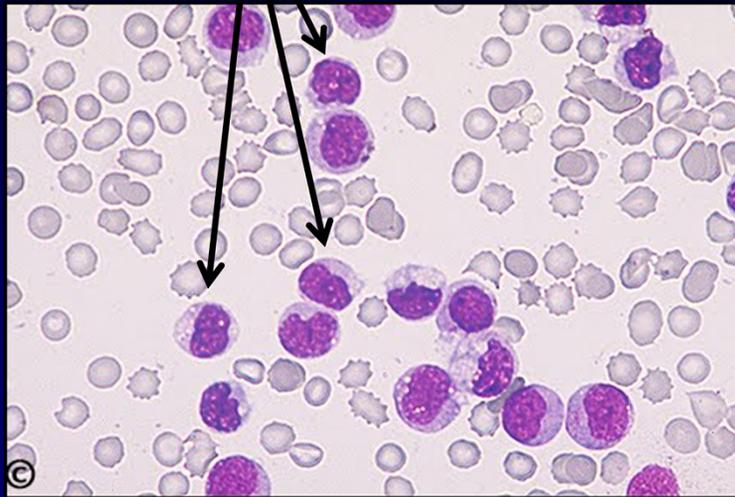
As treatment continues, increasing number of protein means a significant increase chance of resistance

Transition: Chemotherapy comes in many variations and many may treat. Threat of resistance means choosing harshest, strongest first.

Pictures: <http://nursingcrib.com/news-blog/nurses-risk-exposure-to-chemo-drugs/>
http://anthro.palomar.edu/synthetic/synth_3.htm

Citation: Sun, Yu, Judith Campisi, Celestia Higano, Thomaz M. Beer, Peggy Porter, Ilsa Coleman, Lawrence True, and Peter S. Nelson. "Treatment-Induced Damage to the Tumor." *Nature Medicine* 18 (2012): 1359-368. *Nature Medicine*. Nature Publishing Group, 5 Aug. 2012. Web. 20 Feb. 2013.

B-Cells in Leukemia Blood



Transition: What if we could develop a small army of cells that would attack only cancer cells?

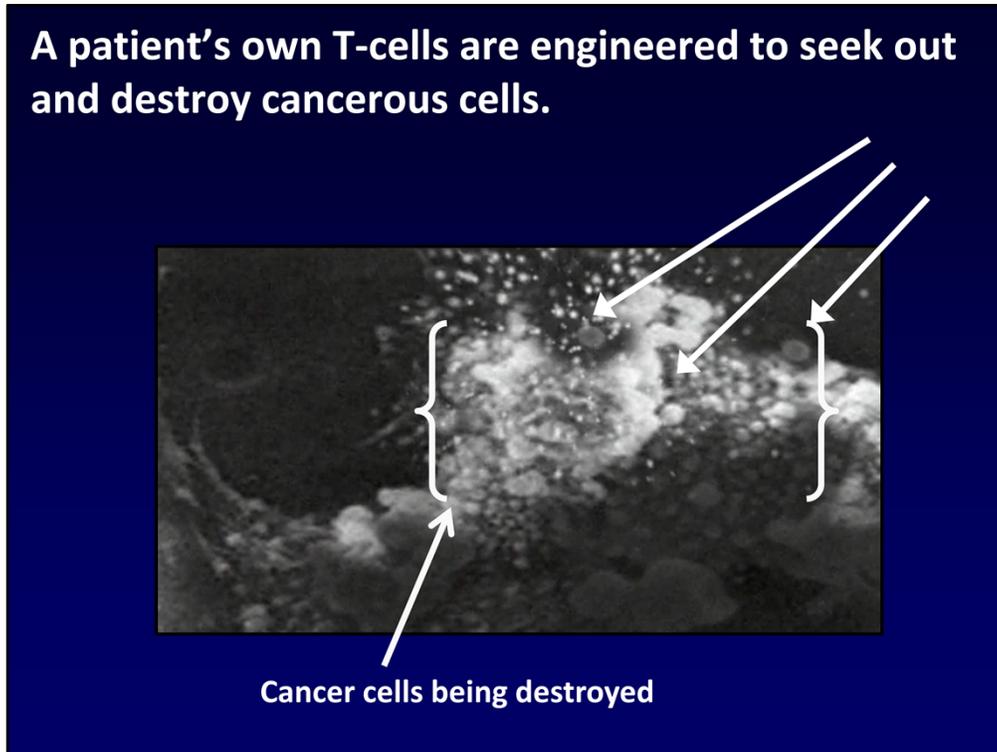
According to researchers such as Arl June at University of Pennsylvania, that is possible for blood cancers – Acute Lymphoblastic Leukemia, Non-Hodgkin’s Lymphoma and Chronic Lymphocytic Leukemia

1. B-cell cancers of the blood are most common type of childhood cancer
2. Common identifier: Protein on surface – CD19

Citation: NY Times

Grady, Denise. "Cell Therapy Shows Promise for Acute Type of Leukemia." *NY Times*. Section N.p., 21 Mar. 2013. Web. 27 Mar. 2013.

Picture: http://1.bp.blogspot.com/_sVp7q-fPnxs/TQ7-zKaMdzI/AAAAAAAAACf8/bHpXPQMgRes/s1600/chronic%25252Bmyelomonocytic.bmp



Main Point 2: A patient's own T-cells are engineered to seek out and destroy cancerous cells

Uses two important aspects of biology

Every cell's biology is unique in some way (marker or identifier exists)

Viruses have ability to infiltrate their own DNA into pre-existing cells

Patient's own T-cells (WBCs) are filtered out

“Boot camp” – infected with HIV

Re-injected into body

According to Stephan Grupp in a video produced about his CTL019 Trial

T-cell multiplication occurs

Each T-cell can kill ~1000 cancer cells

Transition: “Now I'm sure you're thinking this sounds pretty incredible, but not incredibly plausible – has it worked? And it has.” (Rebuttal)

Citation: “Fight Fire with Fire,” *Focus Forward*. Dir. Ross Kauffman. Perf. Stephan Grupp, Carl June, David Porter. *Focus Forward Films*. General Electric, Jan. 2013. Web. 27 Mar. 2013.

Picture: <http://abcnews.go.com/GMA/video/leukemia-cure-believed-found-major-medical-breakthrough-18779754> (WBC & Virus)

Picture 2: <https://www.focusforwardfilms.com/films/72/fire-with-fire> (Destroying)

The CLT019 Trial went better than could have been expected and was very informative for future trials.



Main Point 2 (continued): The CLT019 Trial went better than could have been expected and was very informative for future trials.

Dr. Stephan Grupp (CHOP) paired with Memorial Sloan Kettering and researchers such as Carl June of UPenn – CTL 019

Info about trial

According to the CHOP Annual Report of Milestone...

9 in remission including Emma Whitehead

Youngest, THON child – no other hope

April 17th, 2012

T-cells still working – *no sign of cancer*

Transition: “So now you’re probably think – Wow! It can actually work, but this is just one type of cancer... Can it do anything else? And yes, yes it most definitely can.” (Rebuttal)

Citation: "Little Girl, Big Science." *Milestones: The Annual Report*. The Children's Hospital of Philadelphia, Dec. 2012. Web. 27 Mar. 2013.

Picture: <http://storage0.dms.mpinteractiv.ro/media/1/1/7627/10385467/2/emily-whitehead.jpg?height=600&width=600> (Emily – Sick)

Picture 2: <http://images.smh.com.au/2013/03/26/4141074/art-353-emilywhitehead1-300x0.jpg> (Emily – Healthy)

T cells could be trained to fight against many different cancers.



Main Point 3: T cells could be trained to fight against many cancers

Uses identifiers

Not just CD19 and not just HIV

Dr. Richard Bresser – Chief Health and Medical Editor for the NY Times

Very versatile with other identifiers

Other blood cancers, prostate tumors/cancers

Already success in other cancers... UC San Diego Moores Cancer Center

Very similar, live virus, brain cancer

Glioblastoma – one of deadliest brain tumors

Transition: Quotation: “This new breakthrough is truly revolutionary. It’s brand new and by new I mean some of the articles I have cited were published less than week ago... however even in it’s early stages it has produced results greater than could be expected.”

Citation: ABC Is There A Cure? Robins, Robin. "Leukemia Cure? Possible Major Medical Breakthrough." *ABC News*. ABC News Network, 21 Mar. 2013. Web. 27 Mar. 2013.

Citation: TOCA 511: "Treating Brain Cancer With Novel Viral Vector." *ScienceDaily*. ScienceDaily, 27 Apr. 2012. Web. 27 Mar. 2013.

Picture: <http://colorcancer.org/wp-content/uploads/2011/07/Cancer-represent-Colors.png>

Picture 2: <http://sites.duke.edu/dvvc/files/2012/01/mouse768x7681.jpg> (Mouse)

In summary immunotherapy holds promise for our fight against cancer.



PENNSSTATE


Conclusion: Summary

A patient's own cells are used.

The virus chosen and the target to have the virus find can both be manipulated.

Successful first clinical trial

Doctor's gained valuable info from success and failure

Can use to improve/tailor

Already other trials

Children like Emily can grow up – last year, she attended her first THON at Penn State!

Picture 1: http://a57.foxnews.com/global.fncstatic.com/static/managed/img/Health/660/371/chemo_drug_640.jpg?ve=1

Picture 2: <http://www.astrosurf.com/luxorion/Bio/t4-3d.jpg>