Understanding the development of cancer for pesticide applicators and handlers

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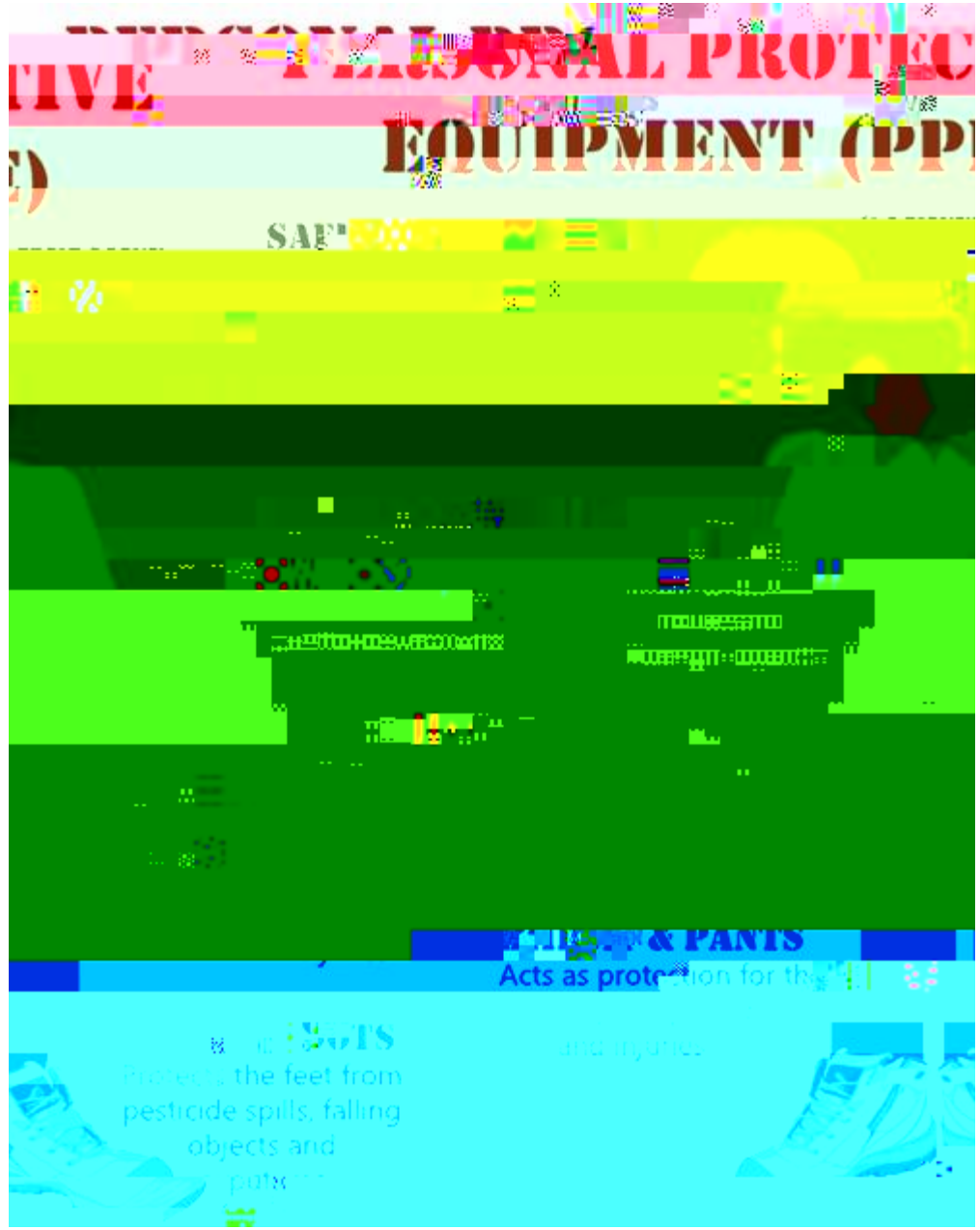
Board of Pesticides Control

Maine Department Agriculture, Conservation, & Forestry

Commercial Pesticide Applicator Meeting for Field and Forages

Middlebury American Legion

April 5, 2019


EQUIPMENT (PP
& PANTS
Acts as prote
the feet from
pesticide spills, falling
objects and

Why talk about cancer?

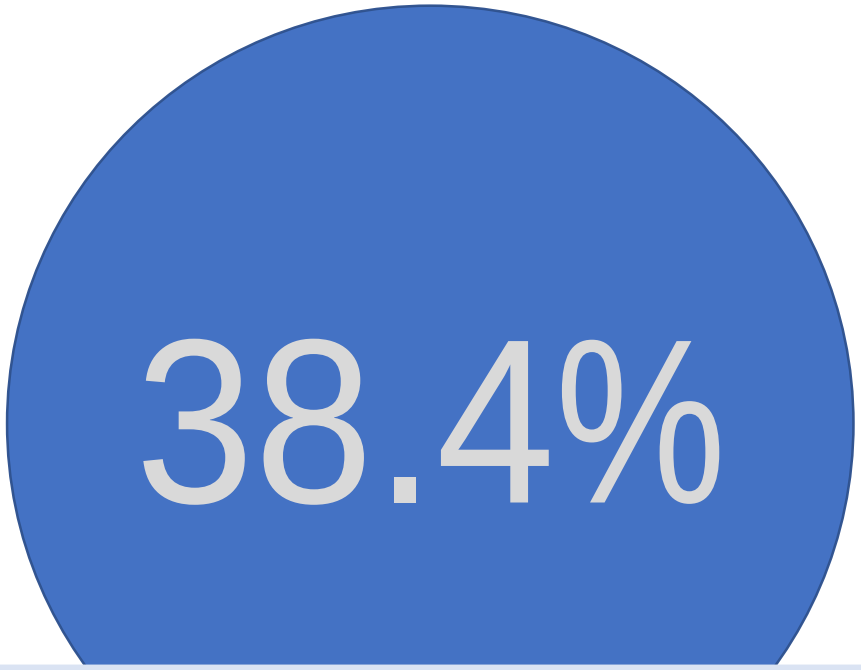
- Cancer is not the only concern with pesticide exposure!

- I've been asked to speak about glyphosate recently
    - Highlighted some basic misunderstandings about cancer

- Also, ...

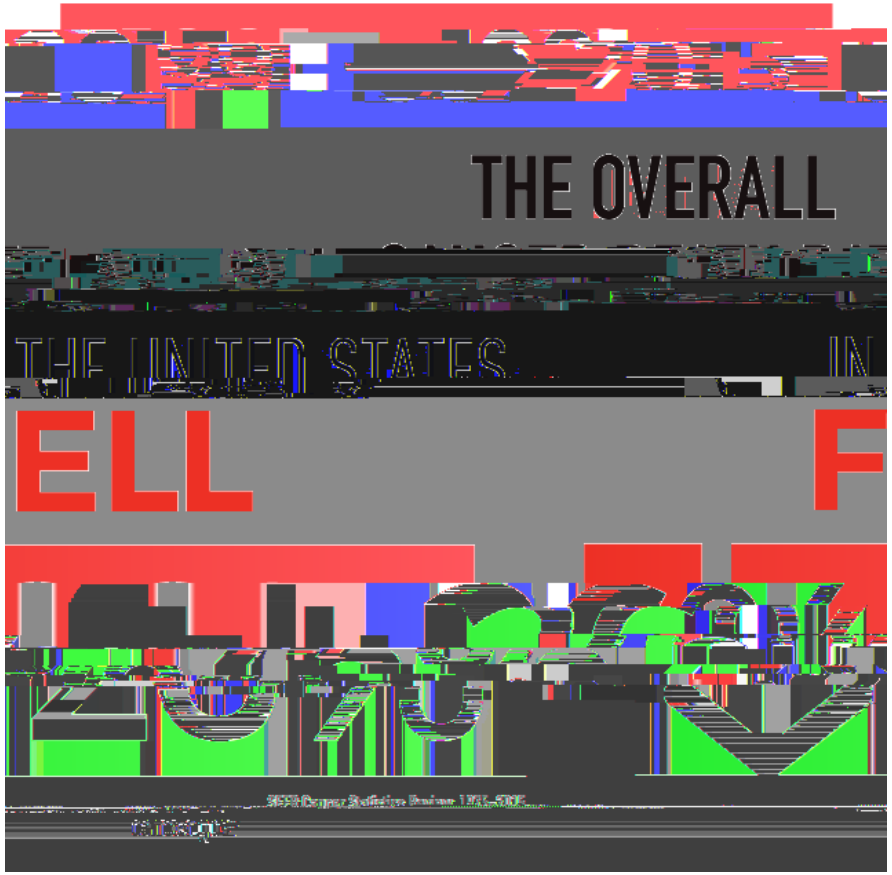
Why talk about cancer?

... because it affects nearly everybody either directly or indirectly

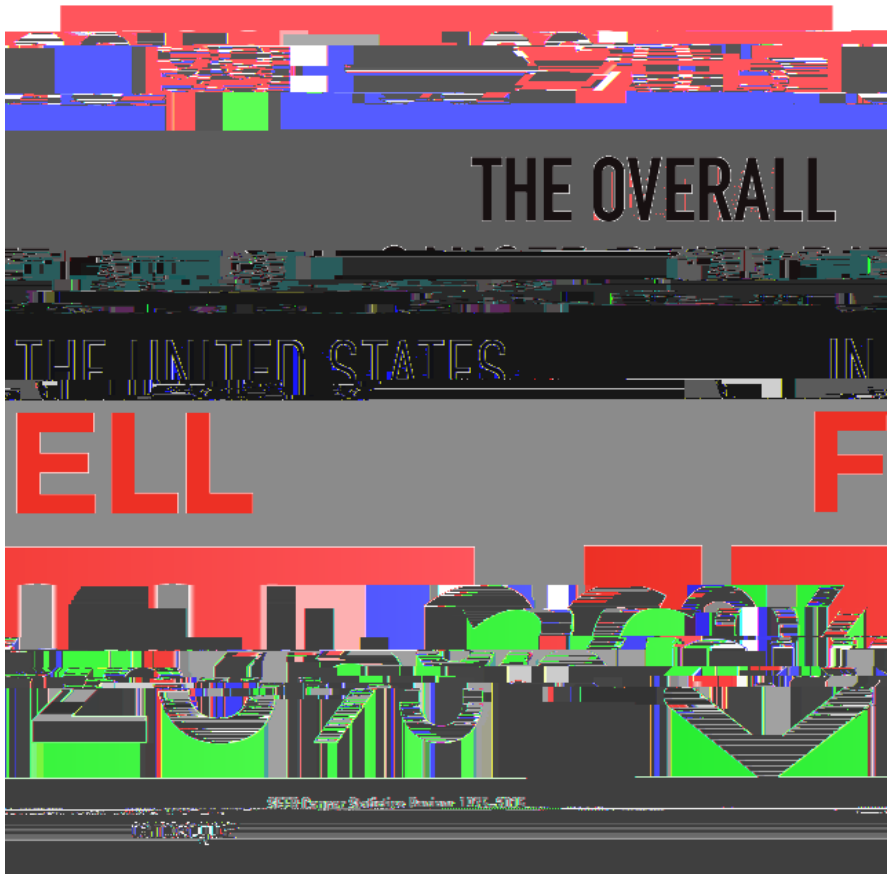


Of all men and women in the US will receive a cancer diagnosis at some point in their lives.

In the US, the lifetime risk of developing cancer is



Note: this is death rate not incidence rate.



Note: this is death rate not incidence rate.

NIH’s cancer-

- Constantly exposed to carcinogens in our ideal diet
  - Estimated we consume 1.5 grams of pesticide daily
  - These are naturally occurring plant protectants
  - Only a few (< 100) tested but ~50% of them are mutagens

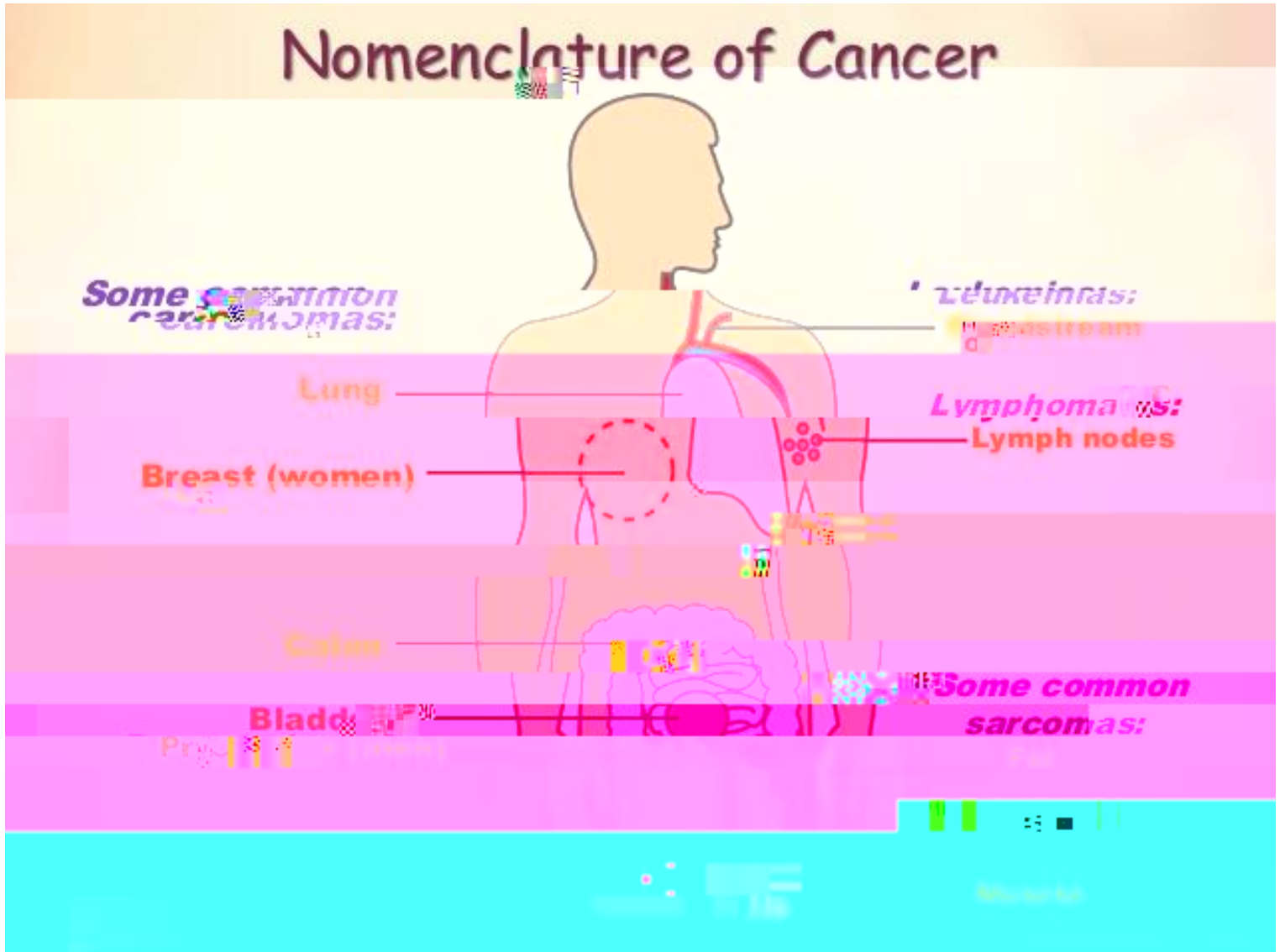
- Begs the question:

- Reality is that our body is full of mechanisms that prevent cancer.
- The development of a metastatic aggressive cancer is the result of failures at multiple levels throughout the development of cancer.
  - It takes many ‘hits’ to set cancer development in motion

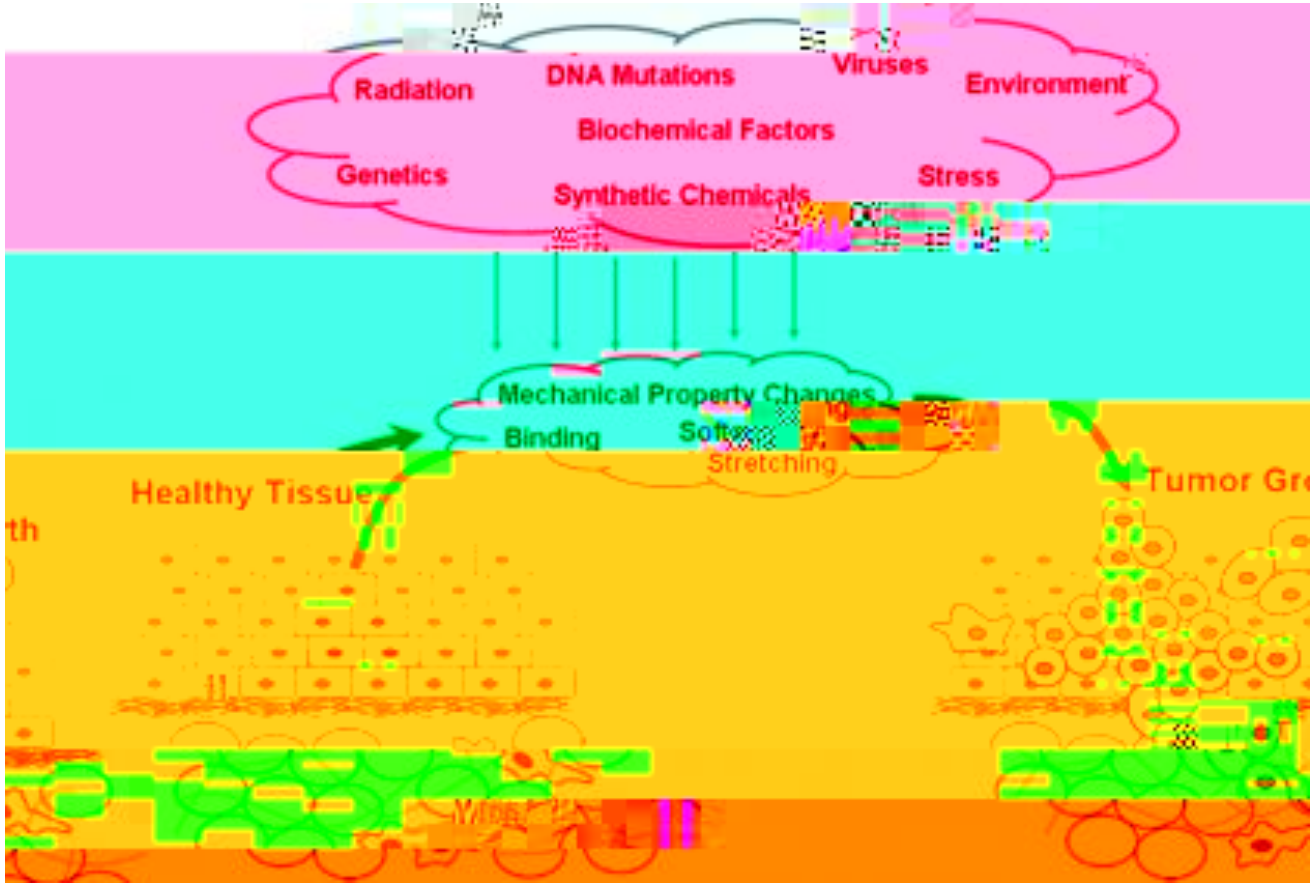
- Reality is that our body is full of mechanisms that prevent cancer.
- The development of a metastatic aggressive cancer is the result of failures at multiple levels throughout the development of cancer.
  - It takes many ‘hits’ to set cancer development in motion

This is a reason why applicators are more at risk than the general population. Applicators have repeat exposures over long periods of time.

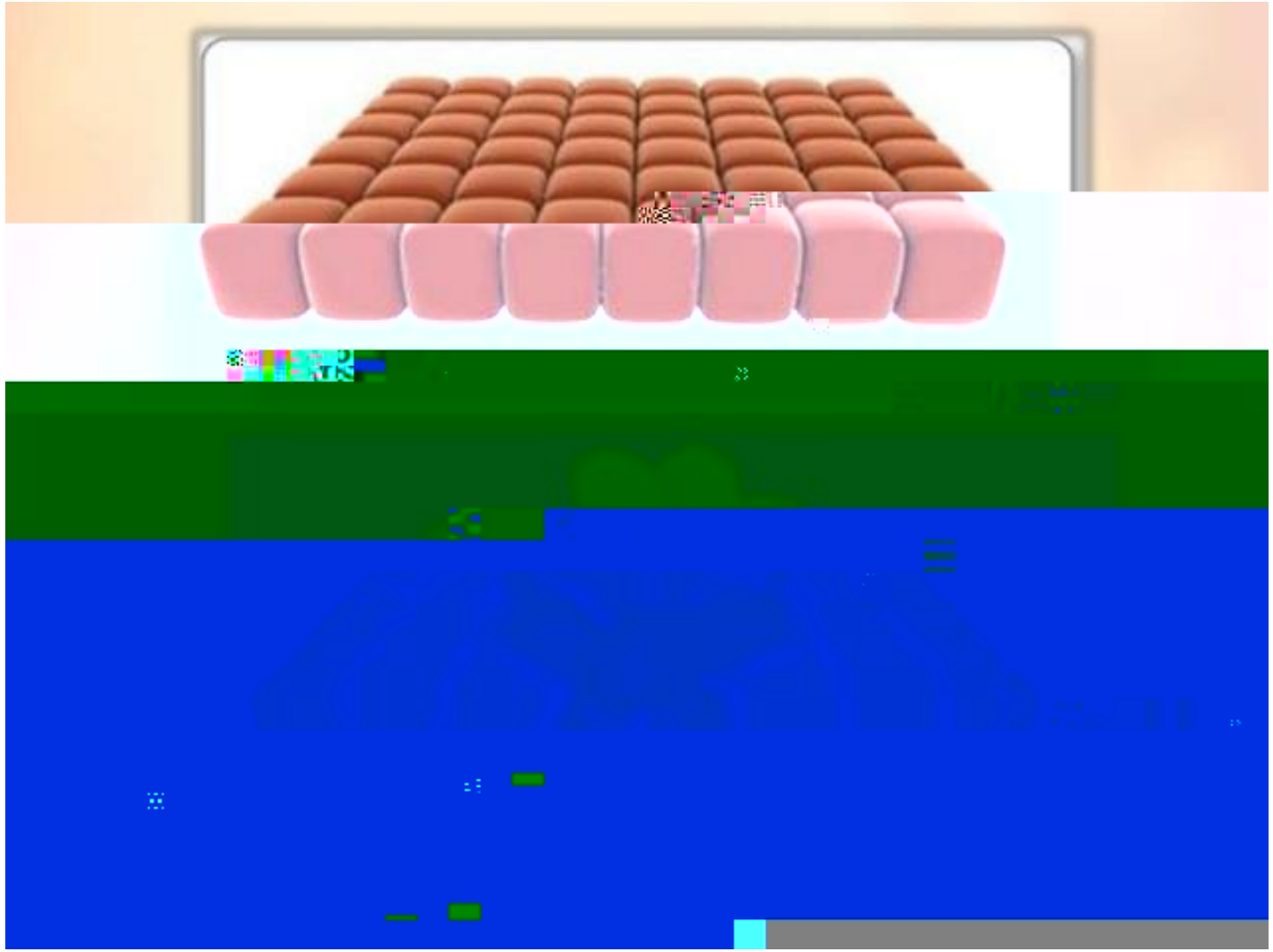
Nomenclature of Cancer



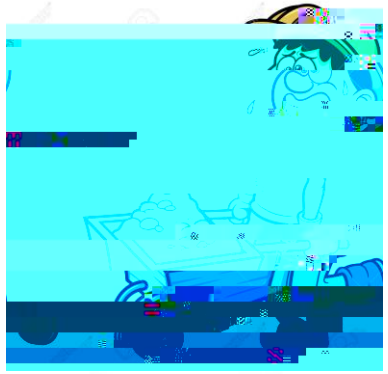
Tumors are what we typically think of when we think of cancer.

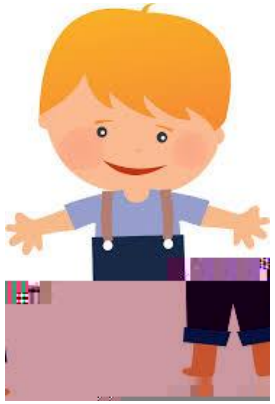


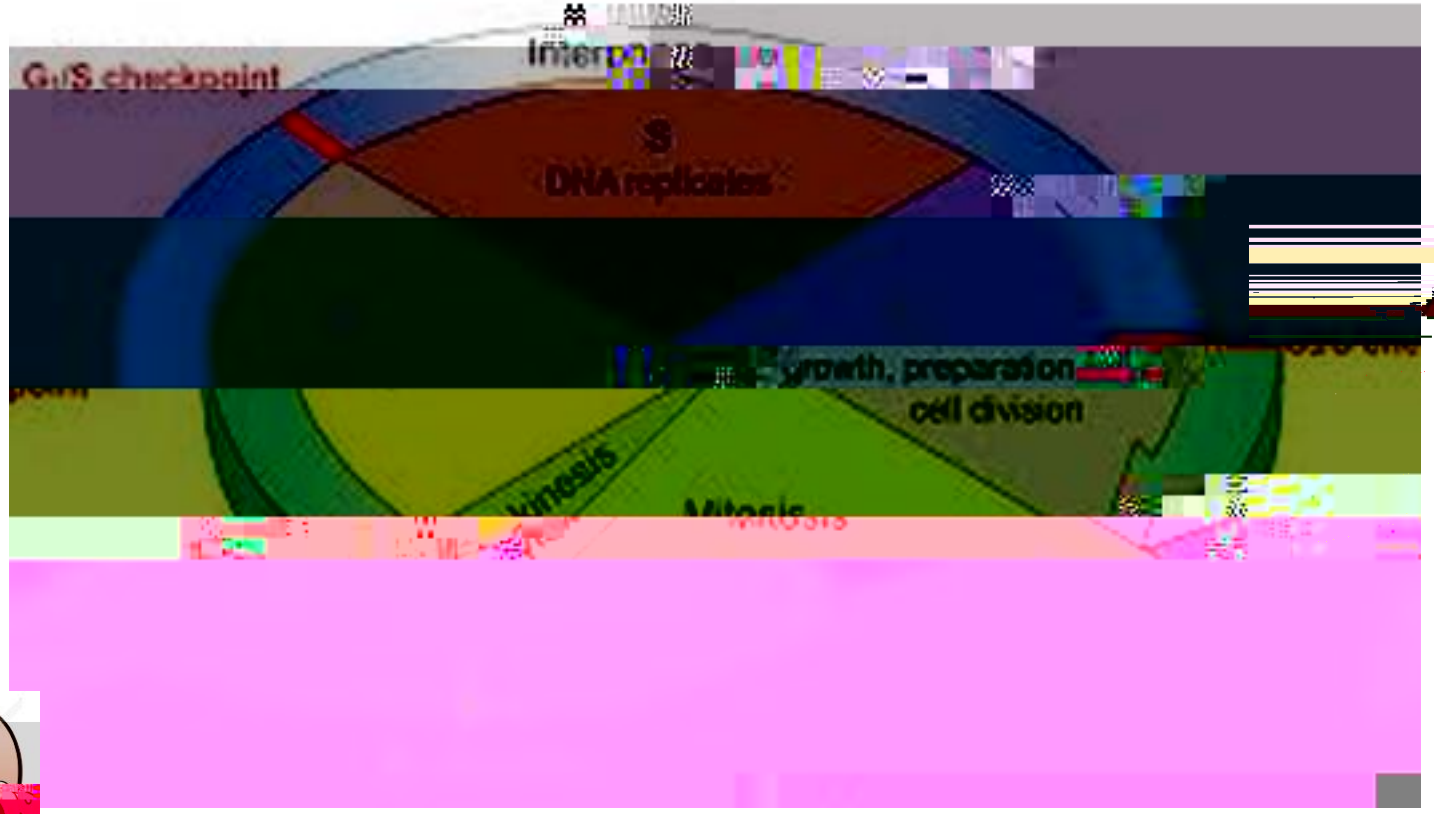
https://www.bu.edu/eng/2013/04/24/computer-simulations-suggest-new-pathways-for-cancer-progression/

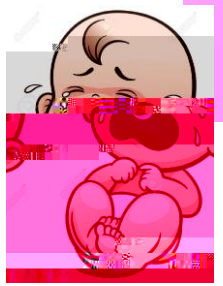


So, on to the details









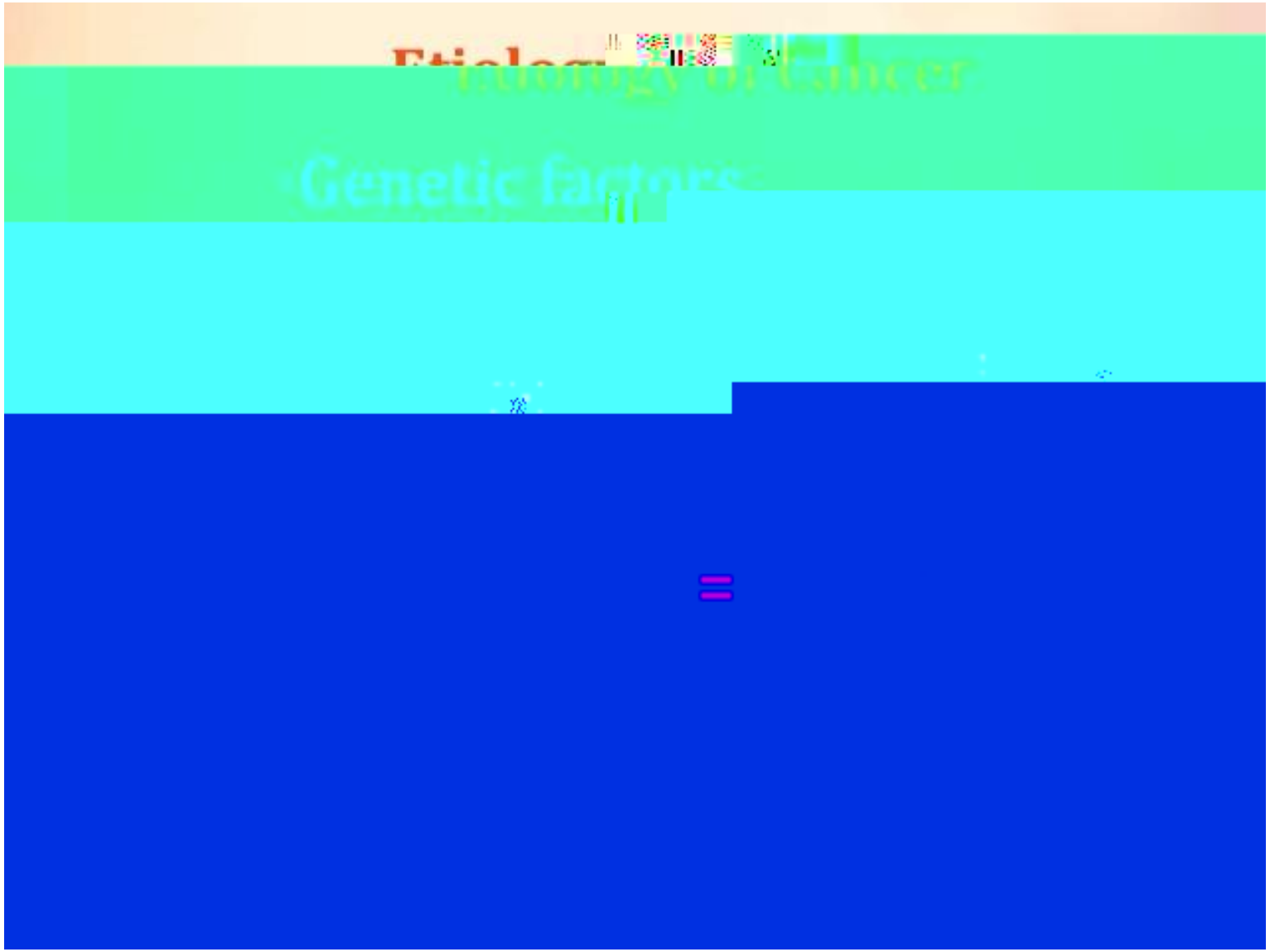
https://radiationtherapycompany.weebly.com/biochemical-pathway.html

Loss of Normal Growth Control

Stages of cancer development

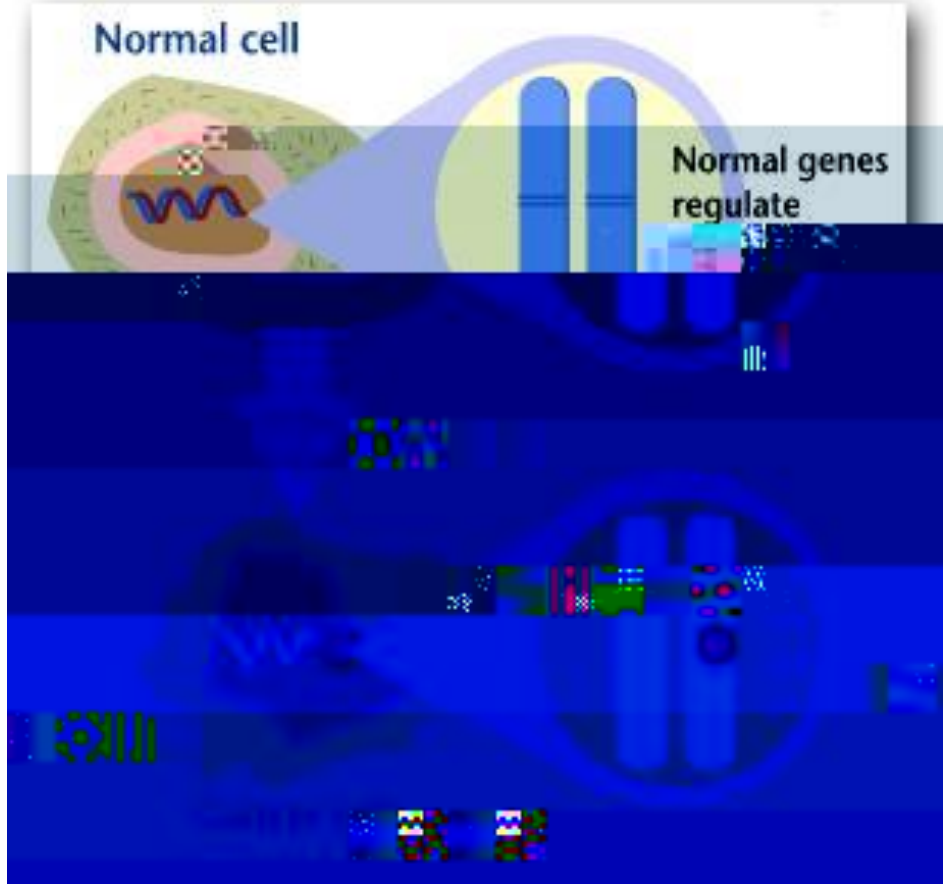
- Stage 0 means there's no cancer, only abnormal cells with the potential to become cancer.
- Stage I means the cancer is small and only in one area. This is also called early-stage cancer.
- Stage II and III mean the cancer is larger and has grown into nearby tissues or lymph nodes.
- Stage IV means the cancer has spread to other parts of your body. It's also called advanced or metastatic cancer.

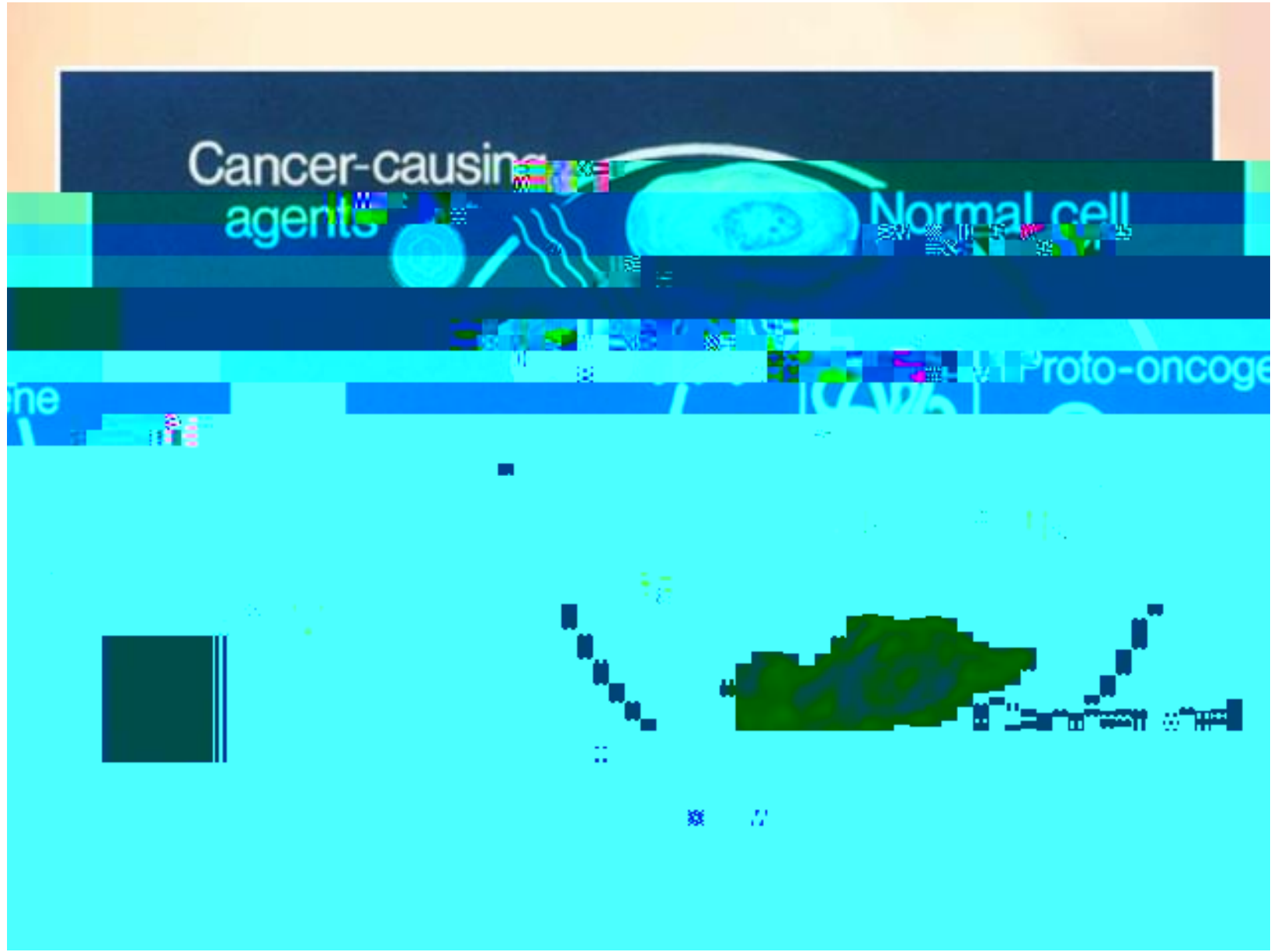
Stages of cancer development

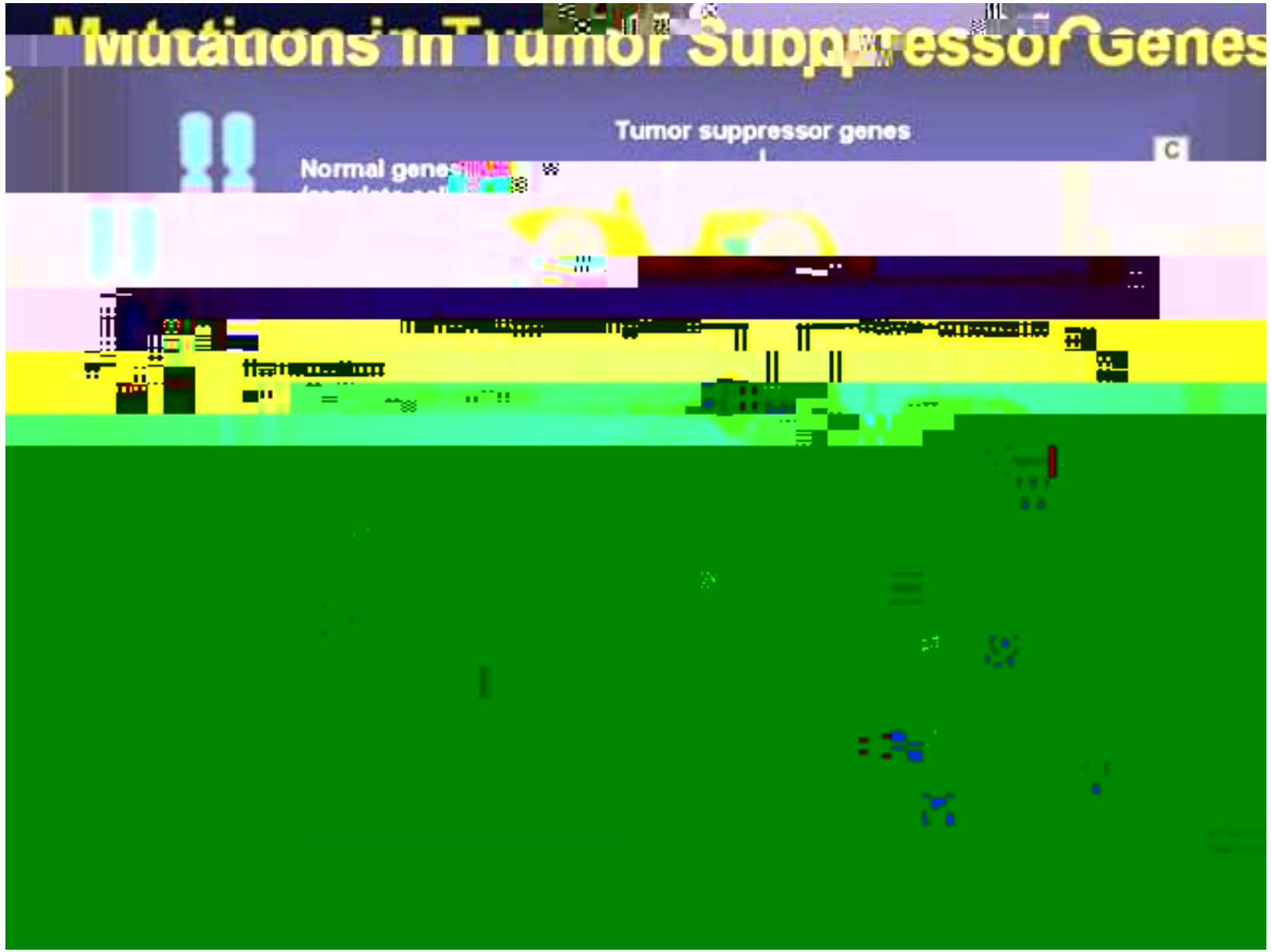

Etiology of Cancer
Genetic factors
=

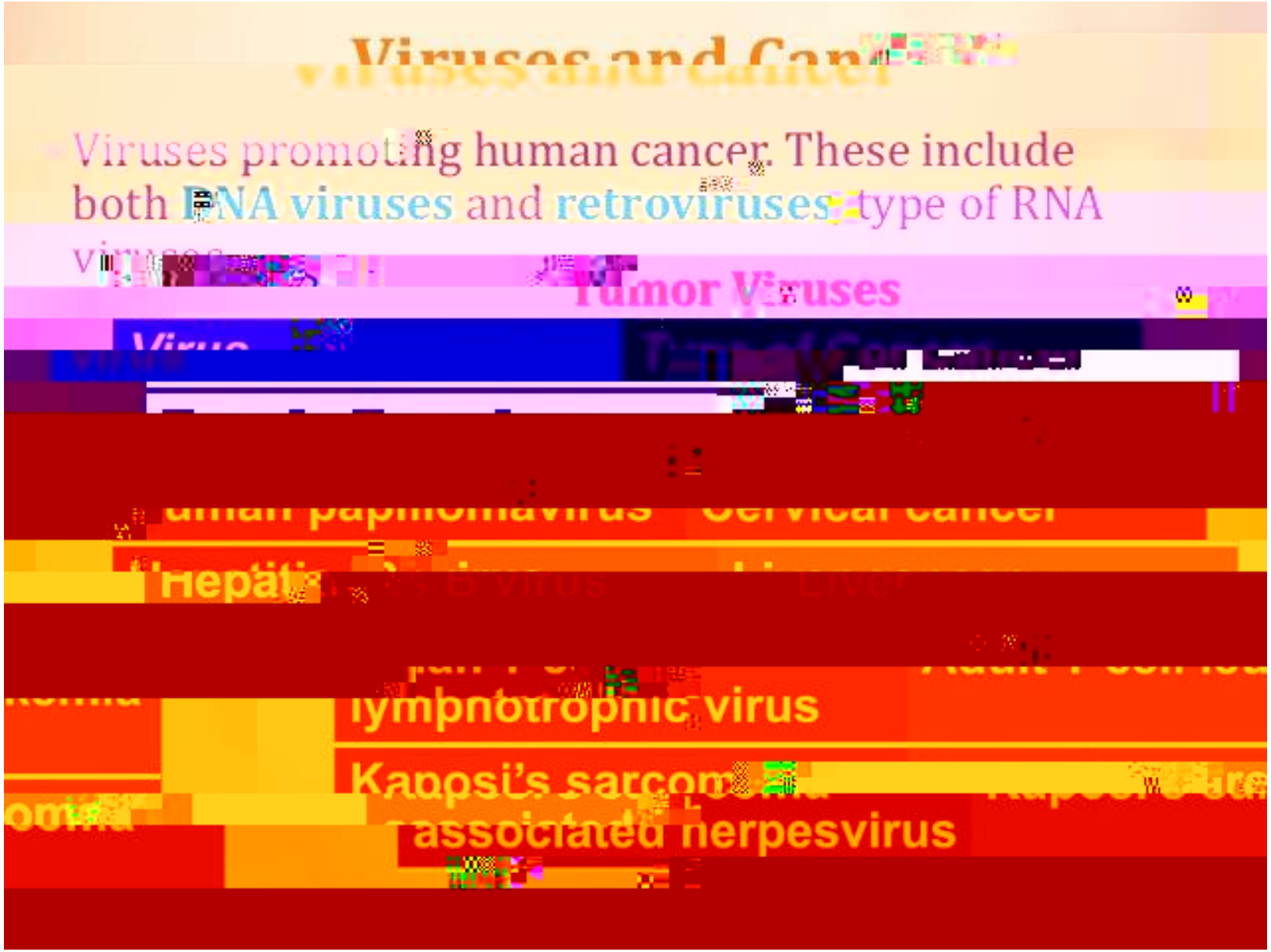
Genes involved with cancer

- Oncogenes: genes that promote cancer
- Proto-oncogenes: normal gene before mutations
- Tumor suppressor genes: genes that normally restrain cell growth but can break
- Mutator /DNA repair genes: normally fix broken DNA but can break



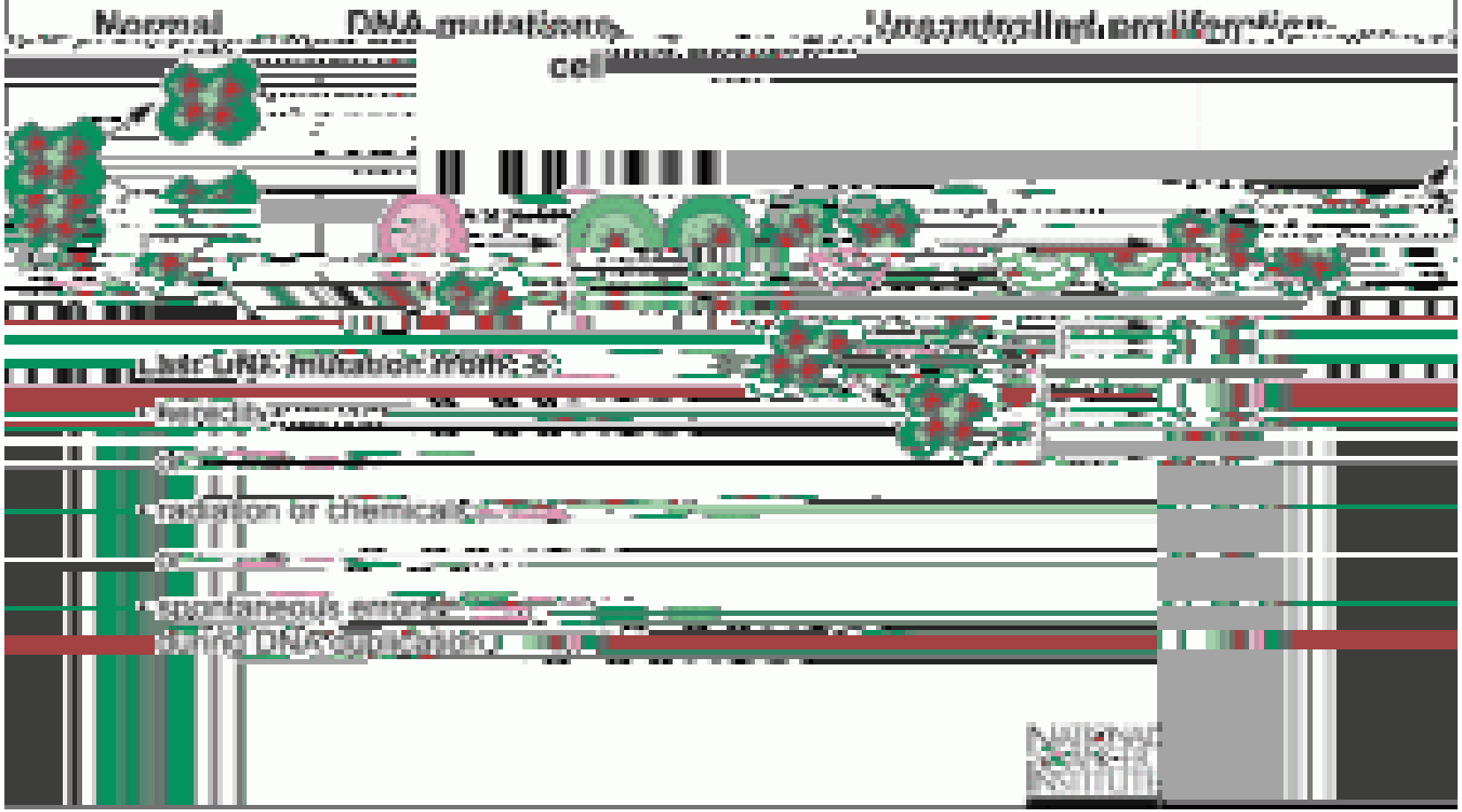

Cancer-causing
agents
Normal cell
Proto-oncoge


Mutations in Tumor Suppressor Genes
Tumor suppressor genes
Normal genes
C

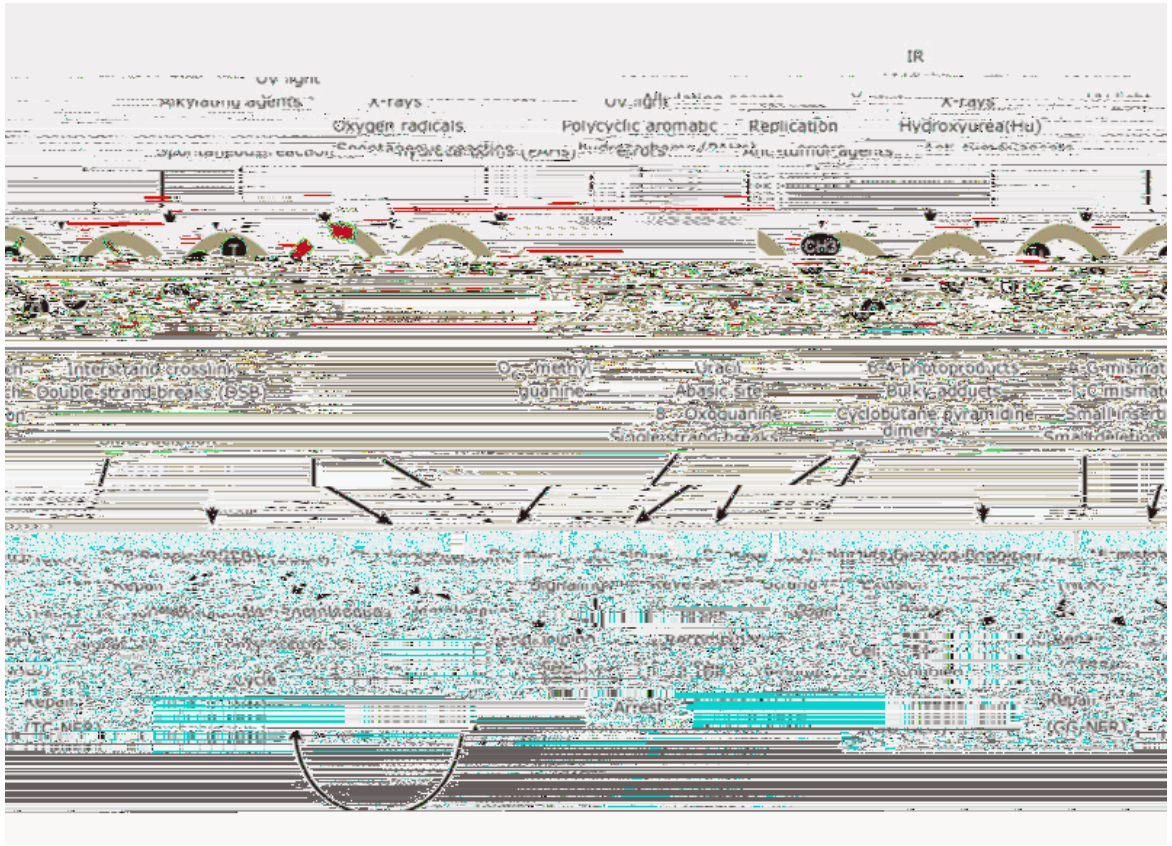

Viruses and Cancer
Viruses promoting human cancer. These include both DNA viruses and retroviruses, a type of RNA
Tumor Viruses
Virus
Cervical cancer
Hepatitis B virus
lymphotropic virus
Kaposi's sarcoma
associated herpesvirus


Tobacco Use and Cancer
Some Cancer-Causing Chemicals in Tobacco Smoke
benz[a]anthracene
benz[a]pyrene
benzene
nickel compounds
N-nitrosonornicotine
N-nitrosopiperidine

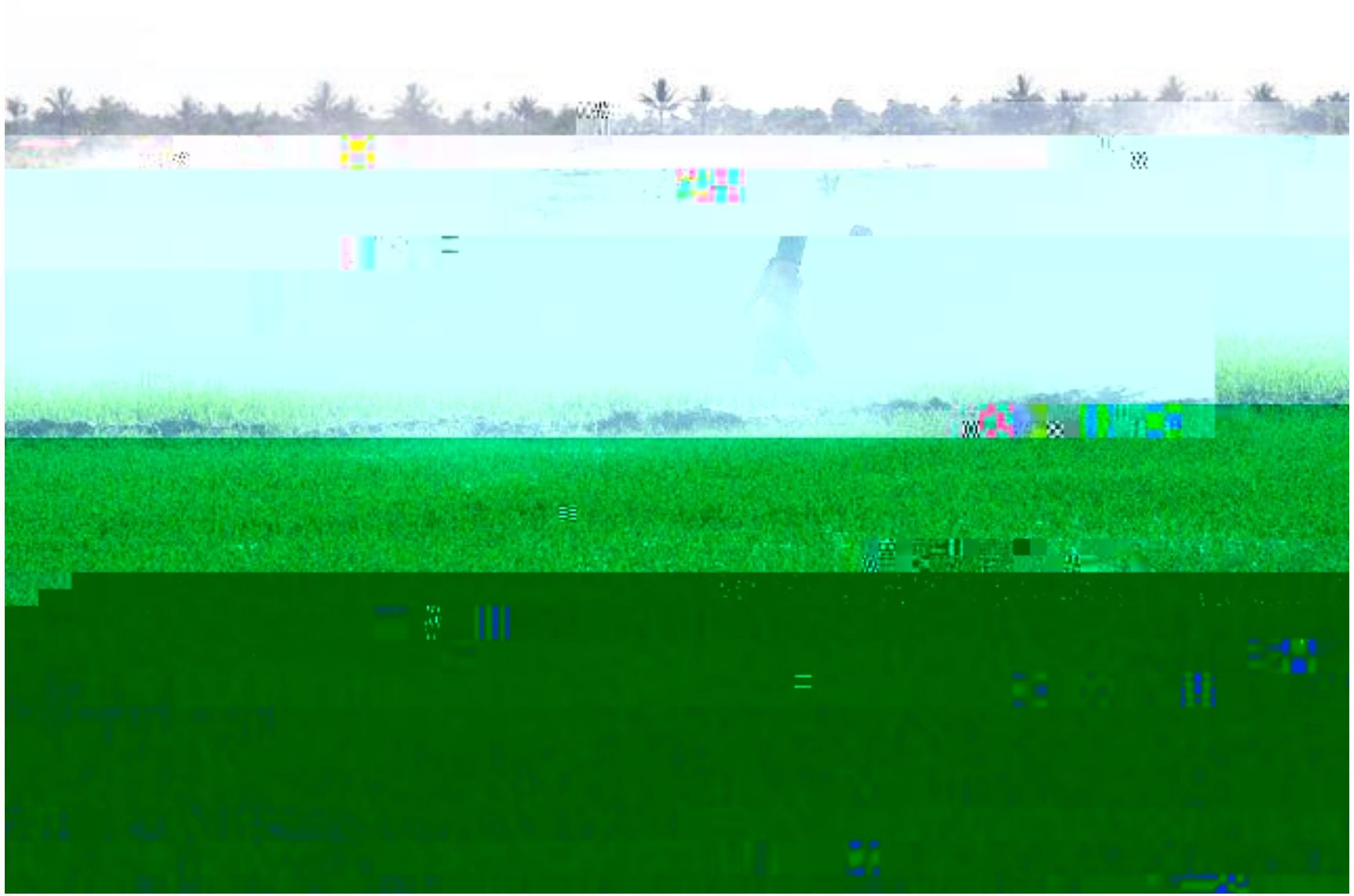
Cancer Arises From DNA Mutations in Cells




5' - end
3' - end
1 spiral coil - 3,4 nm


IR
X-rays
Oxygen radicals
Polycyclic aromatic
Replication
Hydroxyurea(Hu)
Abasic site
Cyclobutane pyrimidine dimers
Arrest

http://bdj.pensoft.net//showimg.php?filename=oo_85929.gifhttp://bdj.pensoft.net//showimg.php?filename=oo_85929.gif



How does EPA classify carcinogenicity of pesticides?

- Carcinogenic to humans.
- Likely to be carcinogenic to humans.
- Suggestive evidence of carcinogenic potential.
- Inadequate information to assess carcinogenic potential.
- Not likely to be carcinogenic to humans.
- Multiple descriptors (differing routes).

(2005)

In our daily lives what causes cancer?

In our daily lives what causes cancer?

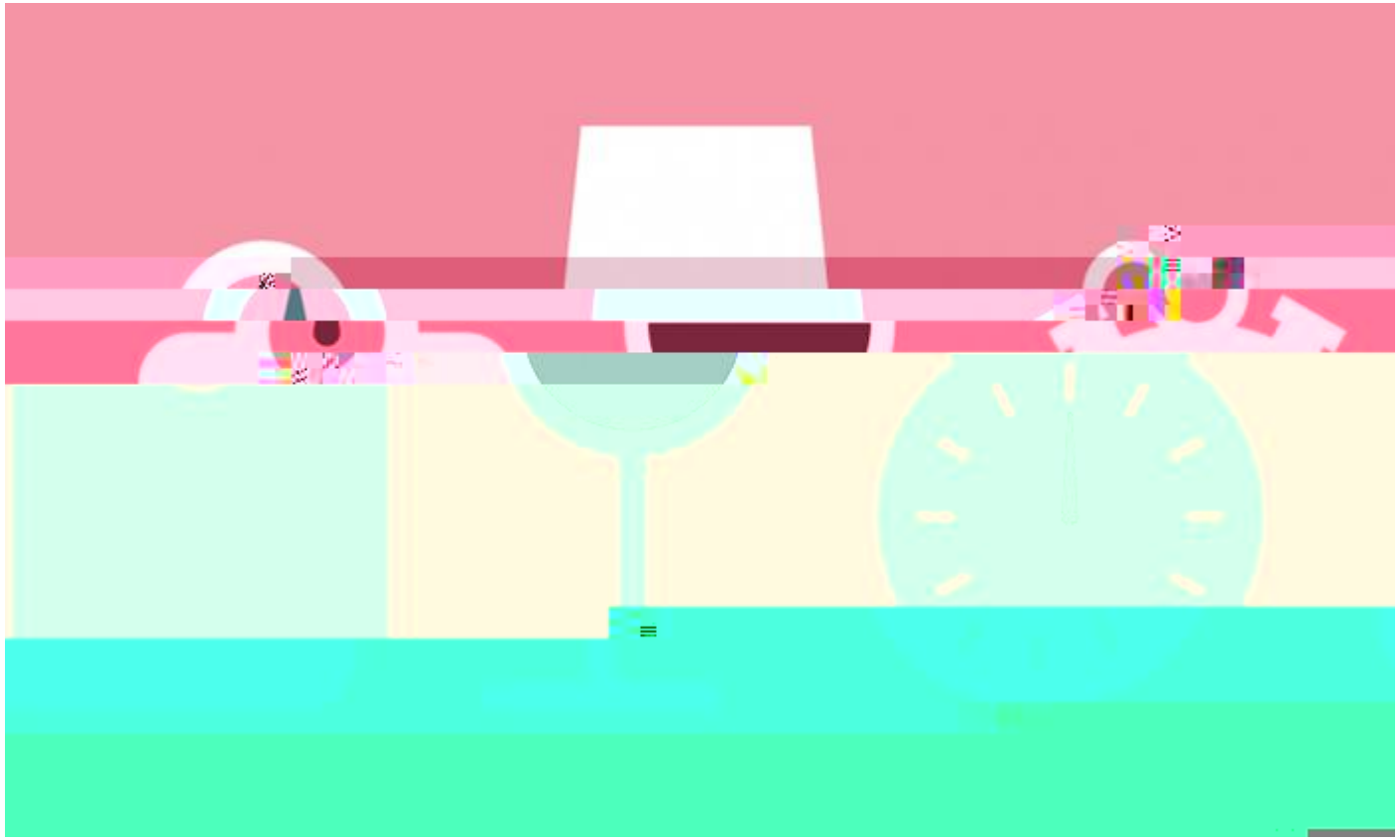
- I’m warning you this answer is really boring.

In our daily lives what causes cancer?

- I’m warning you this answer is really boring.

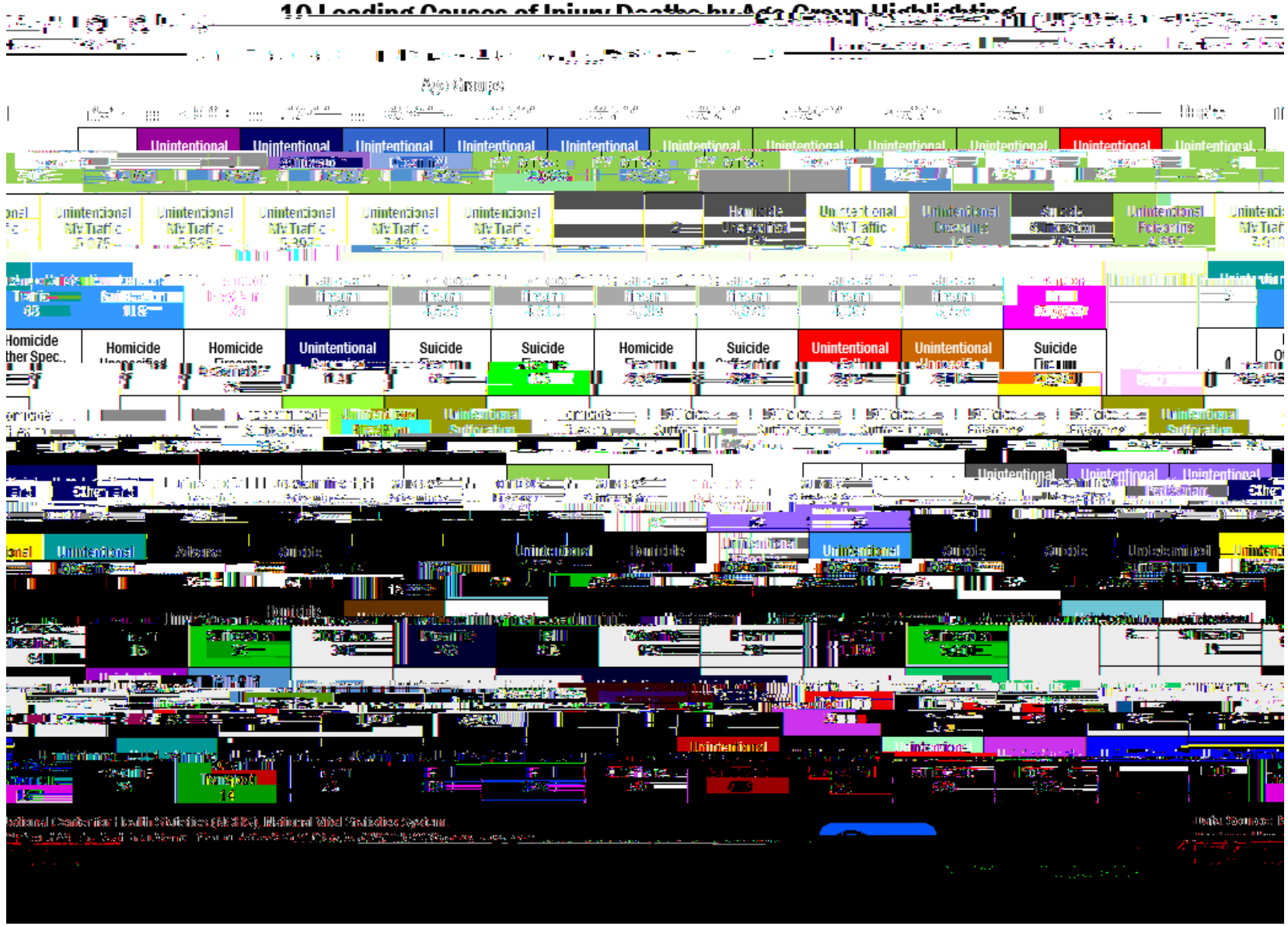
----> Do the things your mother told you to do.

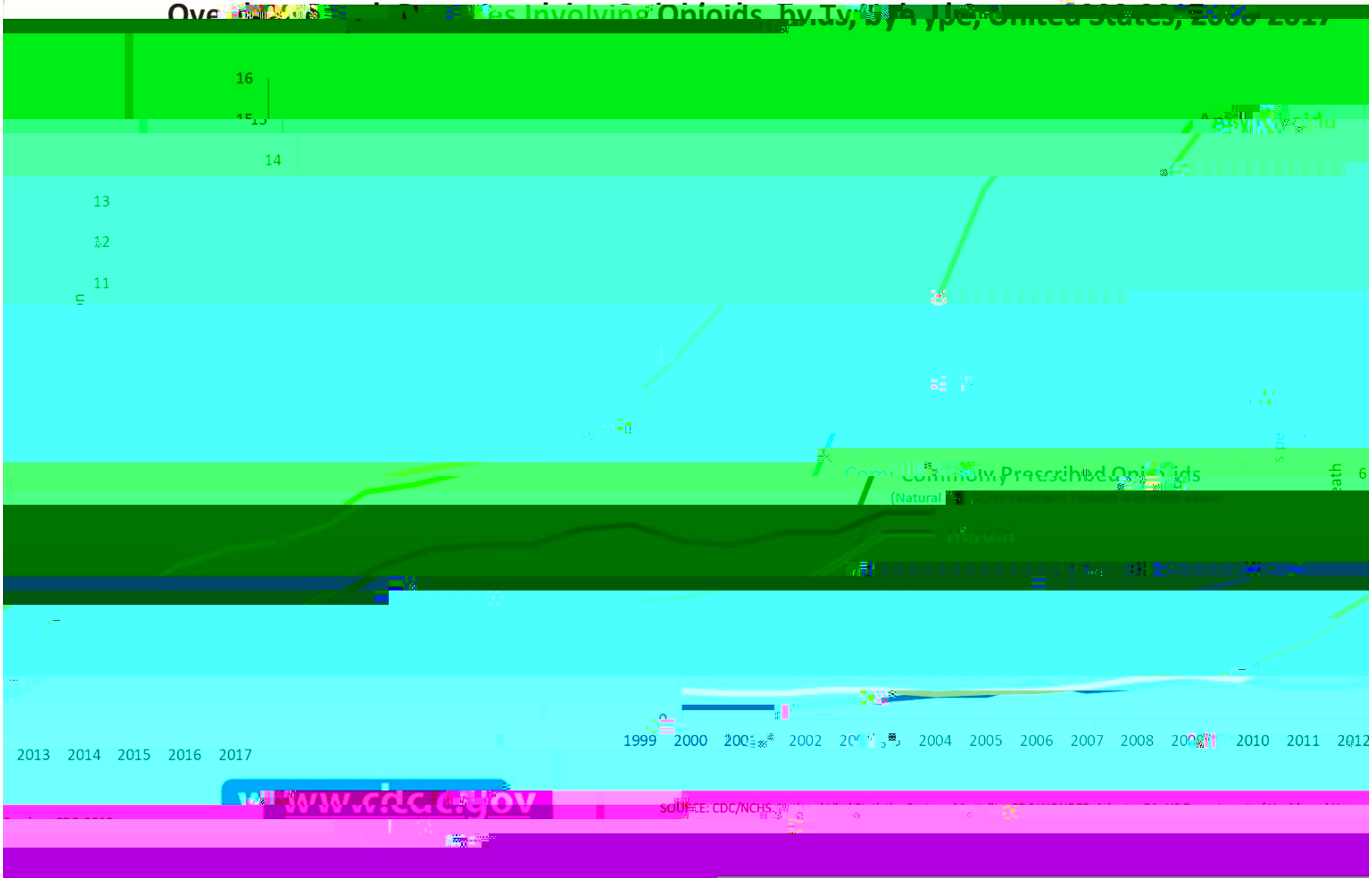
For example: breast cancer




CANCER RESEARCH UK
How many cance
Inactivity
Alcohol
Over-weight
Breast
Low fruit & veg diet


Data Source: National Vital Statistics System, National Center for Health Statistics, CDC.


Unintentional
Homicide
Suicide
Unintentional
Homicide
Suicide
Homicide
Suicide
Unintentional
Unintentional
Suicide


16
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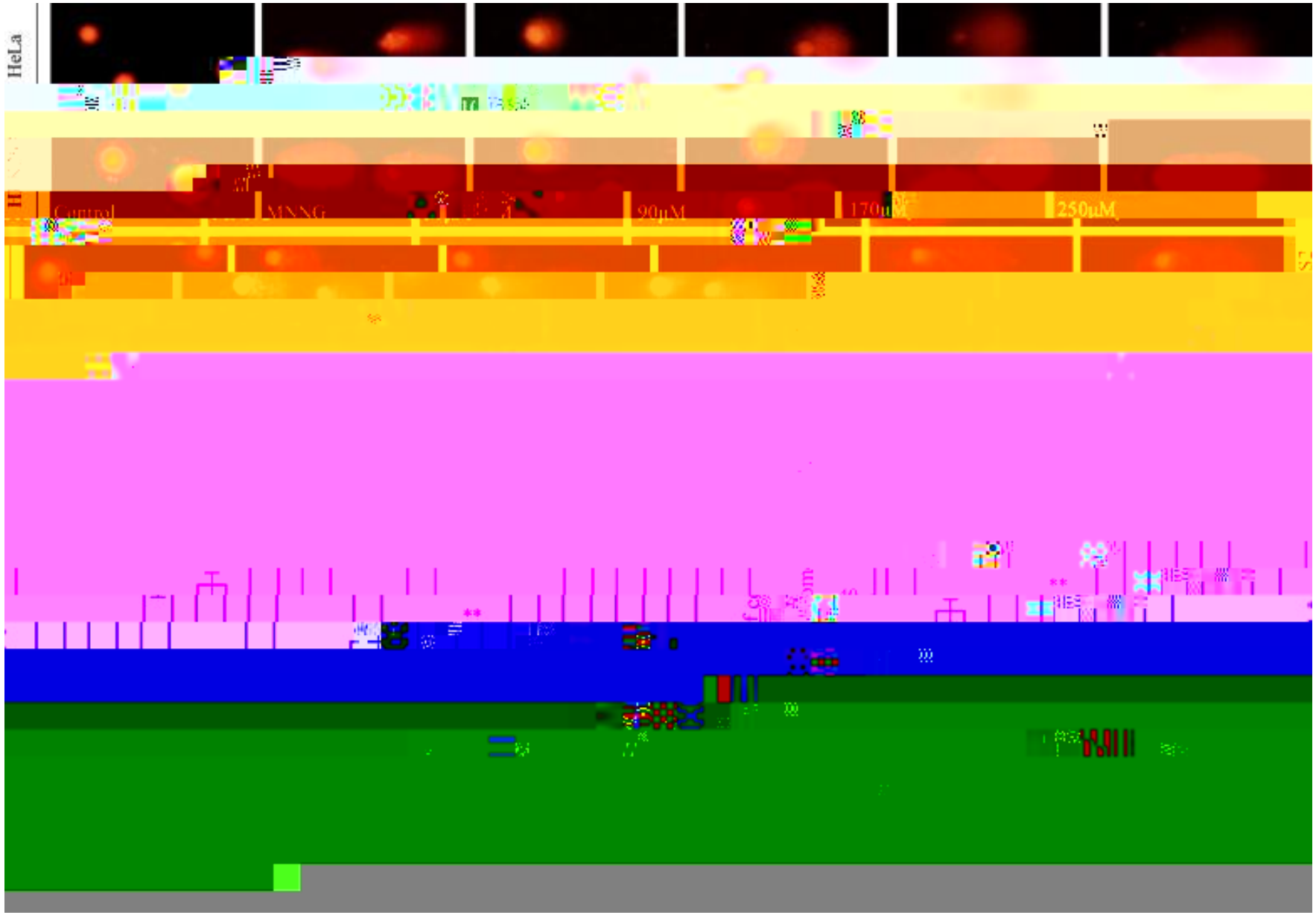
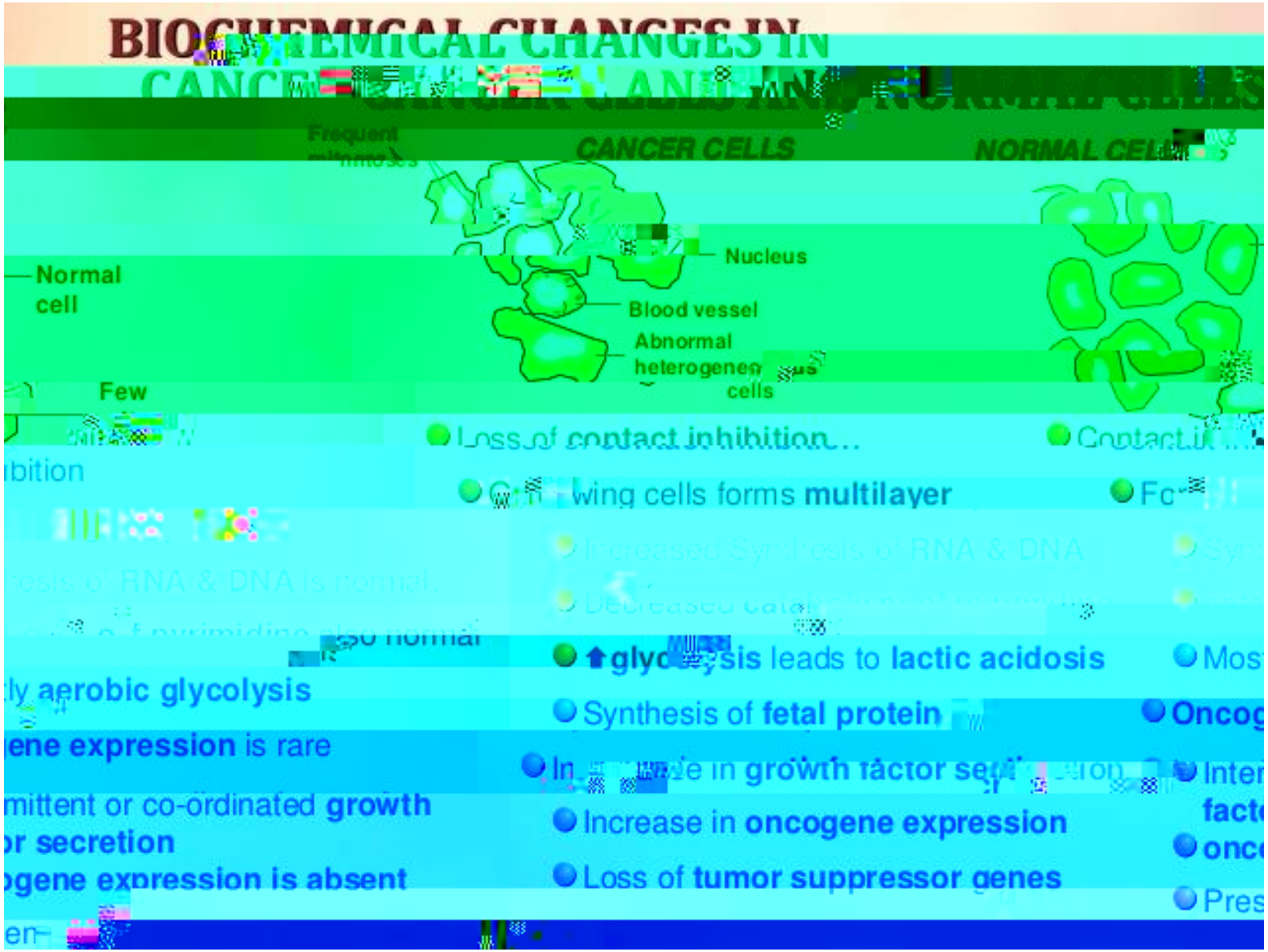
2011
www.cdc.gov
SOURCE: CDC/NCHS

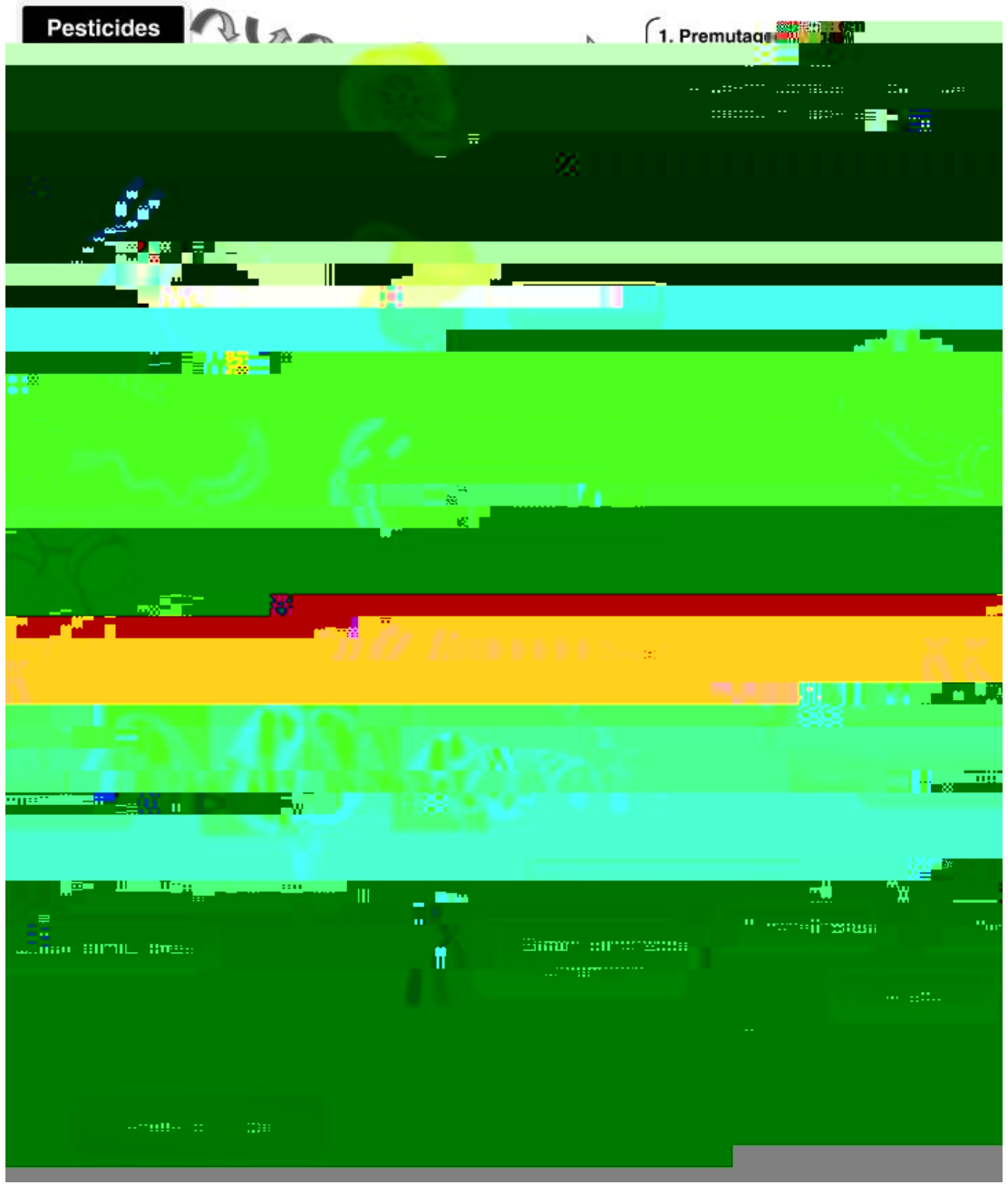
Please feel free to reach out to me at:

pamela.j.bryer@maine.gov


HeLa
Control
MNNG
90μM
170μM
250μM



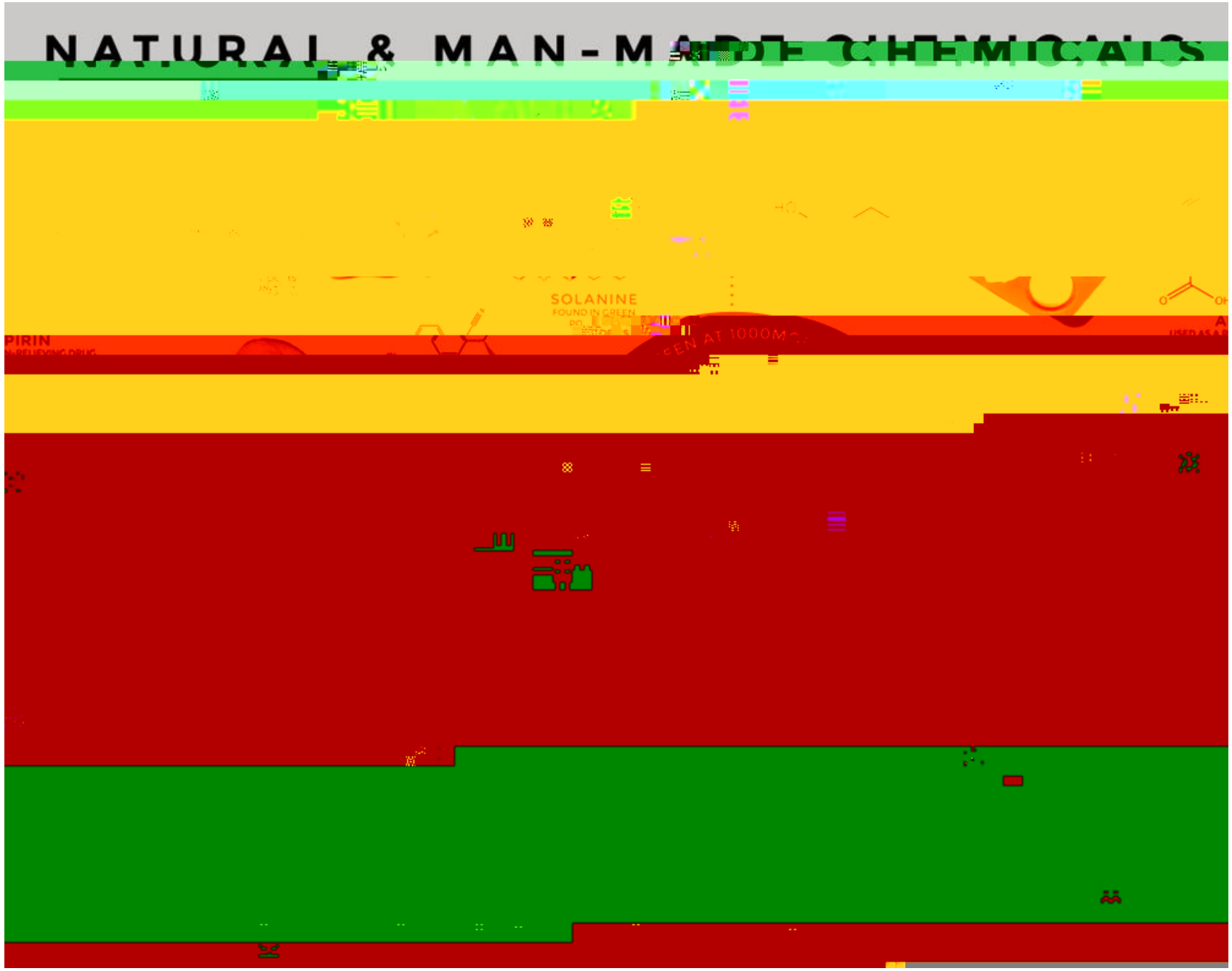
https://www.slideshare.net/ashokktt/biochemistry-of-cancer-37948337


Pesticides

How does EPA classify carcinogenicity of pesticides?

Standard EPA classification categorization descriptions

Group A: "Human Carcinogen"


NATURAL & MAN-MADE CHEMICALS
SOLANINE
FOUND IN GREEN