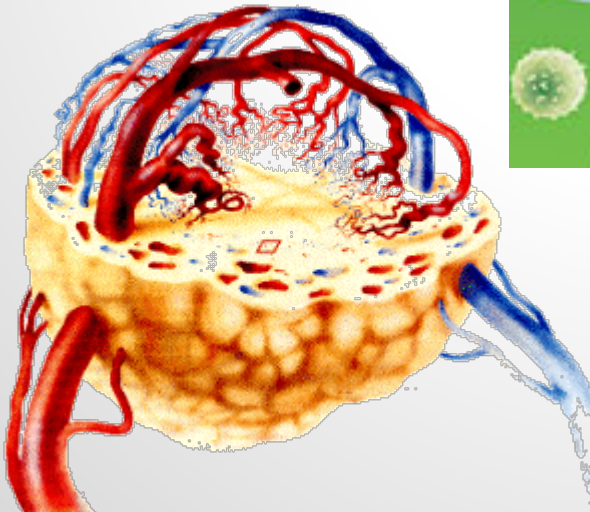
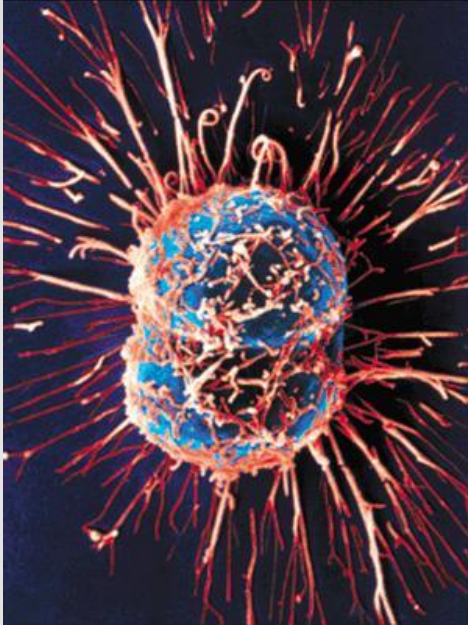


Team Human Health

Three Ideas

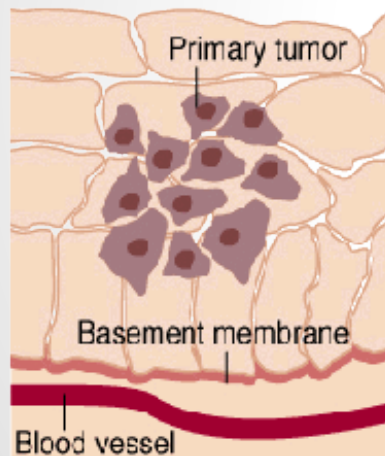
March 11th, 2015

I. Cancer targeting and destruction



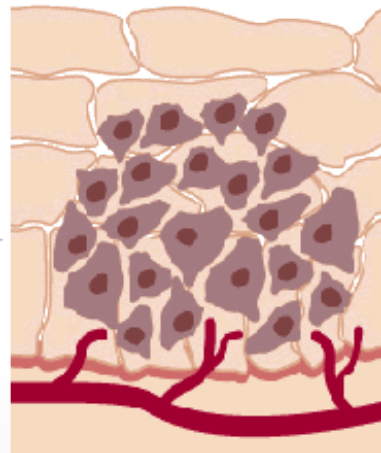
Angiogenesis and Tumor Growth

Avascular tumor
remain small



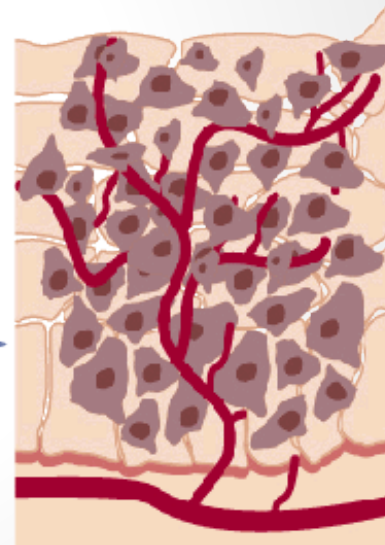
1

Tumor produced
angiogenic factor
stimulate endothelial
cell growth



2

Vascularized tumor
can grow unlimitedly



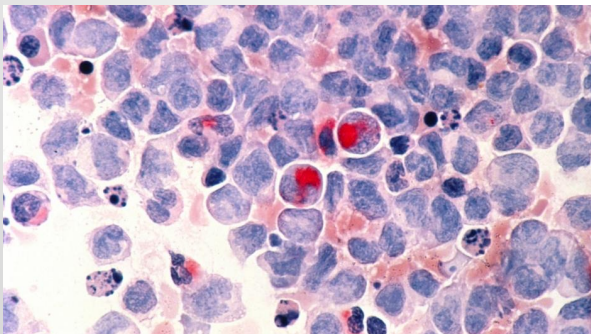
3

Scope of the project

Main Idea: Detect and tag cancer cells on a molecular level before they become a major threat

Scientific:

- Allow doctors to detect small amounts of cancerous growth and eliminate it in advance
- See where cancer originates in a patient's body and allow scientists to better understand the early stages



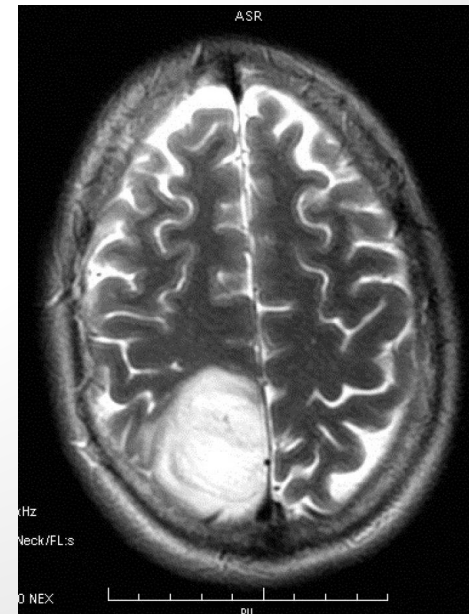
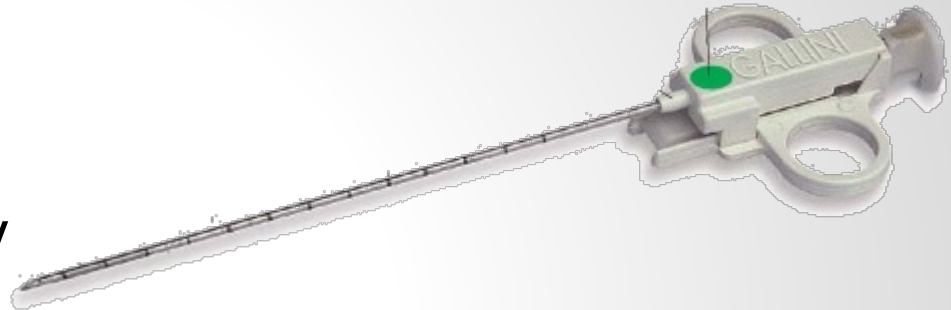
Personal:

- Eliminate the need for invasive detection procedures
- Cancer detection in the developing world



Detecting Cancer Cells

- “Early Detection is the Best Prevention”
 - Hard to detect in early stages
- By the time cancerous growths appear on a scan it may be too late
 - Procedures are invasive and frightening



Alternative Methods

- X-rays
 - Most common
 - Detect larger abnormalities in body structure
- CAT Scan
 - Create detailed images with radiographic beams
- MRI
 - Powerful magnetic fields to detect abnormalities
 - Patient must lay completely still
- Ultrasound
 - High frequency sound waves to detect large masses in the body
- Biopsy
 - Large needles remove masses of suspicious area for later analysis
- Bloodwork



Knowns and Unknowns

Known:

- What differentiates cancer cells from normal cells
- How to treat cancer cells

Unknown:

- How to effectively access the tumor microenvironment
- How to kill cancer cells **and only** cancer cells

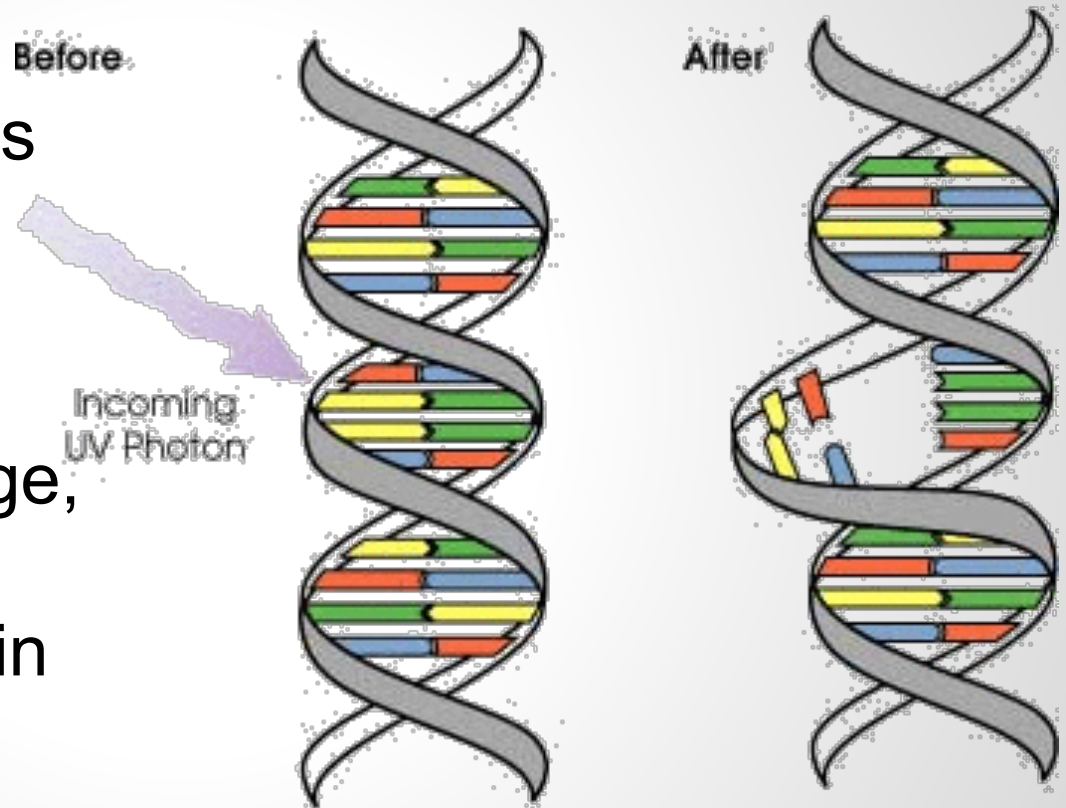


II. UV Damage Mitigation

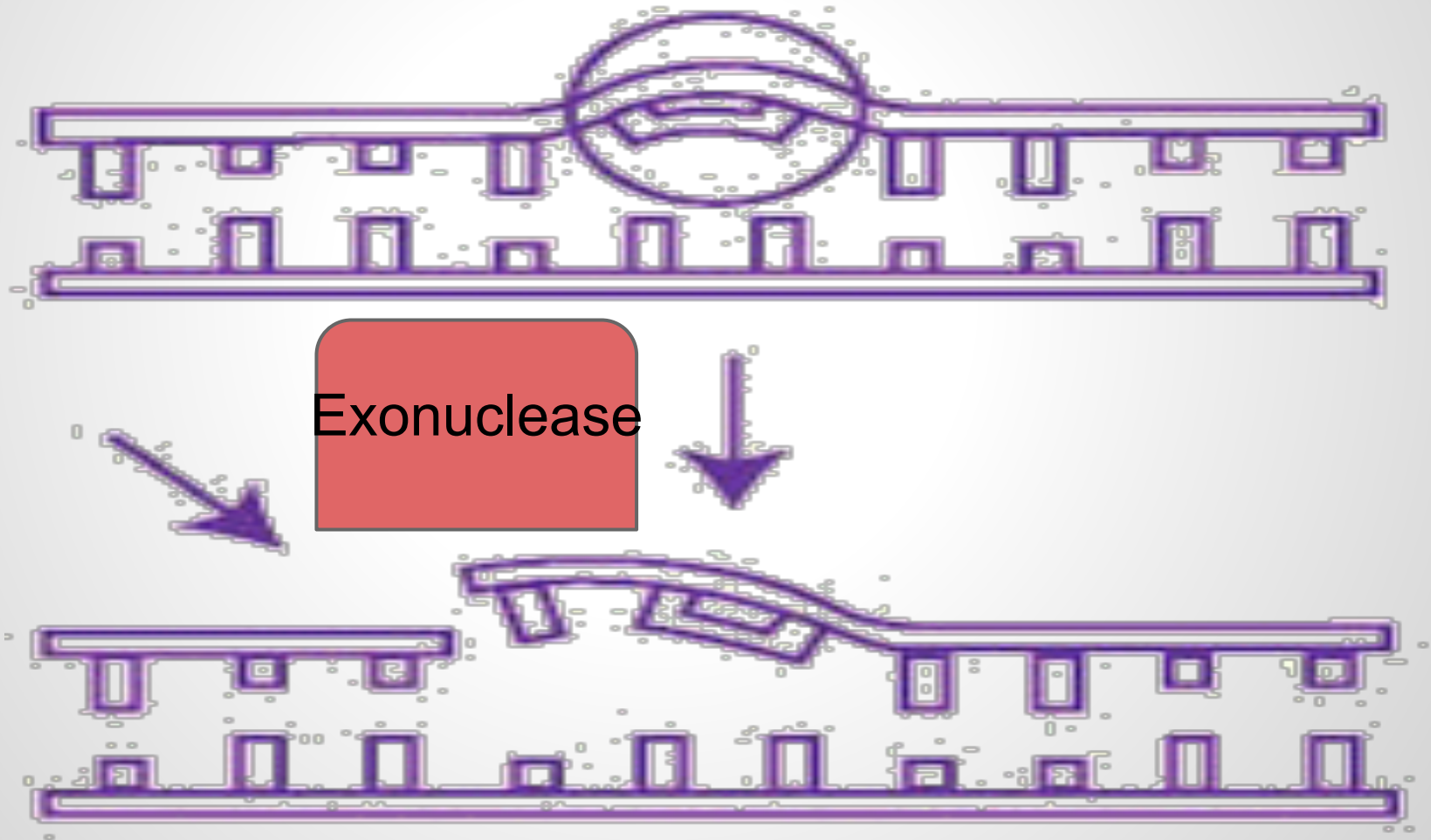
II. UV Damage Mitigation

Problems:

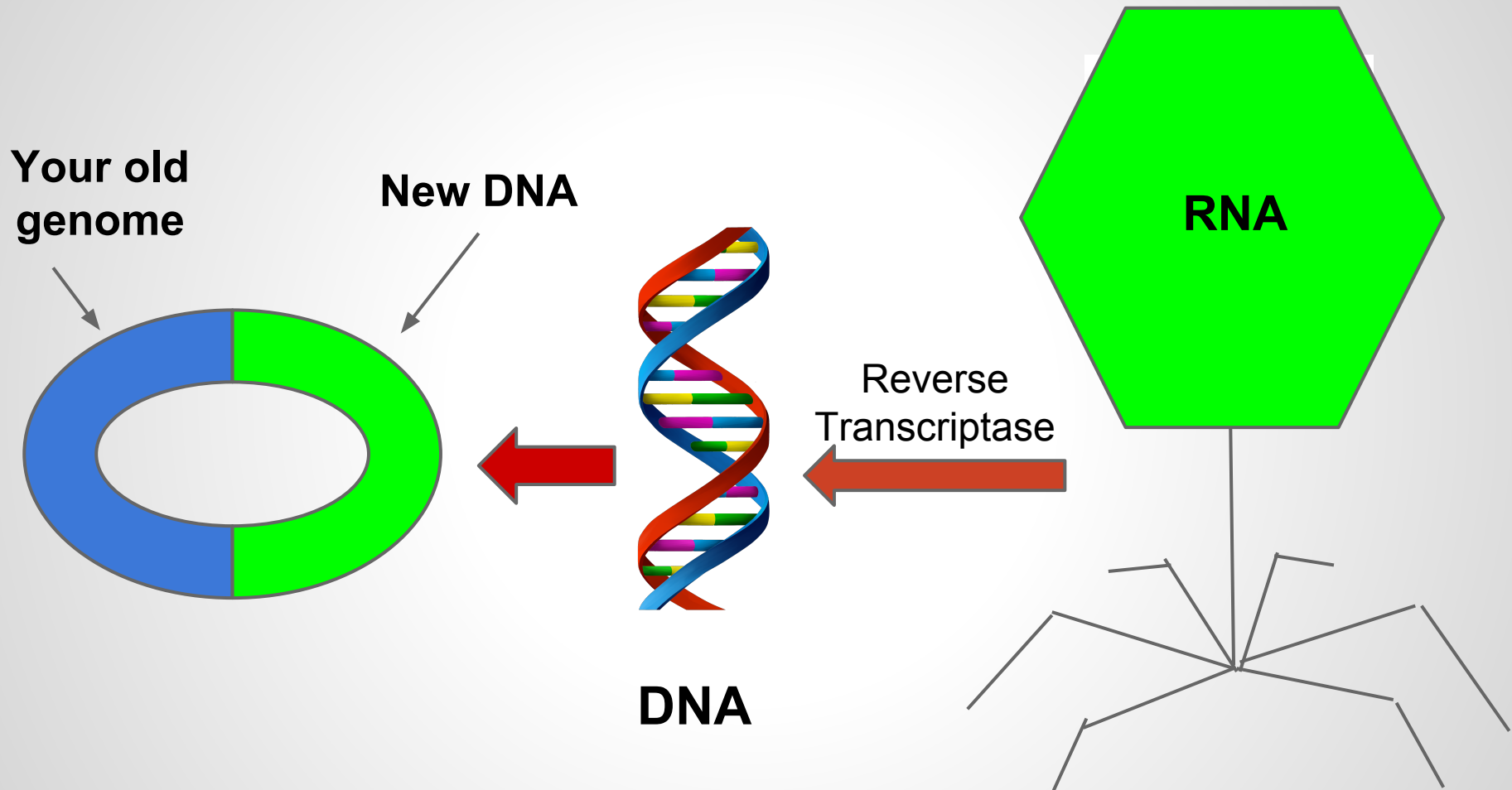
- Sun's UV light affects your DNA within femtoseconds of exposure
- Causes DNA Damage, not always repaired
- Leading cause of skin cancer



Current Repair Mechanisms

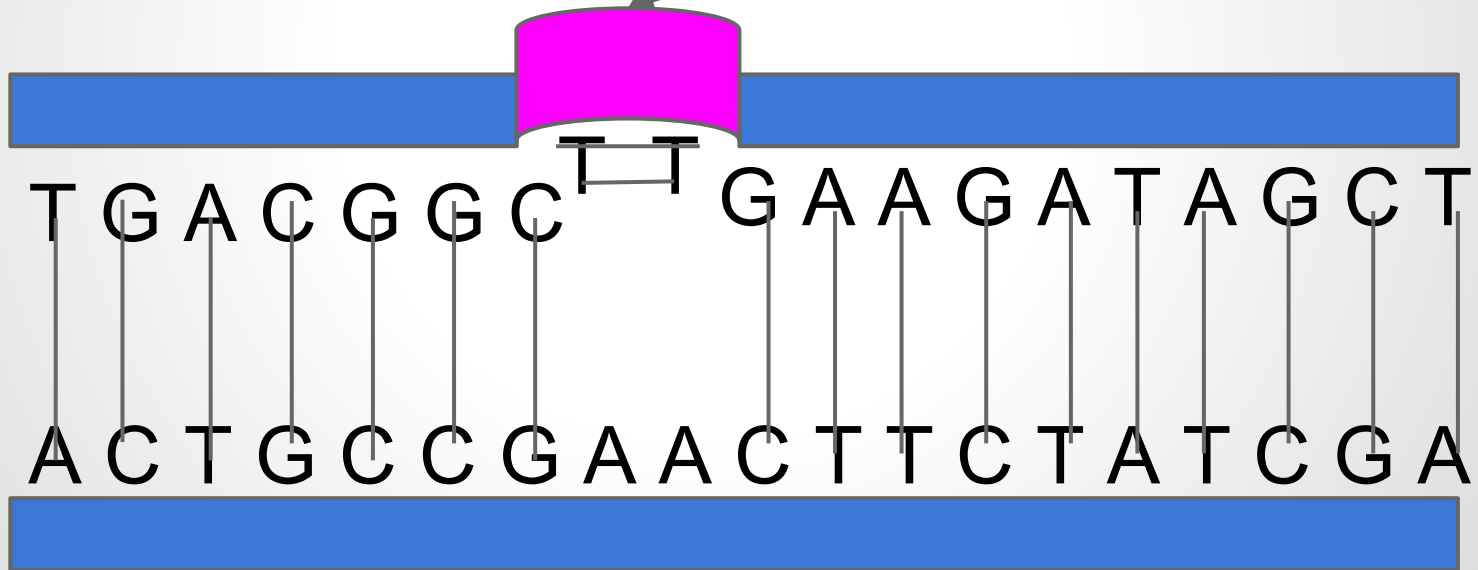


Delivery Mechanism



UV DNA Damage

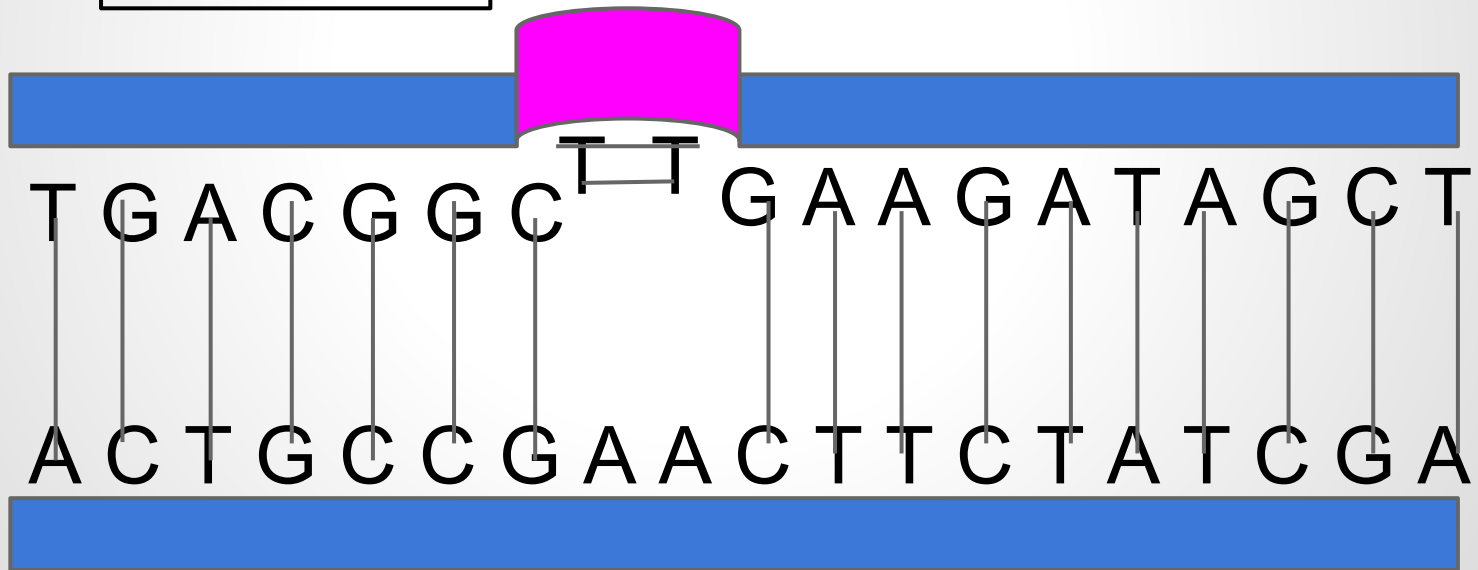
UV Radiation



Biological Sunscreen

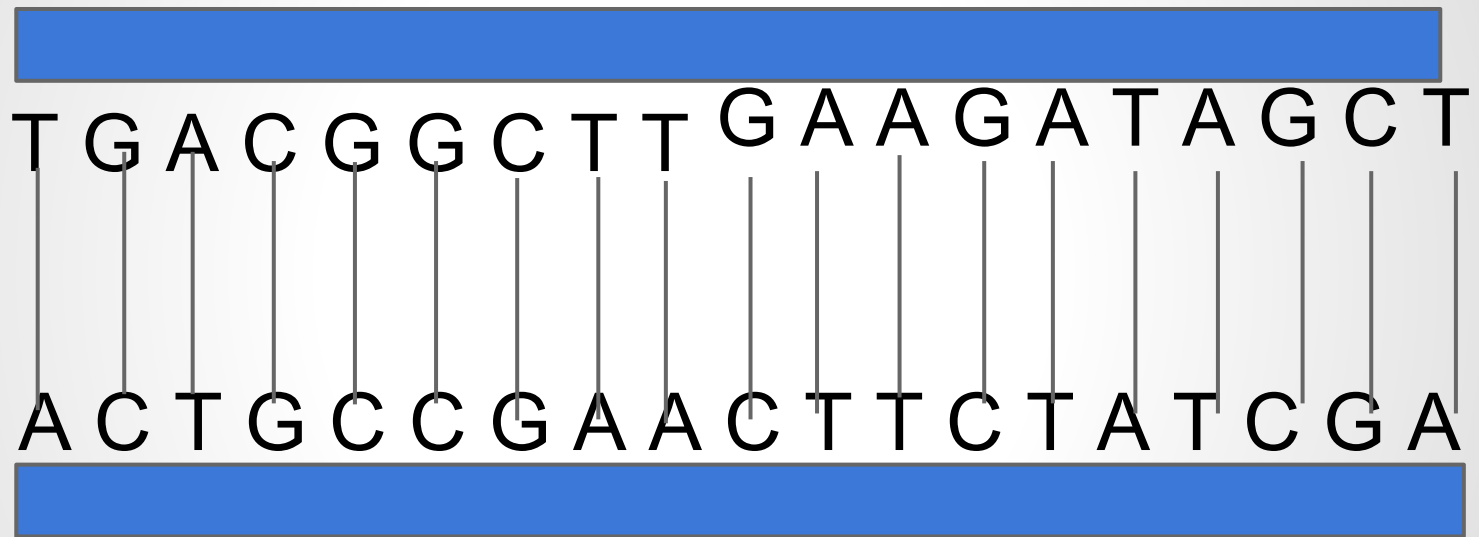
Visible Light

Photolyase
=D



Mitigation Complete

Photolyase
=D



Target Population

- Melanoma--the most common cancer in the United States
- Nearly Half of All Cancer Patients have Melanoma
- The Scope is Universal.

Impact

- Skin Cancer will be infinitely less common
- People will now be safer from UV damage
- Families would no longer lose loved ones to Melanoma
- Furthers Gene Therapy progress



Competition

- No gene therapy technique currently in use
- A lot of promising research--gene therapy is coming soon



Knowns and Unknowns

Known:

- Photolyase has helped repair thymine dimers *in vitro*
- Retroviruses can be engineered to insert photolyase DNA

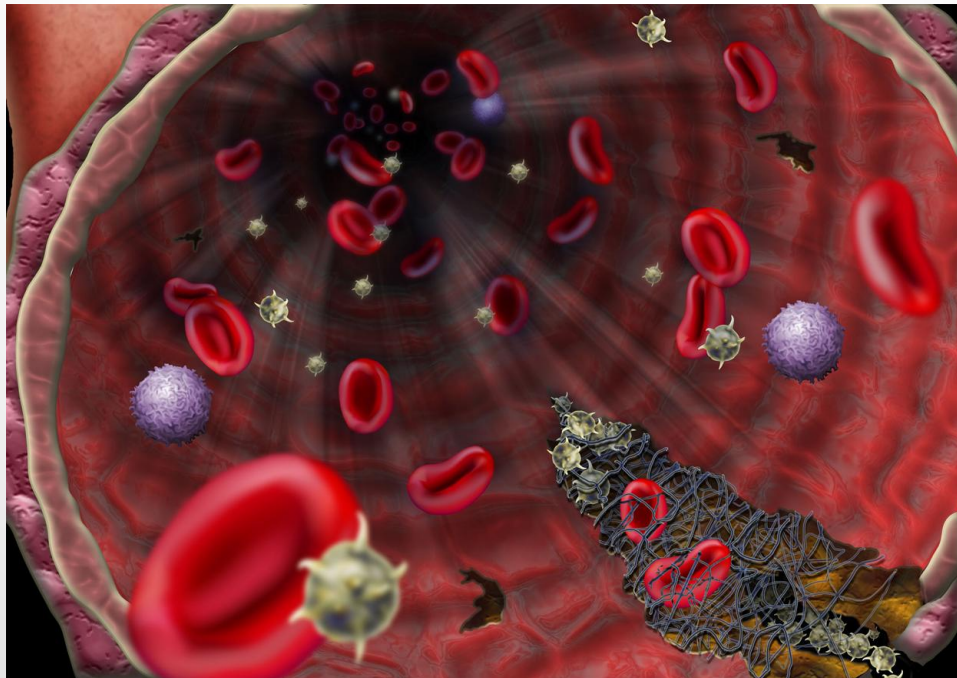
Unknown:

- Will the viral DNA be inserted inside a key gene?
- How effectively can viruses enter skin stem cells?

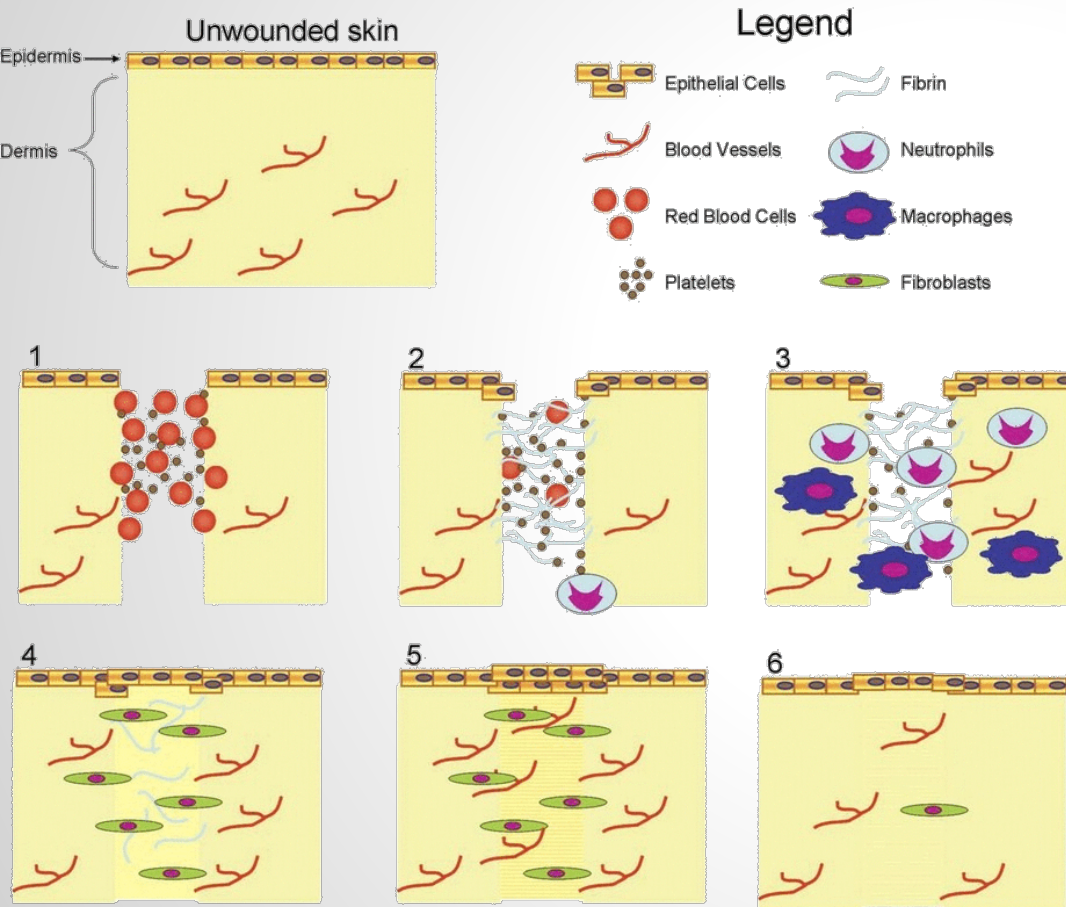
Artificial Wound Sealing

III. Rapid wound sealing via fast-forming scab

- Create cells that can be applied to the skin or potentially live in the body and promote wound sealing



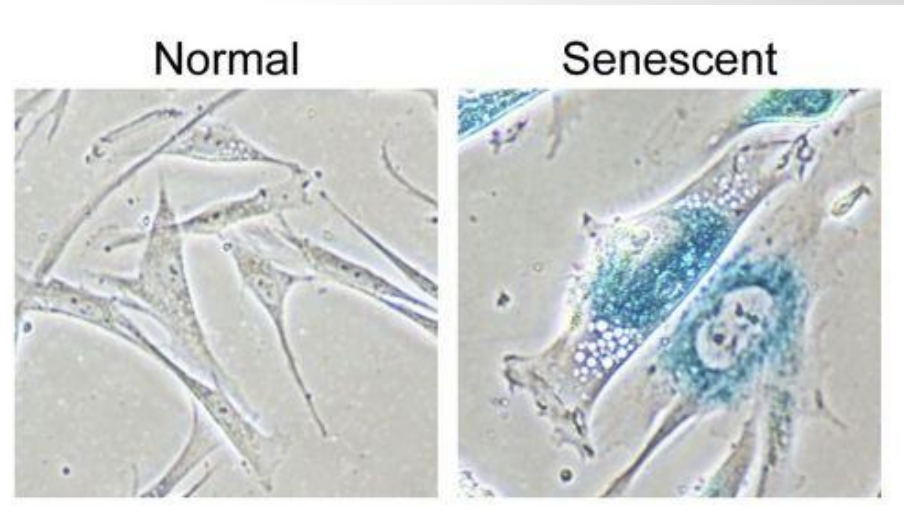
Impacts and Uses



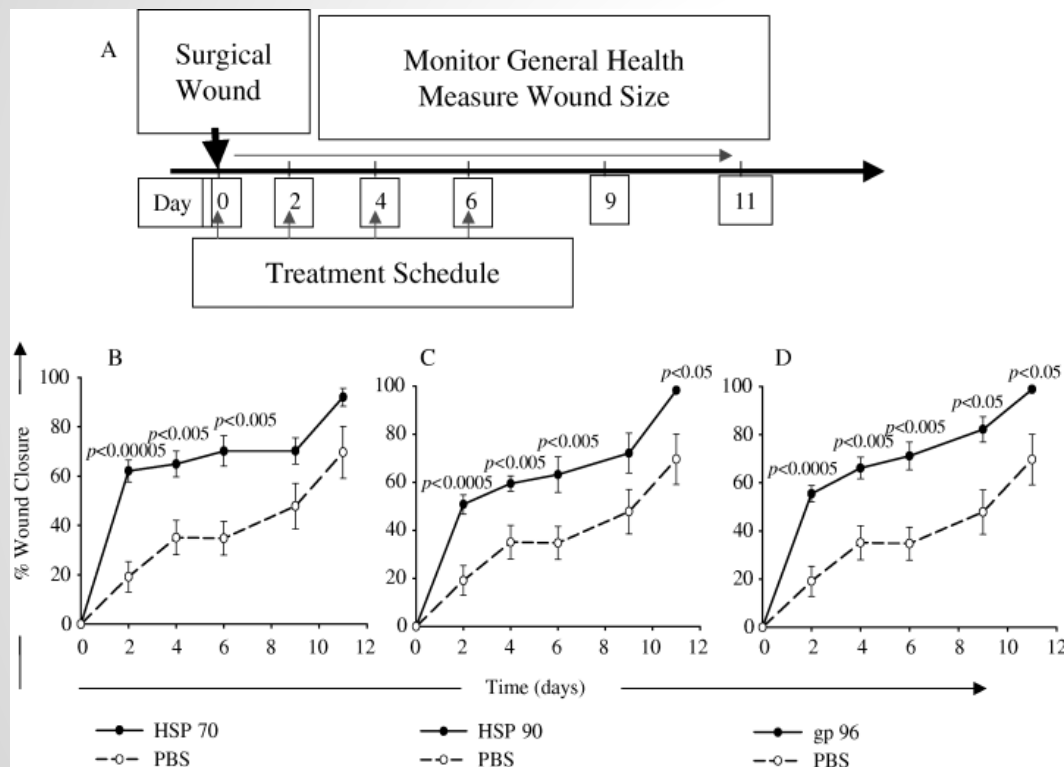
- Prevent extreme blood loss for hemophilia and clotting disorders
- Ensure that those in active jobs could return to work quickly
- Use in households and help in surgeries

Idea 1: Induce Cellular Senescence

- Cells in senescence secrete factors to facilitate wound sealing
- Unfortunately, senescence is irreversible and promotes aging; identifying secreted proteins and inserting into non-senescent cells could be a good alternative



Idea 2: Heat Shock Proteins (HSP)



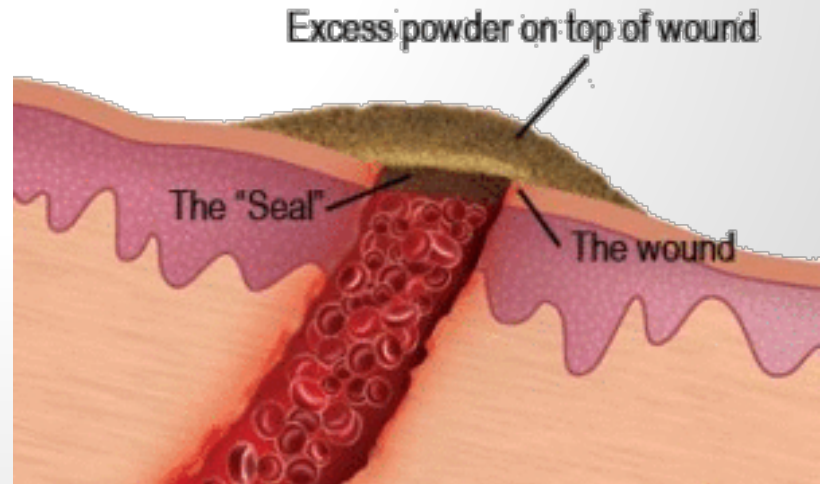
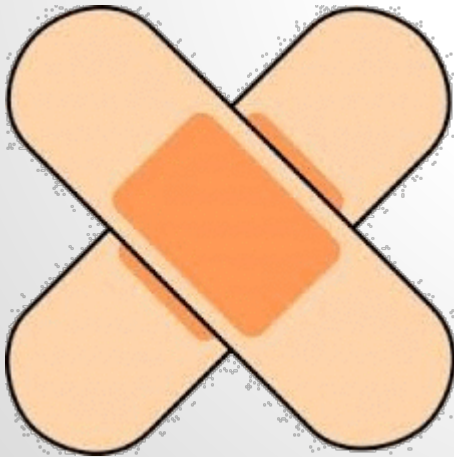
- Increase macrophage-mediated phagocytosis clears debris and neutrophils
- Of Hsp70, Hsp90, and gp96, Hsp70 best increases speed of wound closure
- Identified sequence for Hsp70
- Produce bacteria or mammalian cells with vector for upregulation of Hsp70
 - However under shock conditions for significant upregulation

Kovalchin, Phd Joseph T., Ruibo Wang Md Phd, Md Mihir S. Wagh, Bs Jason Azoulay, Md Melinda Sanders, and Rajiv Y. Chandawarkar. "In Vivo Delivery of Heat Shock Protein 70 Accelerates Wound Healing by Up-regulating Macrophage-mediated Phagocytosis." *Wound Repair and Regeneration*: 129-37.

Competition

Other Products on the Market:

- Bandages
- WoundSeal® Powder



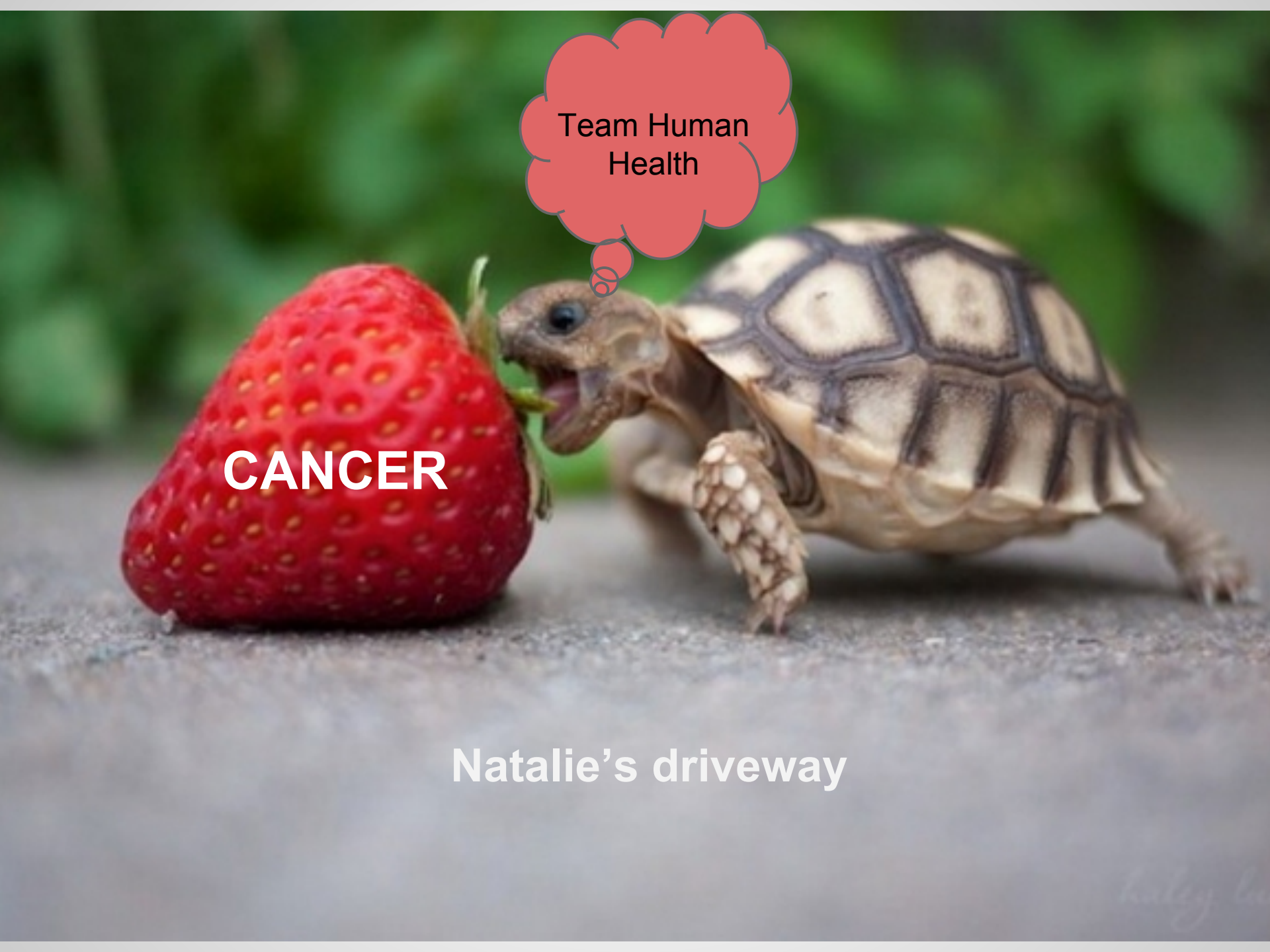
Knowns and Unknowns

Knowns:

- Research into putting the *Drosophila hsp70* gene into plasmid vectors
- Wounds treated with hsp70 heal faster
- Senescent Cells produce “complex mixture of extracellular matrix proteases, growth factors, chemokines, and cytokines”

Unknowns:

- Possible unknown adverse effects on the body
- Could bacteria containing the vector be used on humans
- Can both ideas be combined
- the effects of too much hsp70 protein
- How to keep cells or put cells under shock conditions
- If our system lives in the body as opposed to being applied after an injury, how can we detect a wound and localize our cells to that area?

A photograph of a tortoise with a light-colored, patterned shell and brown head, positioned on a grey asphalt surface. The tortoise is facing left, with its mouth open and biting into a large, bright red strawberry. Above the tortoise's head is a red, cloud-like thought bubble containing the text "Team Human Health". The background is a blurred green, suggesting foliage. The word "CANCER" is written in white, bold, sans-serif capital letters across the middle of the strawberry. At the bottom center, the text "Natalie's driveway" is written in white, sans-serif font. In the bottom right corner, there is a faint, handwritten-style signature that appears to read "halley b...".

Team Human
Health

CANCER

Natalie's driveway

halley b...

Anticipated Questions

1. How can you test if photolyase has repaired the DNA or not?
2. How fast would wounds be sealed with the added cells? What would be the goal? How much faster than “normal” would you consider successful?
3. What are your proposed methods of delivering virus therapy and how often do you imagine it would have to occur?
4. Idea 3: What potential immune responses may occur upon applying cells onto the skin? Would these be the patient’s own cells and if so, from where on the body?
5. Idea 3: Is there a danger of forming ‘superclots’ that may block blood flow?