Steps in the discovery of new cancer treatments

Discovering which protein is altered in one type of cancer

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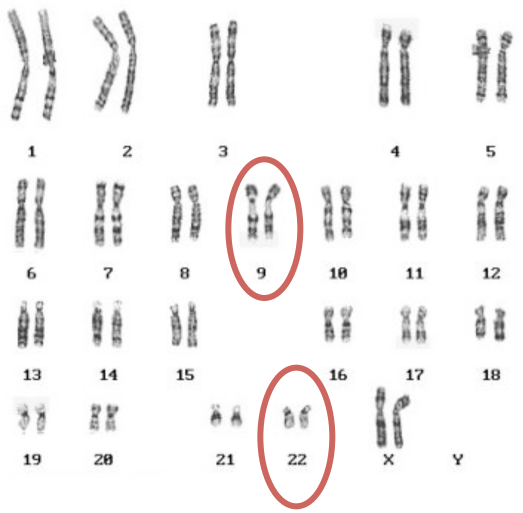
Sharing findings with the scientific community & the general public

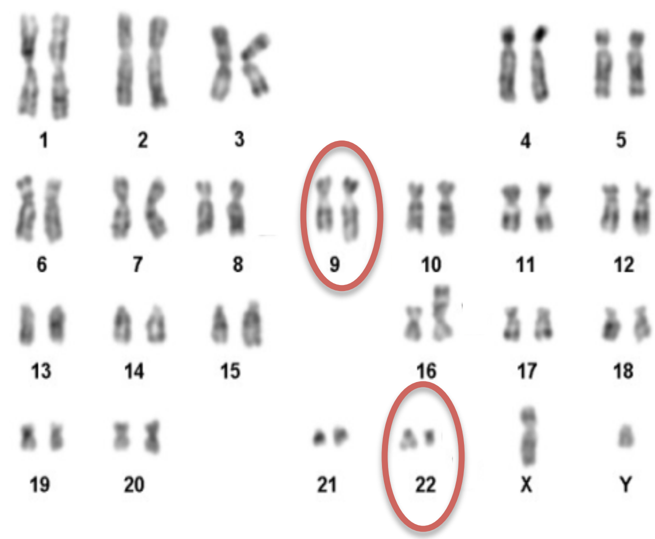
Please take a moment to discuss with your neighbor how cancer has impacted those around you.

What has changed about the DNA in the cancer cell, that may have led to the disease?

All of the chromosomes in a non-cancerous cell



All of the chromosomes in a "CML" cancer cell

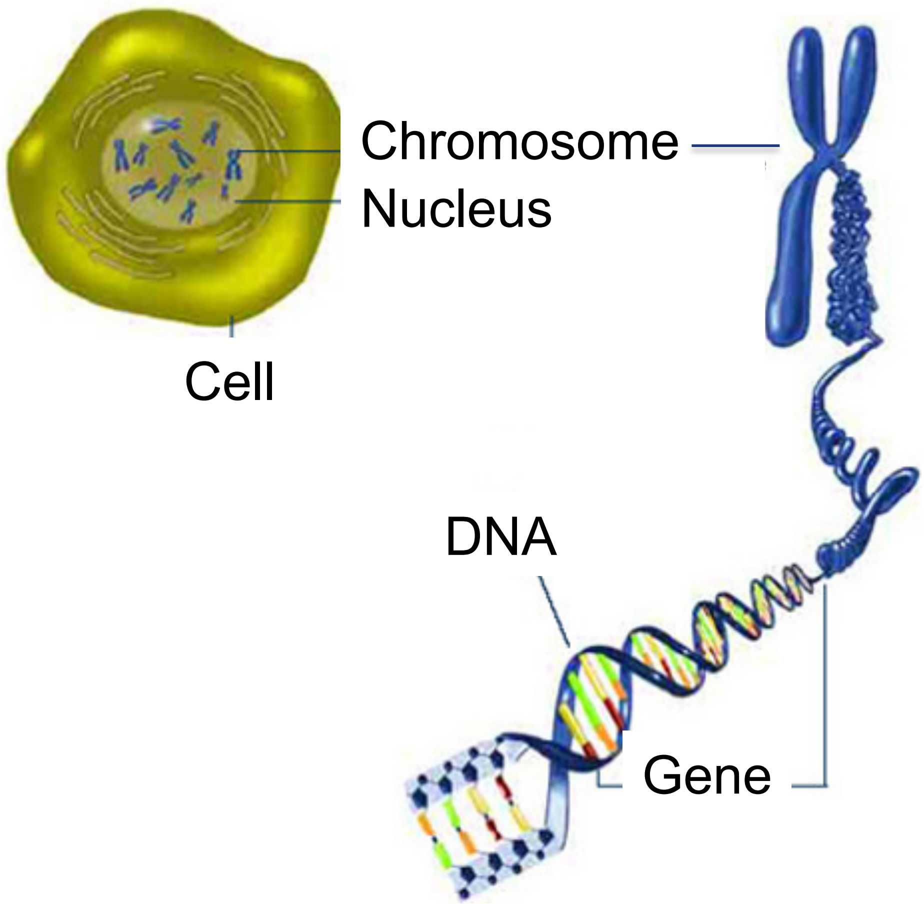


Chromosomes #9 & #22 in a non-cancerous cell

9 22

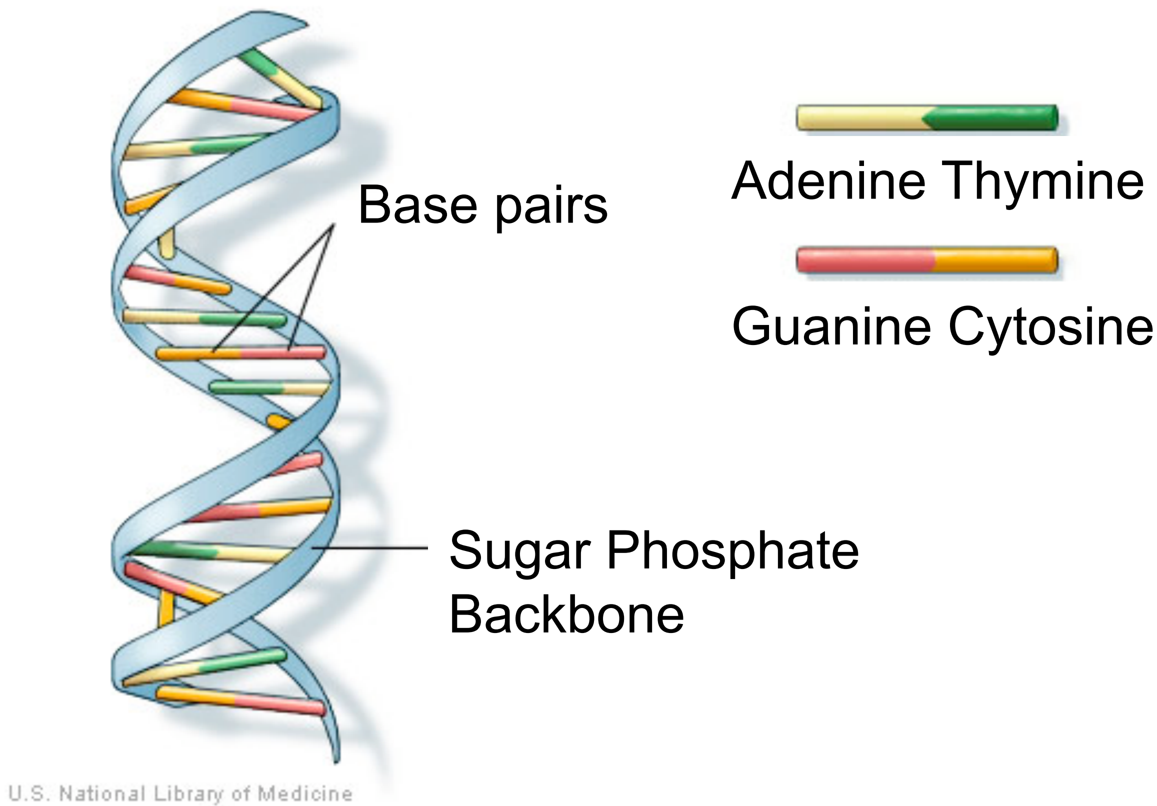
Chromosomes #9 & #22 in a "CML" cancer cell

9 22

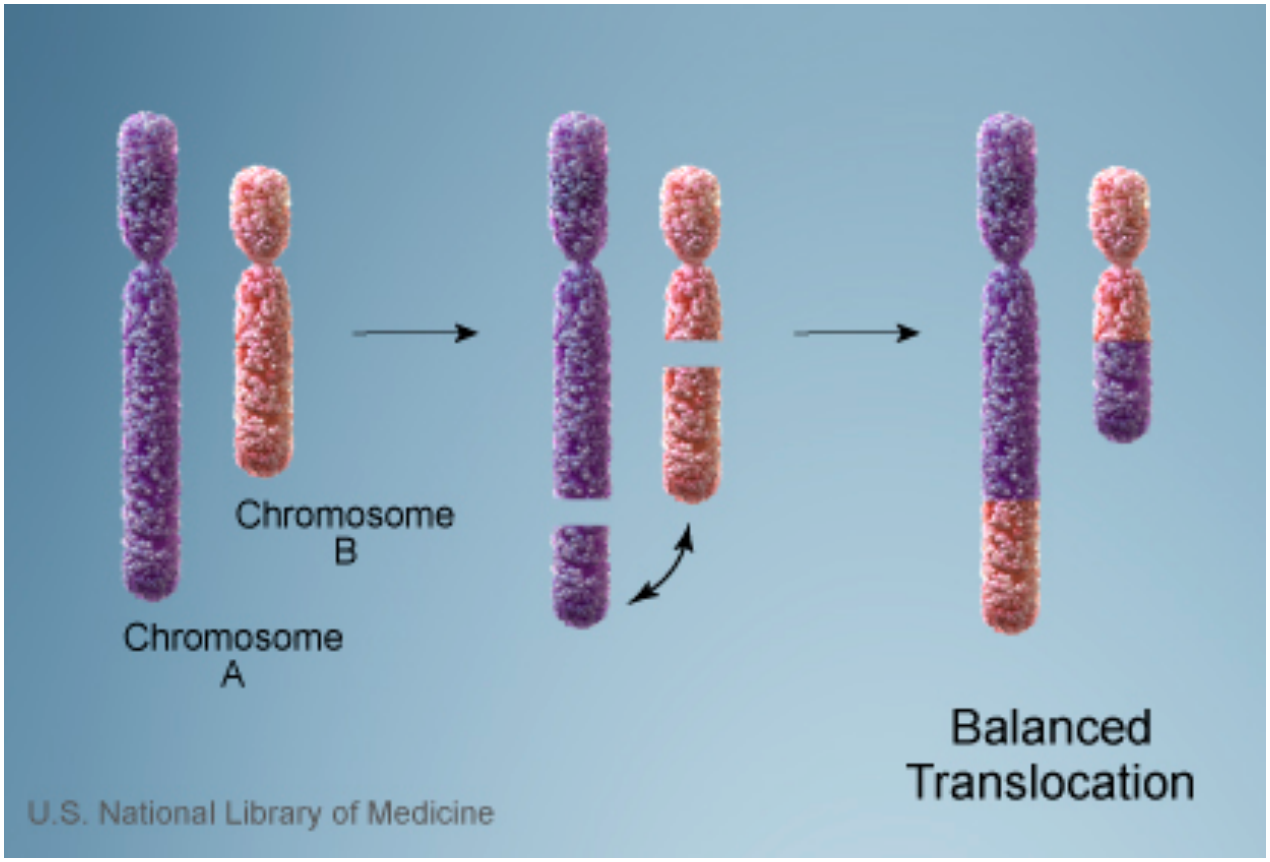


Chromosome
Nucleus
Cell
DNA
Gene

The Basic Structure of DNA

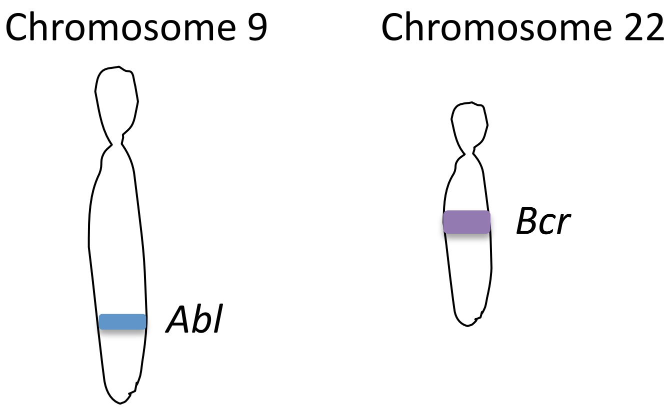


A translocation is when two chromosomes swap their ends

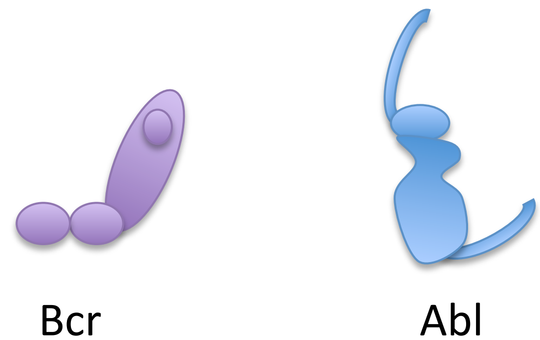


The translocation present in CML cancer patients

The genes encoding *Bcr* & *Abl* in a non-cancerous cell:



The proteins Bcr & Abl in a non-cancerous cell:

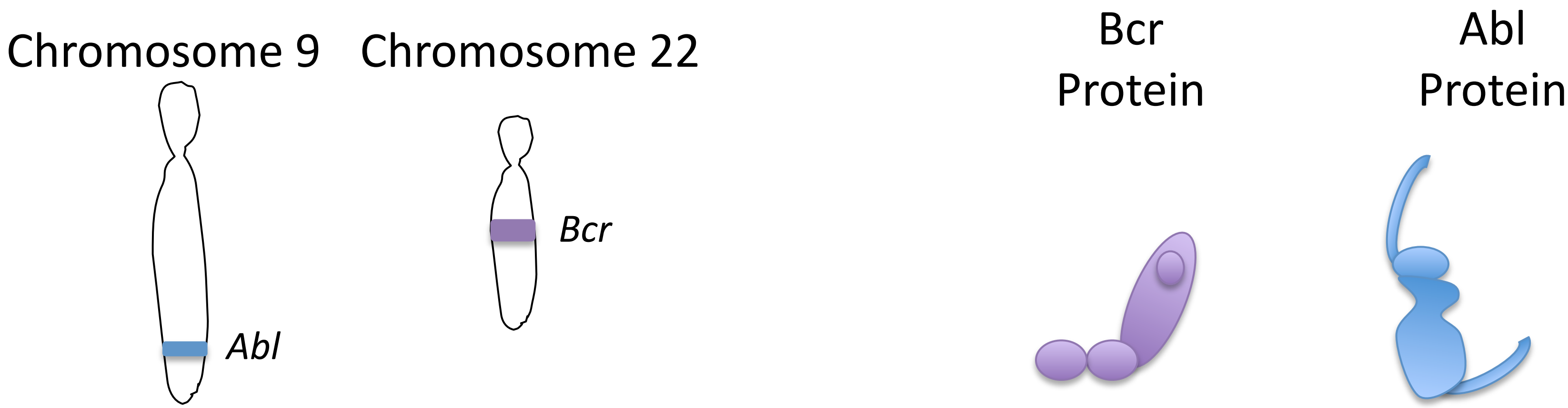


If a translocation occurs between chromosomes 9 & 22...

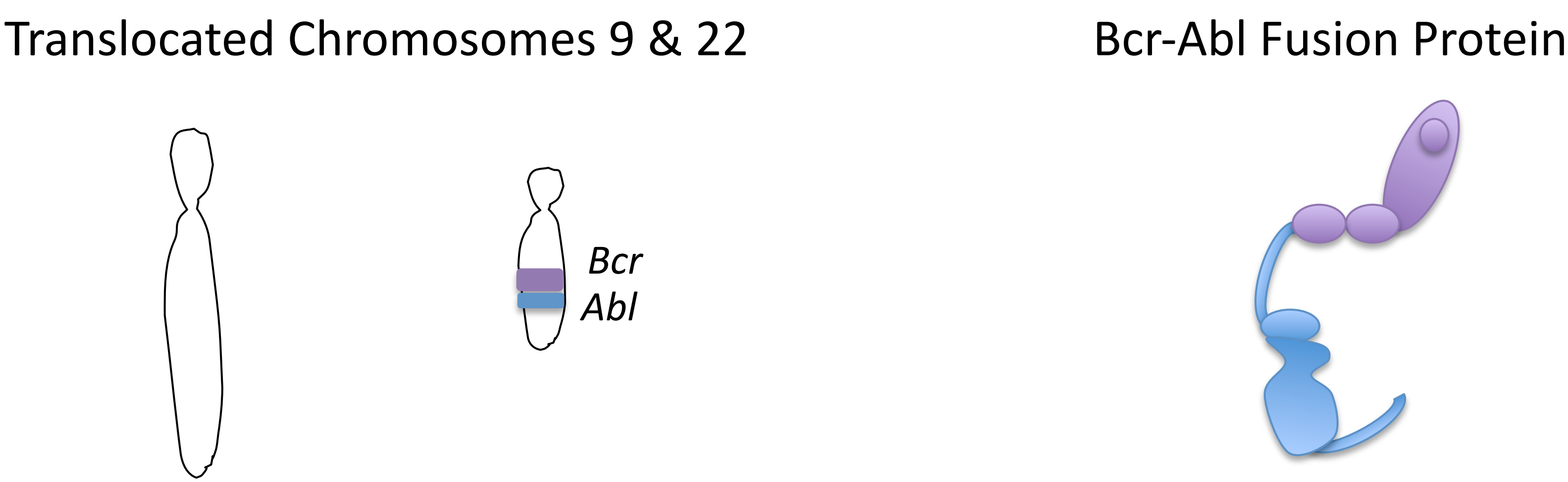
Draw what the Bcr & Abl genes would look like in a "CML" cancer cell.

Draw what the Bcr-Abl fusion protein would look like in a "CML" cancer cell.

Normal cells with no translocation:



CML cancer cells with a translocation:



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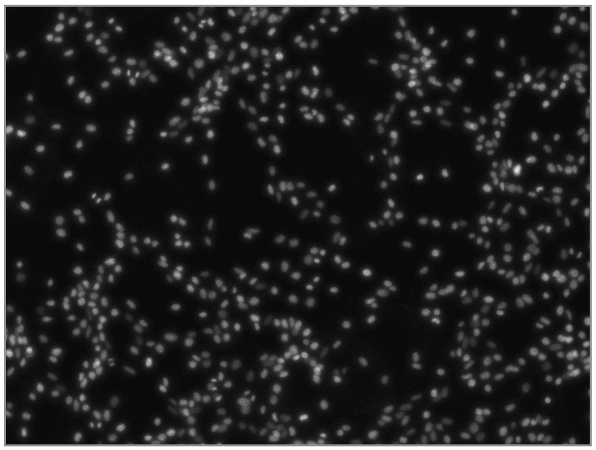
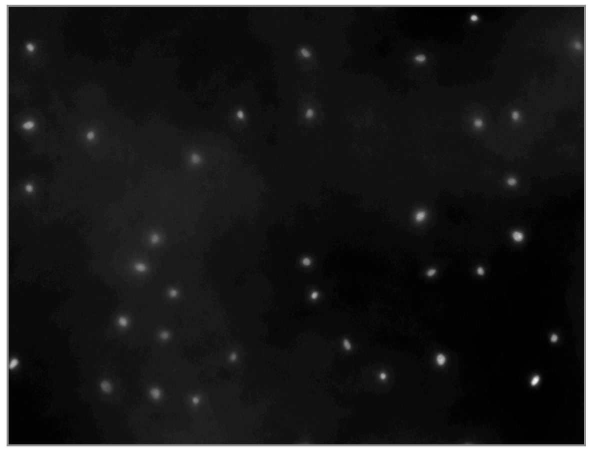
Background for this experiment:
Cancer cell samples have been treated with a negative control, a positive control, and a promising new anti-cancer drug "Chemical A." The DNA in the cells has been stained, so that each nucleus appears as a bright spot. Photographs of the cells were taken and are shown here.

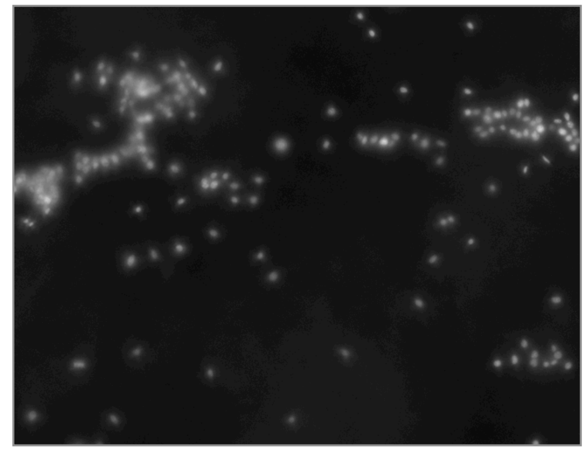
negative control



positive control



promising new anti-cancer drug "Chemical A"



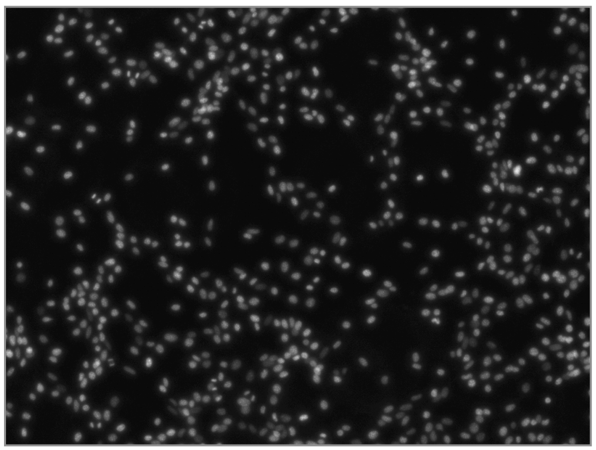
1) What does it mean about what has happened to the cancer cells, when there are lots of bright dots in an image (versus very few bright dots)?

2) How and why would cancer researchers conclude from these photos that "Chemical A" is indeed a promising new anti-cancer drug?

3) What do you think might have been used as a positive control and a negative control in this experiment? Explain your answer.

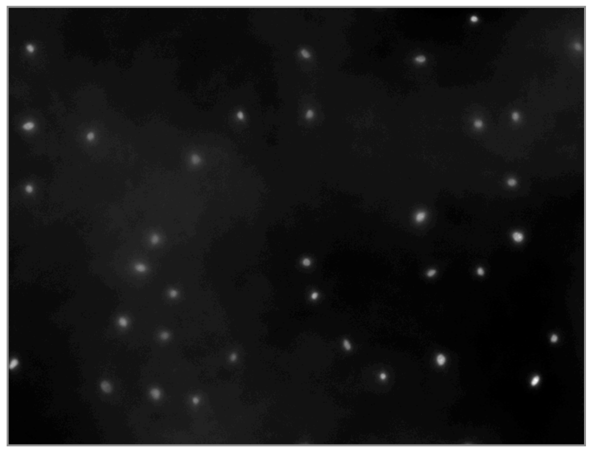
Photos of cancer cells treated with:

a negative control



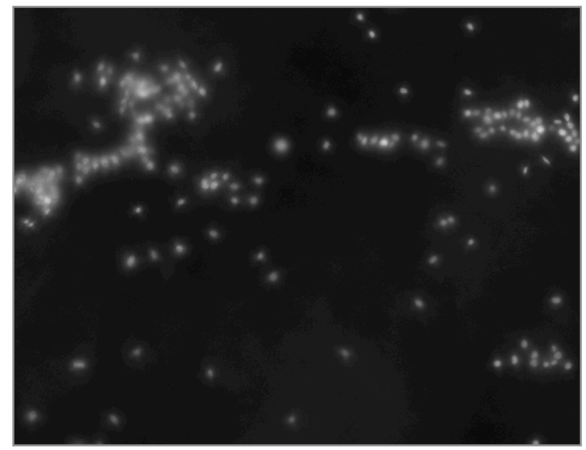
Many cancer cells are alive.

a positive control



Few cancer cells are alive.

a promising new anti-cancer drug "Chemical A"



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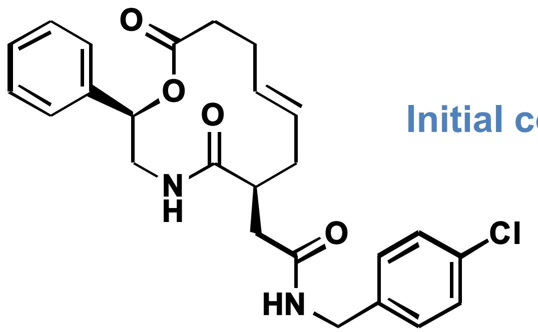
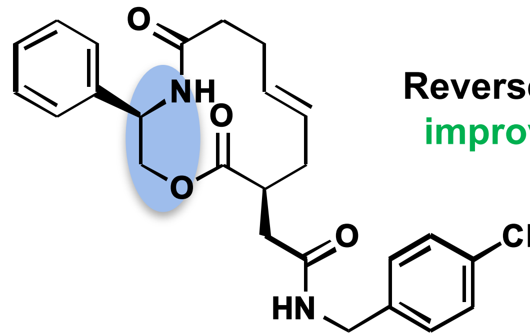


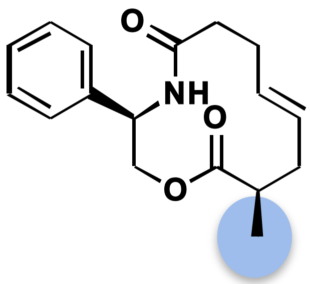
Initial compound



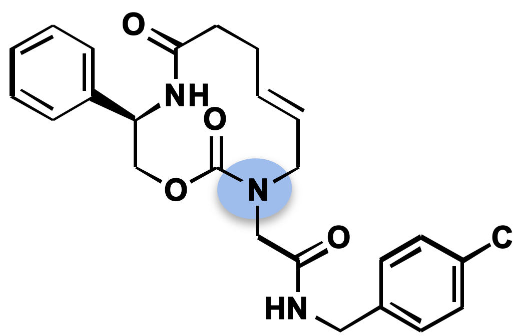
Reverse the atoms =
improved potency

or

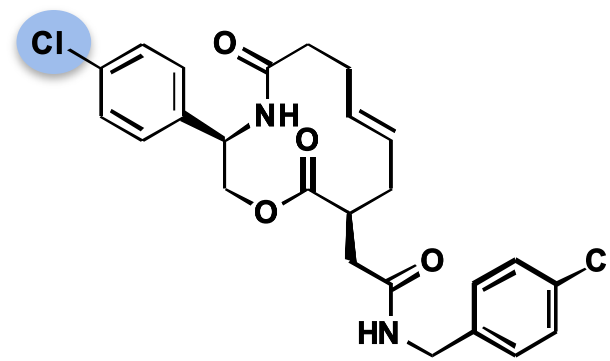
or



Remove lower region =
improved solubility
but lower potency



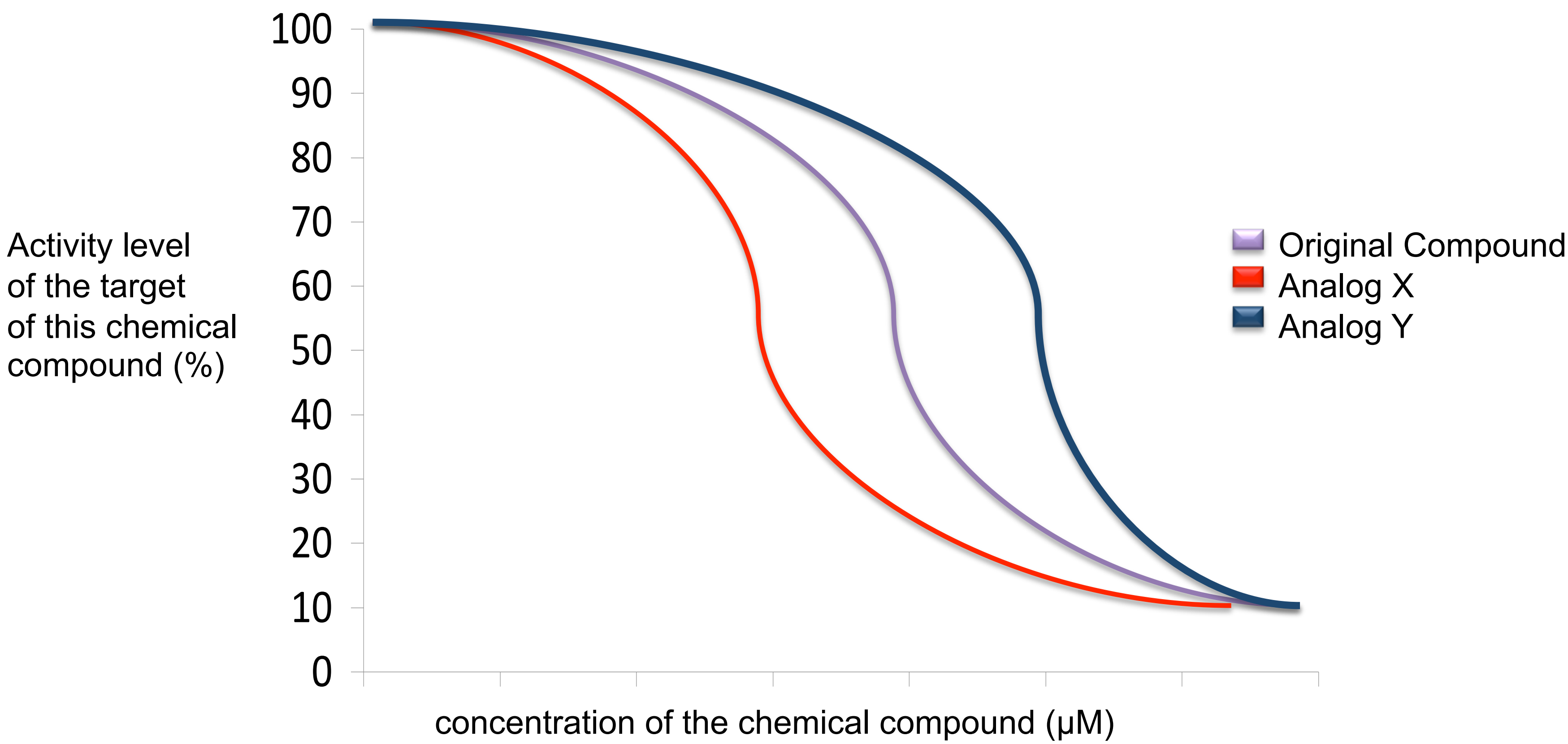
Add nitrogen =
improved stability
but lower potency



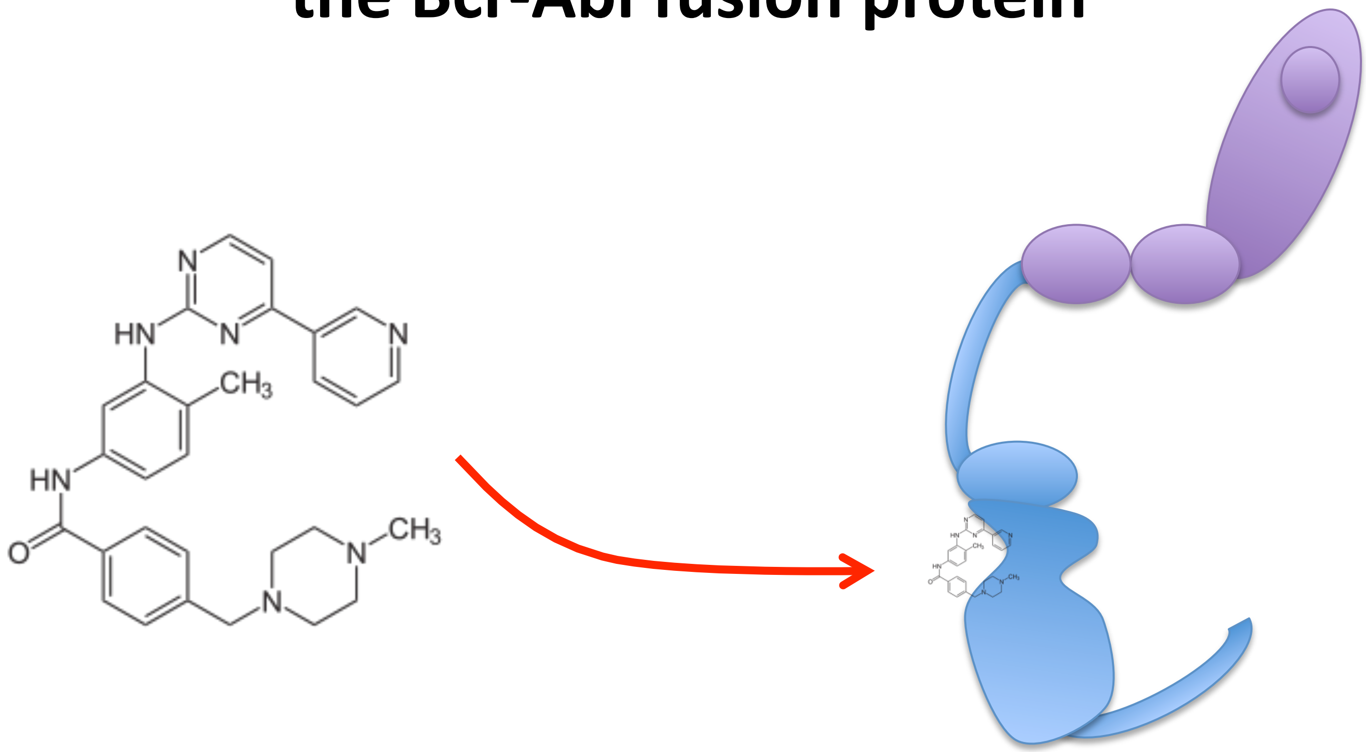
Add chlorine =
even better potency!

This graph is called a "dose response curve," and it shows the amount that a chemical compound inhibits the activity of the cell/protein that it targets.

Which of these three chemical compounds is the most potent?



The chemical compound "Gleevec" binds to & inhibits the Bcr-Abl fusion protein



BCR-Abl

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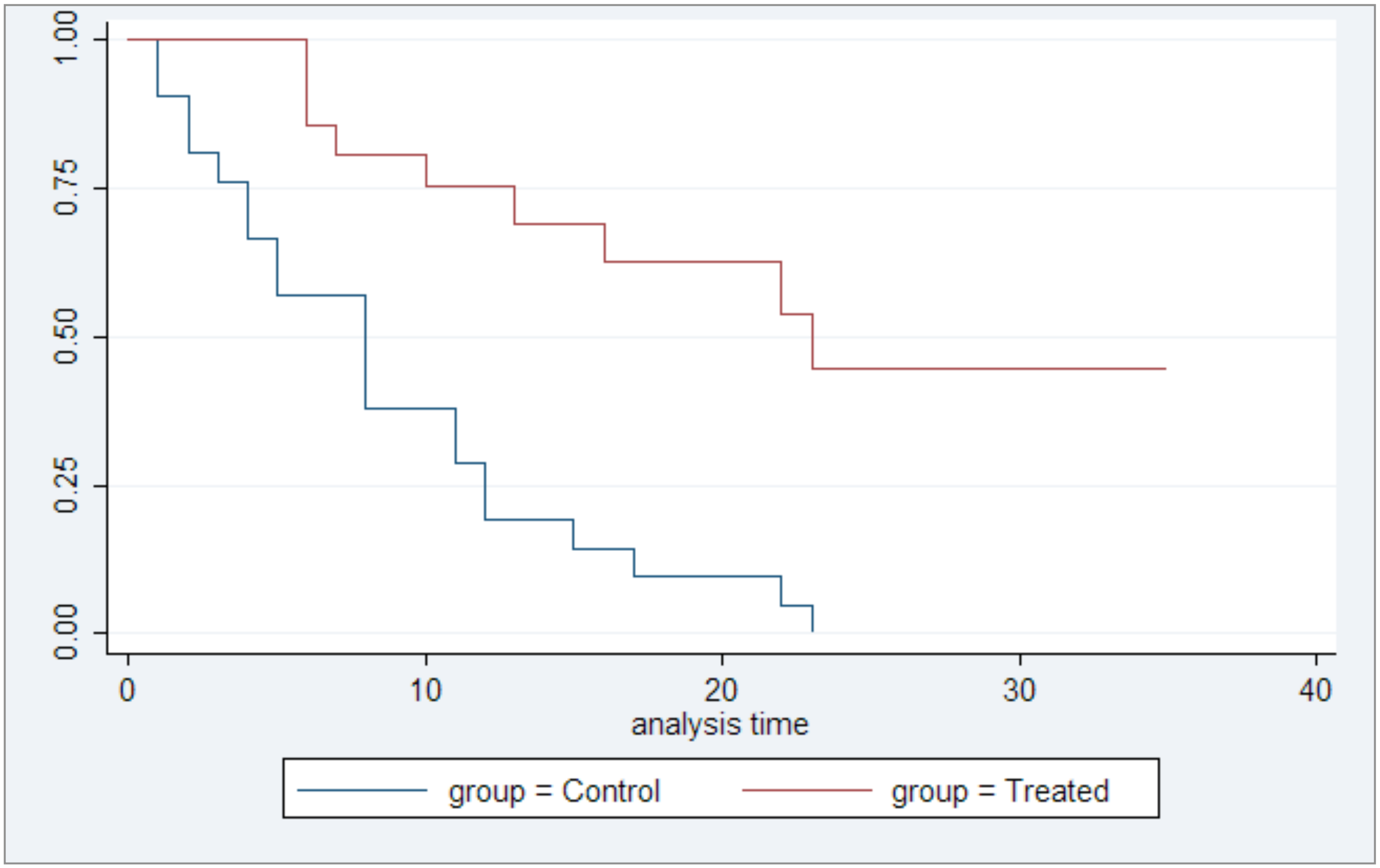
A clinical trial shows us how well patients respond to a new treatment



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Evolution of drug resistance in cancer cells can occur because of changes in the protein target of the drug