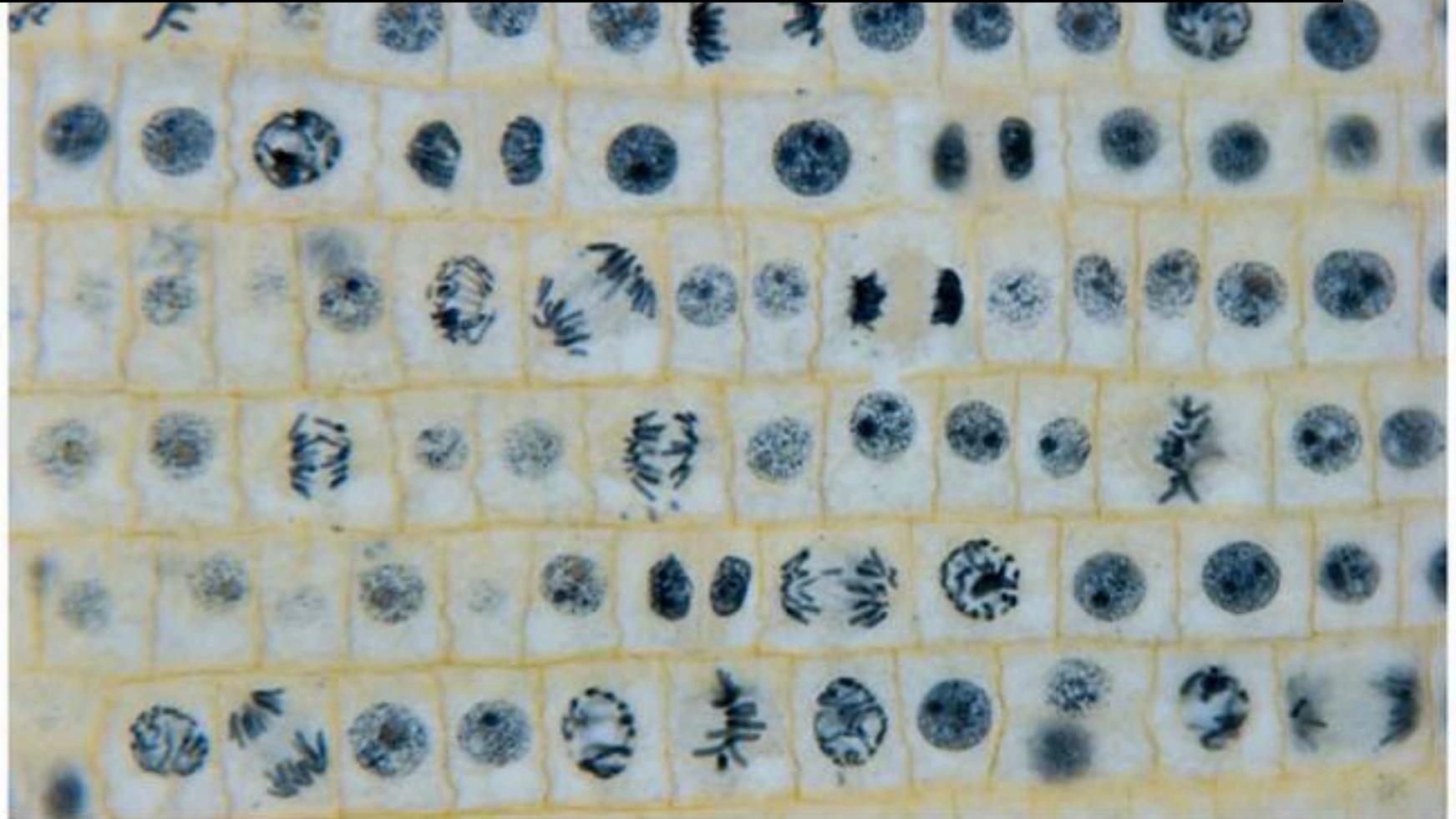


**Warm Up:**  
Define “mitotic Index”. How could this tool be of use to a cancer biologist?

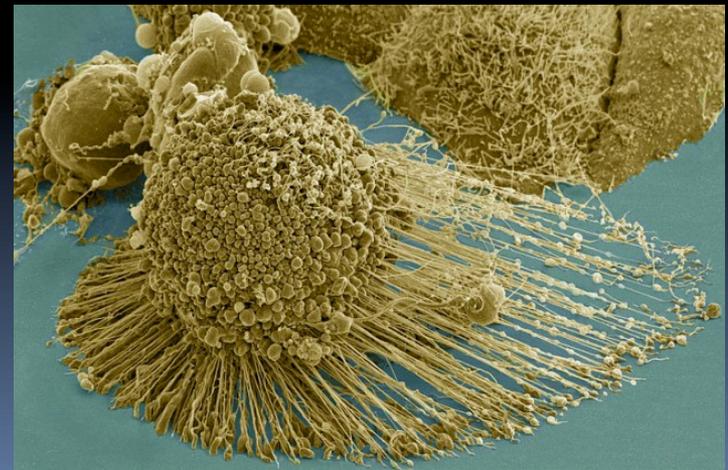
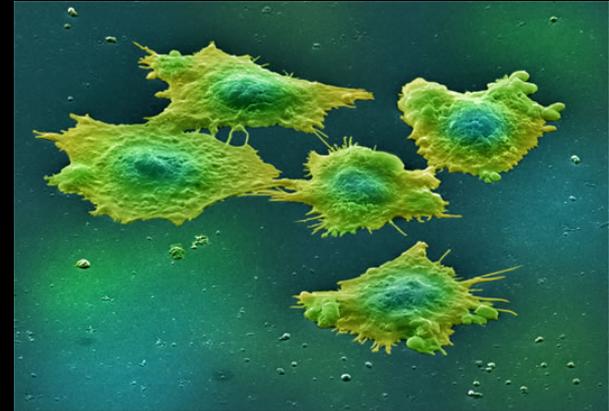
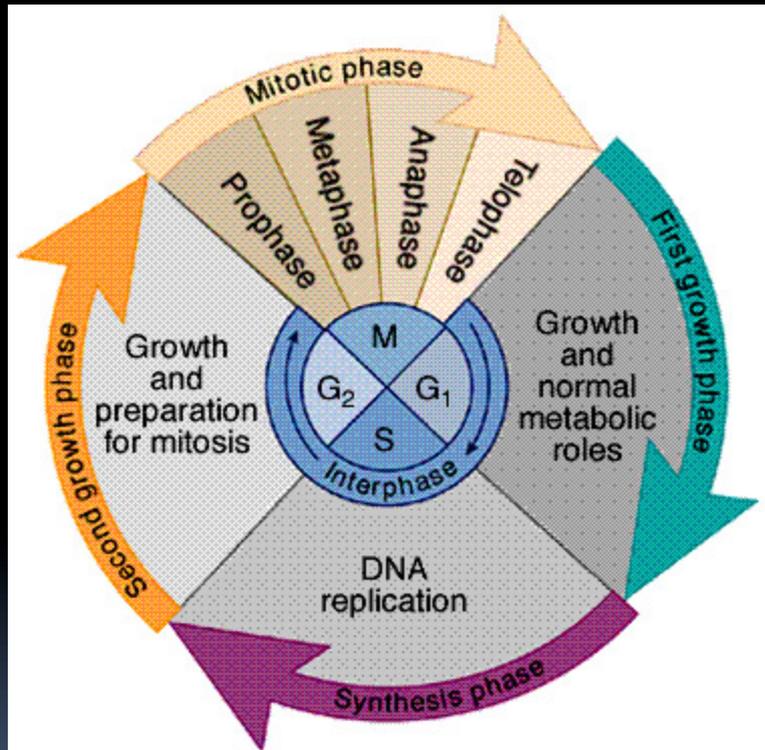
# CELL CYCLE CONTROL AND CANCER

1/19/15

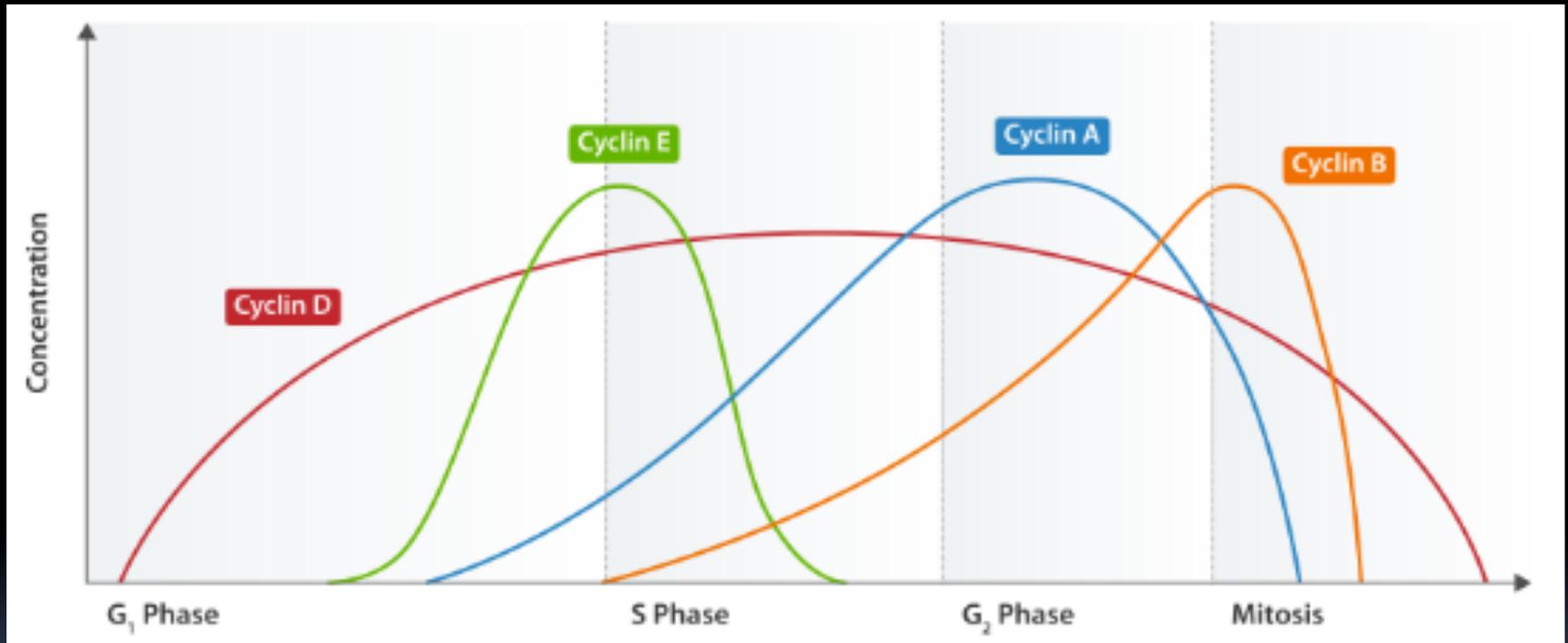
Mitotic Index: Count cells in each stage of Mitosis.



# Cancer is a disease of the cell cycle



Protein factors called “cyclins” regulate the cell cycle to promote correct cell division



**G1/S Check point**

**G2/M Check point**

**M checkpoint during metaphase of mitosis**

Chemical Signals tell a cell when to start and stop dividing.



# Contact Inhibition: neighboring cells stop dividing when they touch each other

## Contact inhibition



Cells form single layer in culture.

**A**



Cells removed.

**B**



Cells replace removed cells; division stops when single layer is repaired.

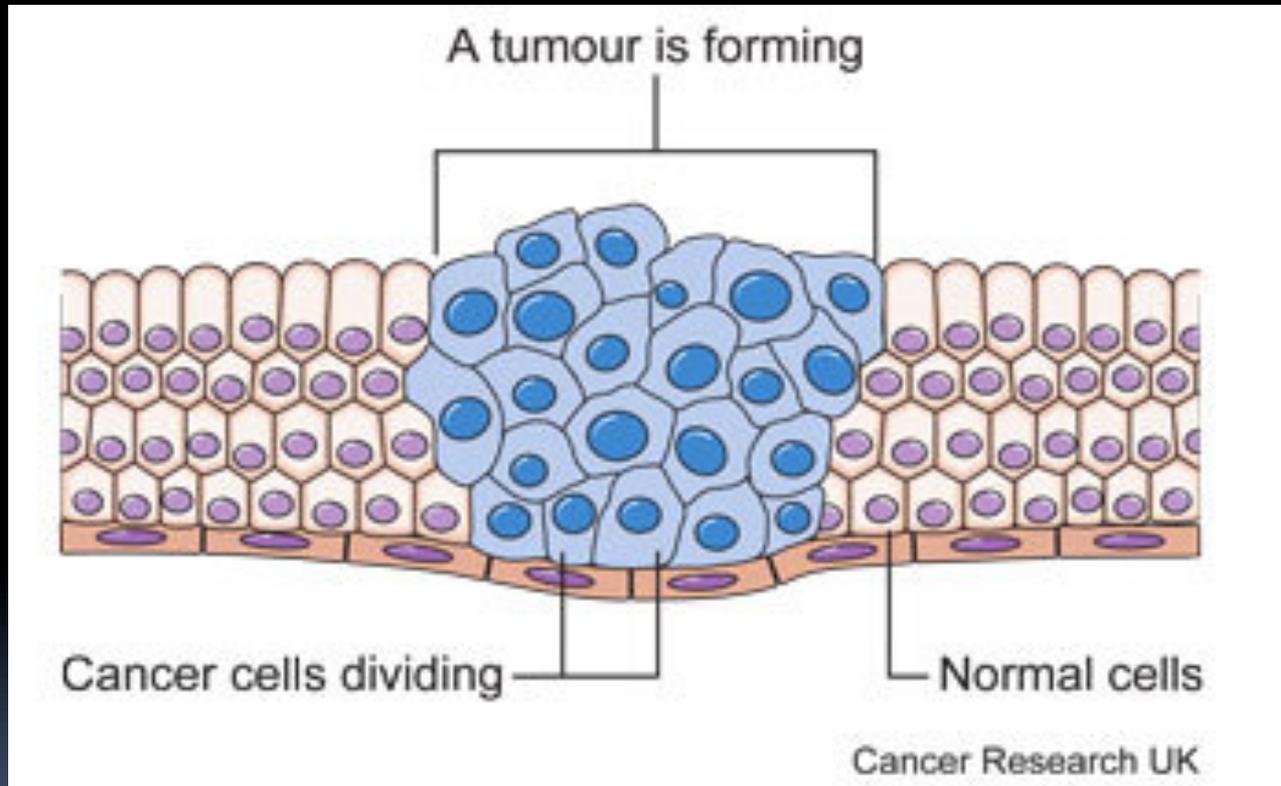
**C**



Cancer cells in culture will continue to divide and pile up haphazardly.

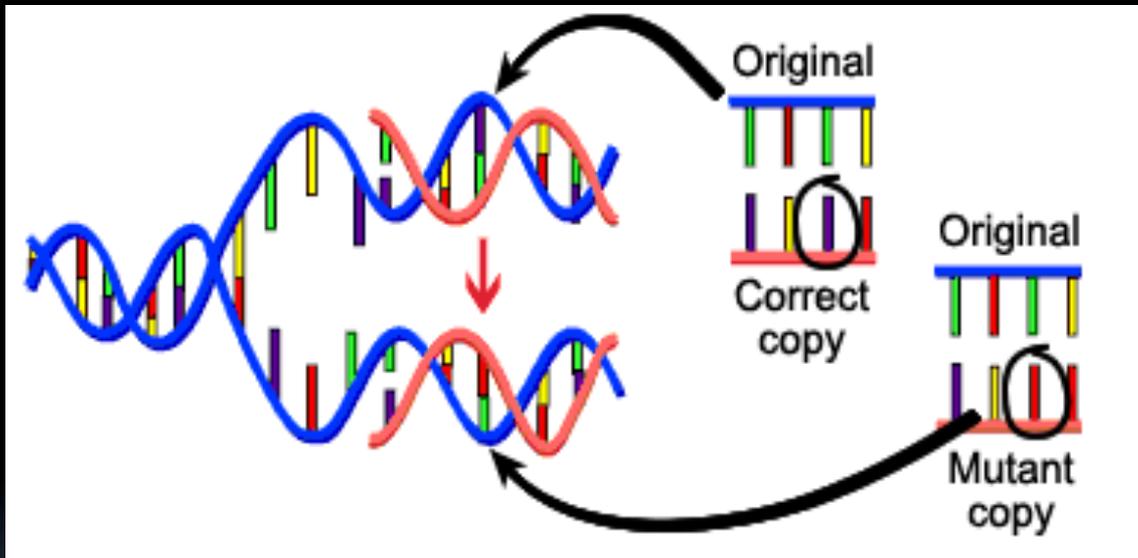
**D**

Cancer is a disease of the cell cycle. Cancer cells divide uncontrollably and tumors form.



Cancer cells DON'T REST!! Cancer cells are locked in the "M" phase of the cell cycle.

# DNA mutations disrupt the cell cycle.

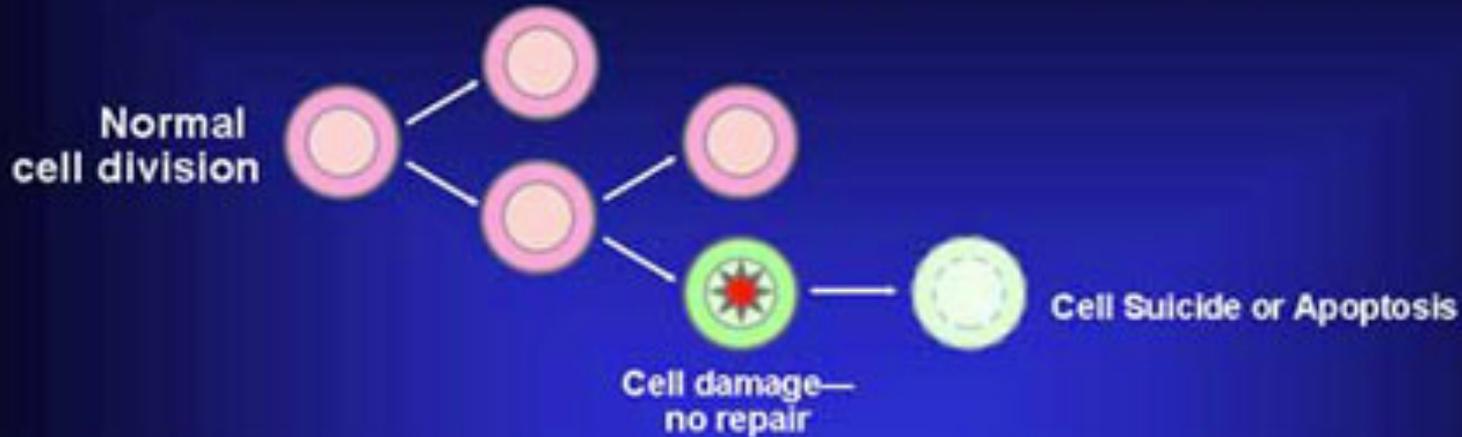


Mutations may be caused by:

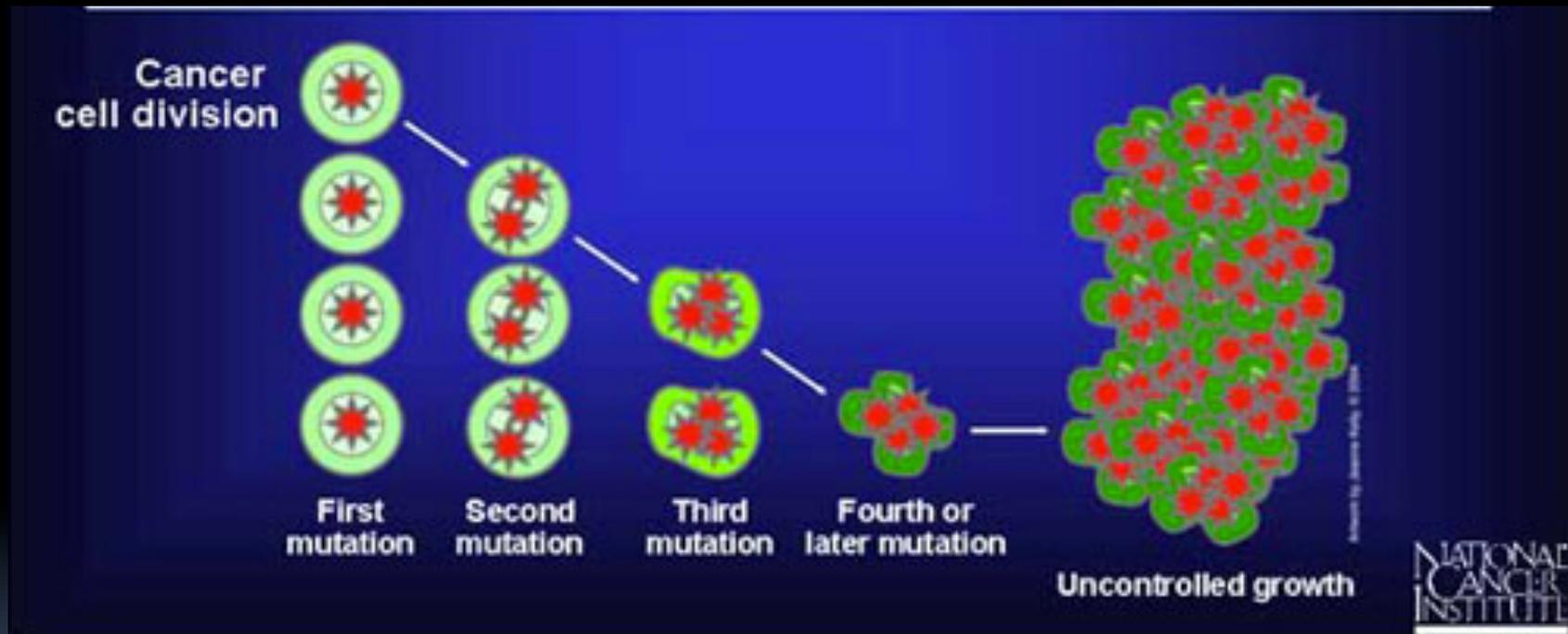
1. radiation
2. smoking
3. pollutants
4. chemicals
5. viruses

Normal cells detect mutations at the CHECK POINTS and eliminate the damaged cell.

## Loss of Normal Growth Control



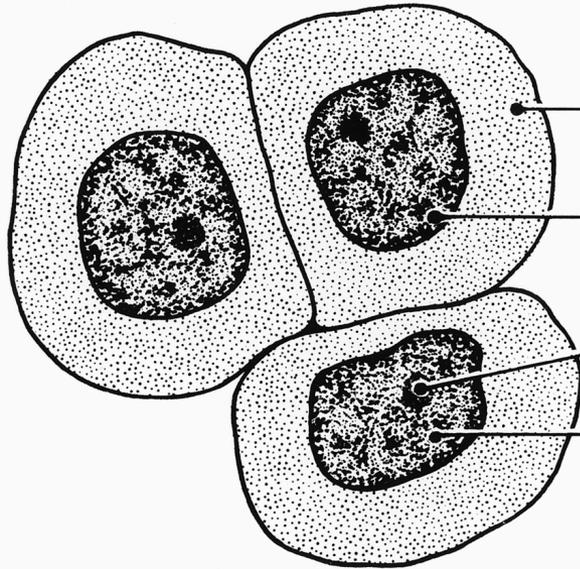
# Cancer cells bypass the checkpoints and continue to divide.



Damaged cells can continue to accumulate mutations leading to an increase in the aggressiveness of a cancer.

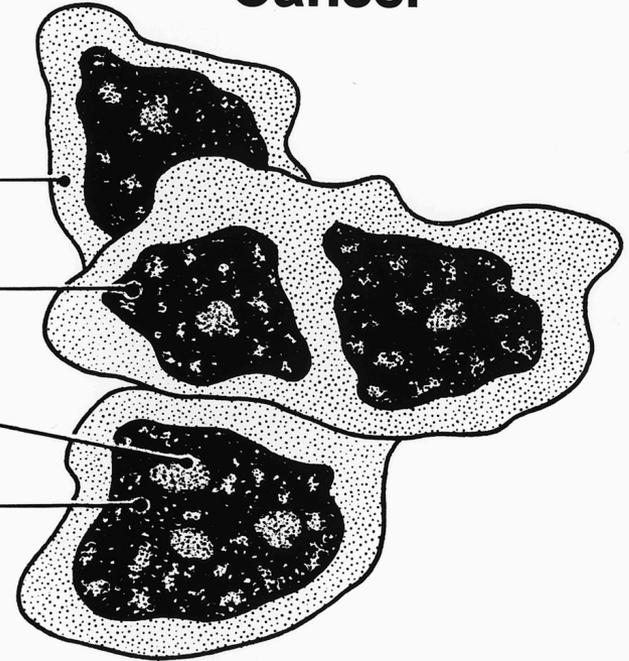
# Normal and Cancer Cells Structure

## Normal



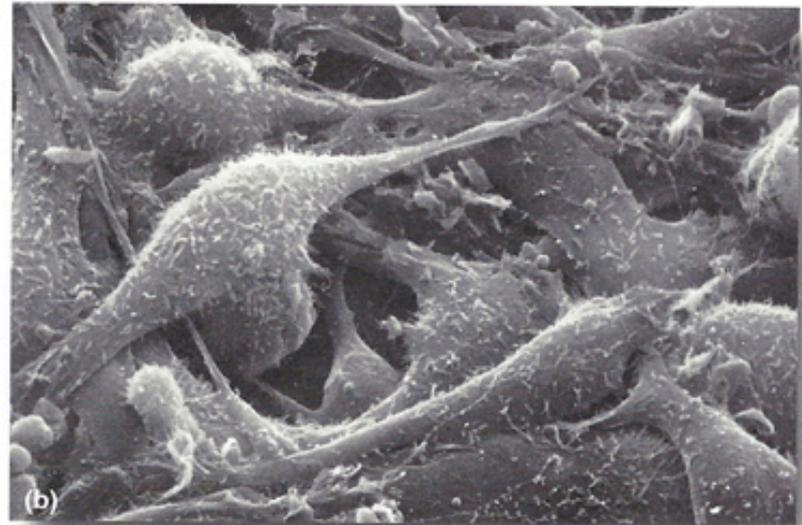
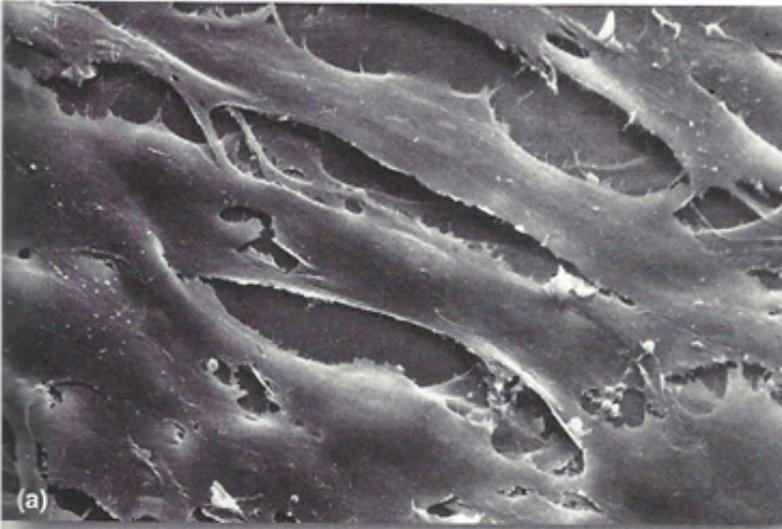
- Large cytoplasm
- Single nucleus
- Single nucleolus
- Fine chromatin

## Cancer



- Small cytoplasm
- Multiple nuclei
- Multiple and large nucleoli
- Coarse chromatin

# Tumor progression

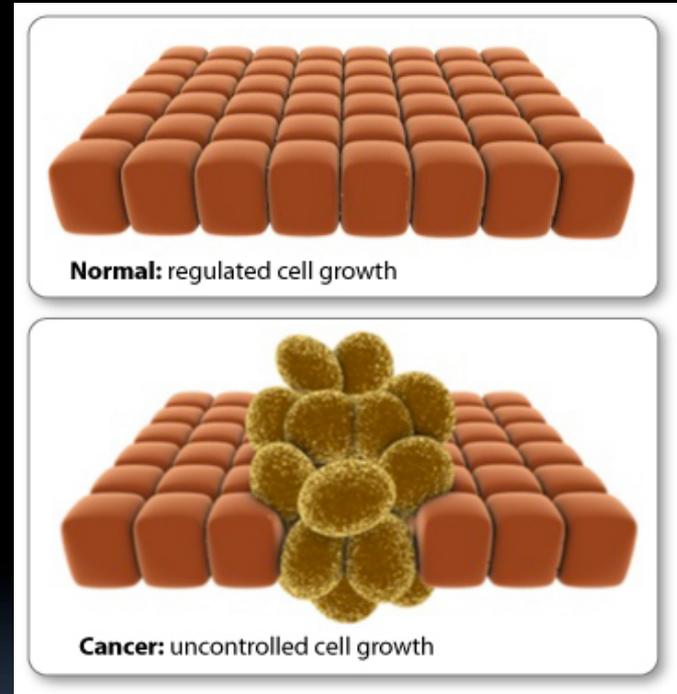


<http://www.discoveryandinnovation.com/>

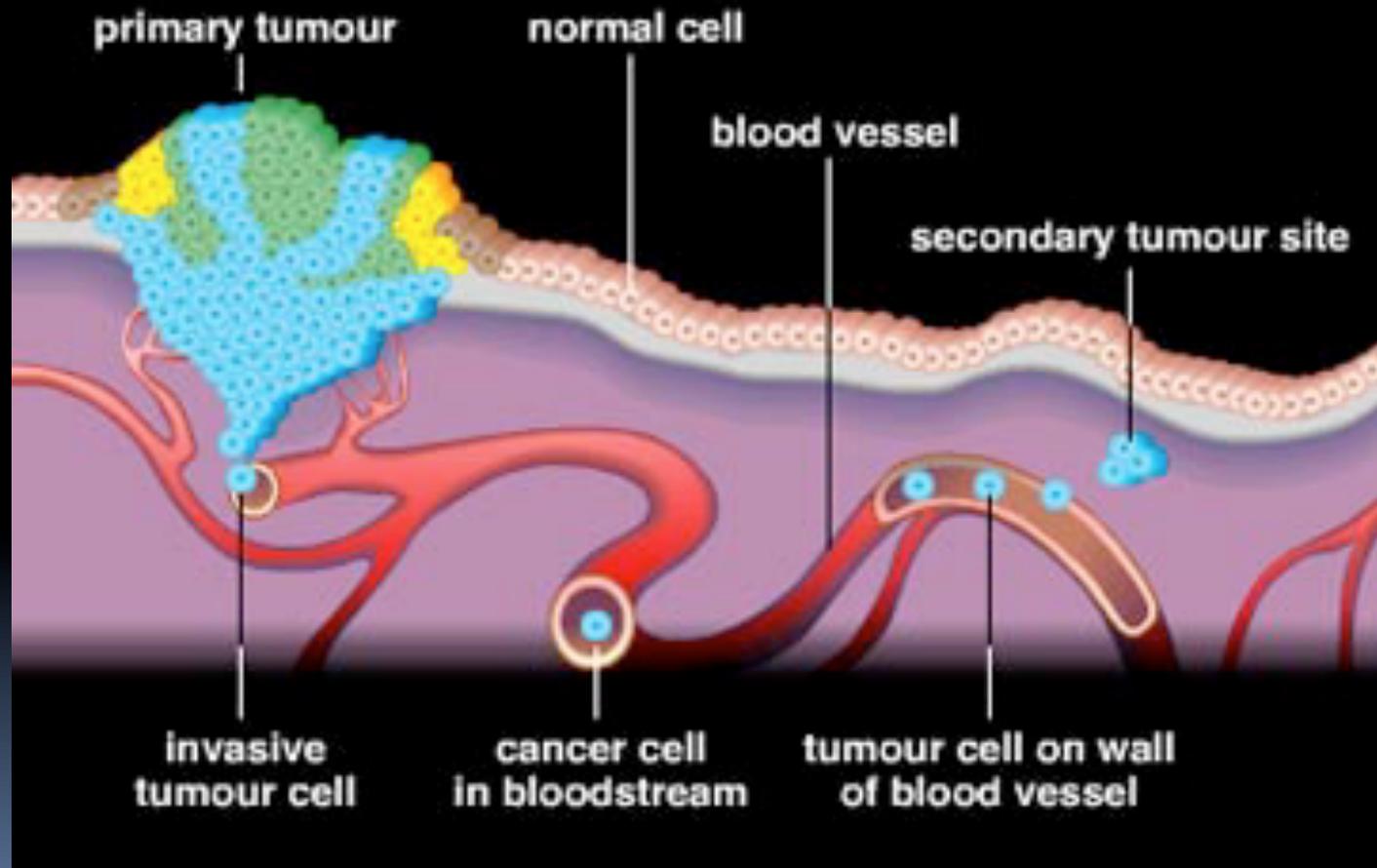
**DNA mutations block the ability of cancer cells to communicate with neighboring cells. Cells continue to grow and form tumors.**



**Skin cancer**

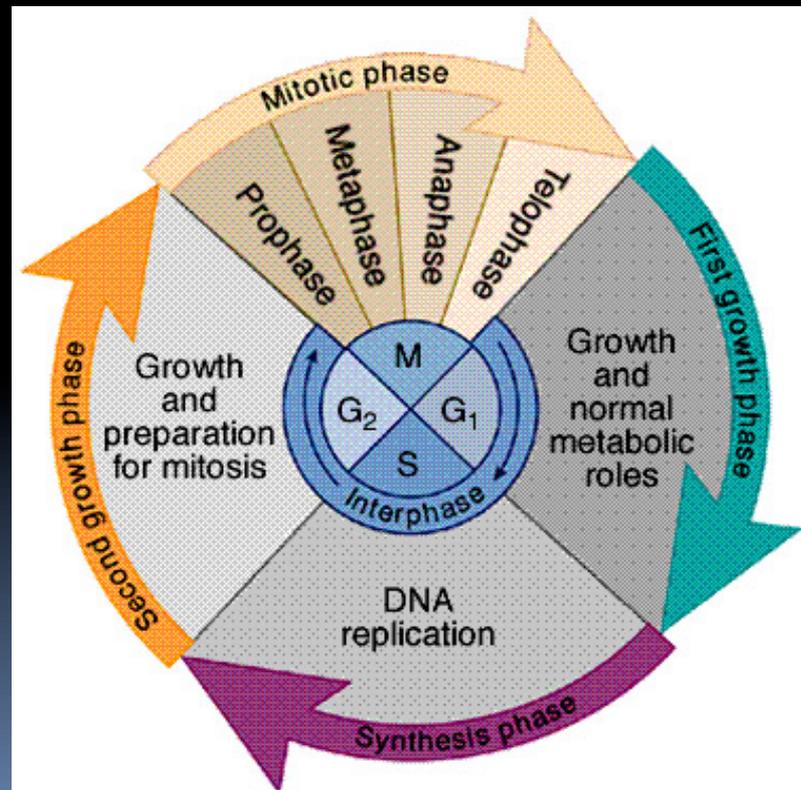


# Metastasis: how cancer cells spread

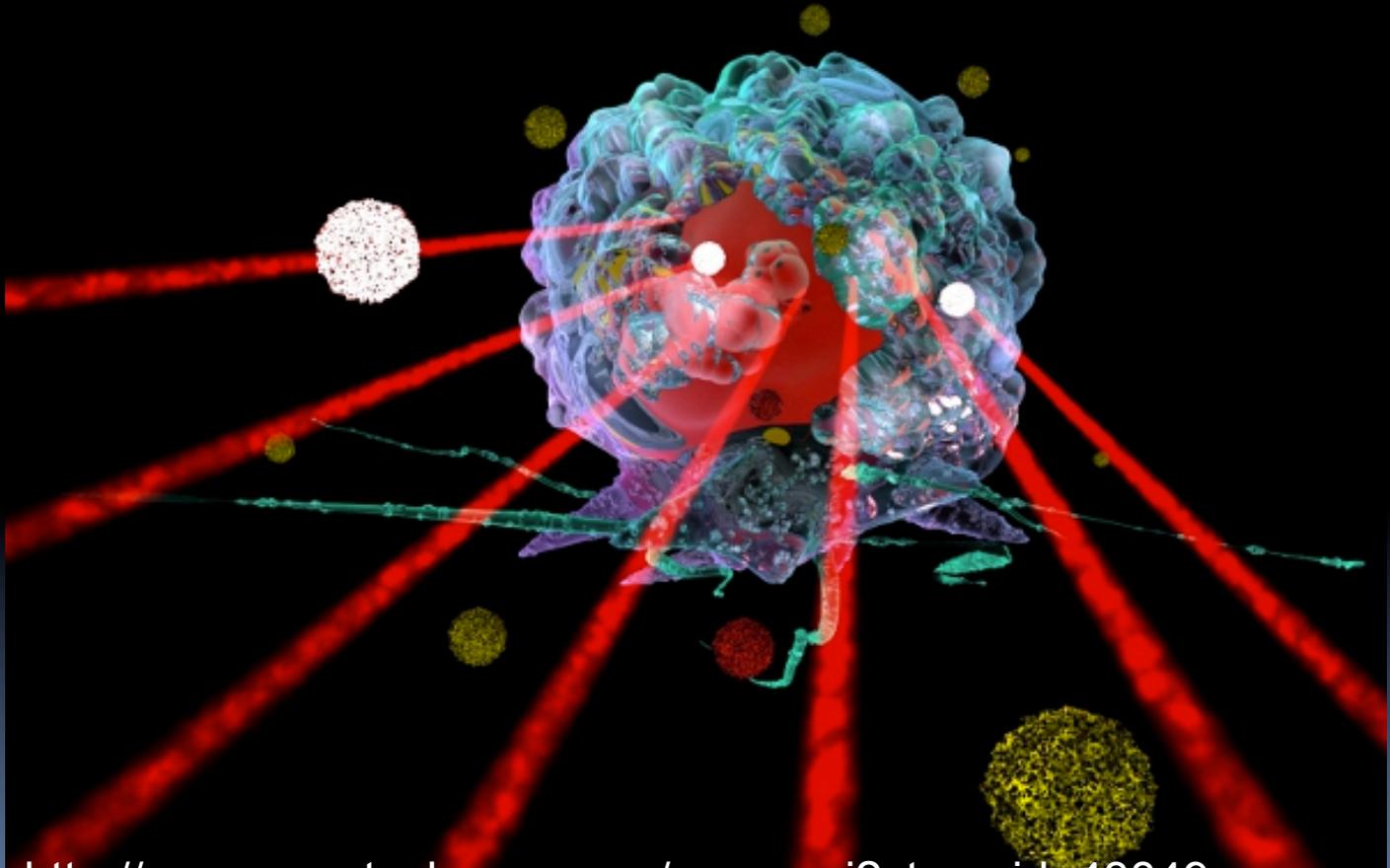


# Treating Cancers

Radiation and chemotherapy target cells that are rapidly and actively dividing.



Treatment is a balance between killing cancer cells while minimizing damage to healthy cells.



[http://www.nanotech-now.com/news.cgi?story\\_id=43849](http://www.nanotech-now.com/news.cgi?story_id=43849)

# Presidential “Moonshot”...

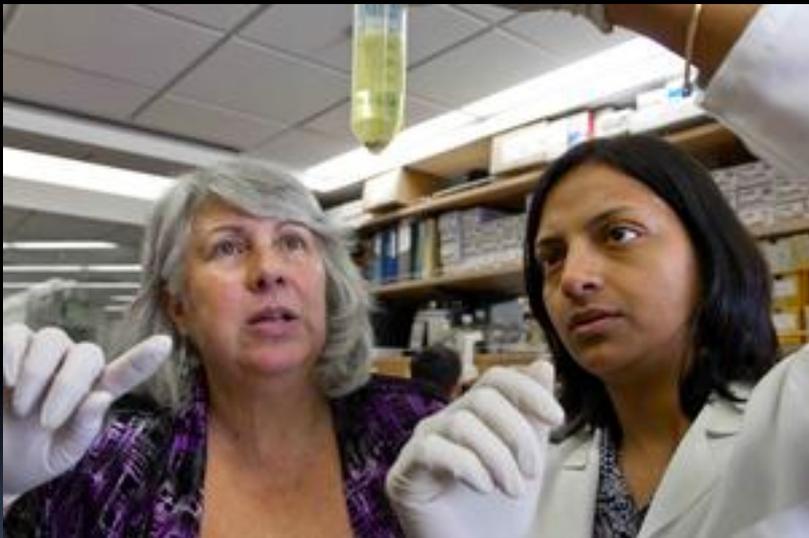


We chose to go to the moon in  
this decade and do the other  
things, not because they are easy,  
but because they are hard...

- John F. Kennedy

# Overview of Cancer

- Dr. Thea Tisty- University of California at San Francisco  
[http://www.exploratorium.edu/imaging-station/research/cancer/story\\_cancer1.php](http://www.exploratorium.edu/imaging-station/research/cancer/story_cancer1.php)



**Write down one question**

# SUMMARY

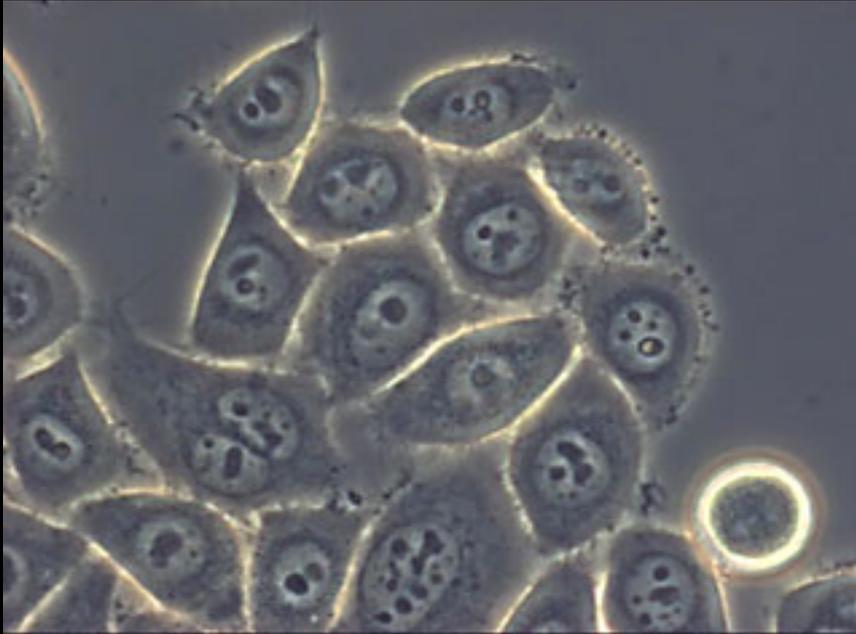
## Normal Cell Division

1. DNA is replicated properly.
2. Chemical signals start and stop the cell cycle.
3. Cells communicate with each other so they don't become overcrowded.

## Cancer Cells

1. Mutations occur in the DNA when it is replicated.
2. Chemical signals that start and stop the cell cycle are ignored.
3. Cells do not communicate with each other and tumors form.

# HeLa cells and Henrietta Lacks



<http://sciencefriday.com/segment/02/12/2010/the-immortal-life-of-henrietta-lacks.html>