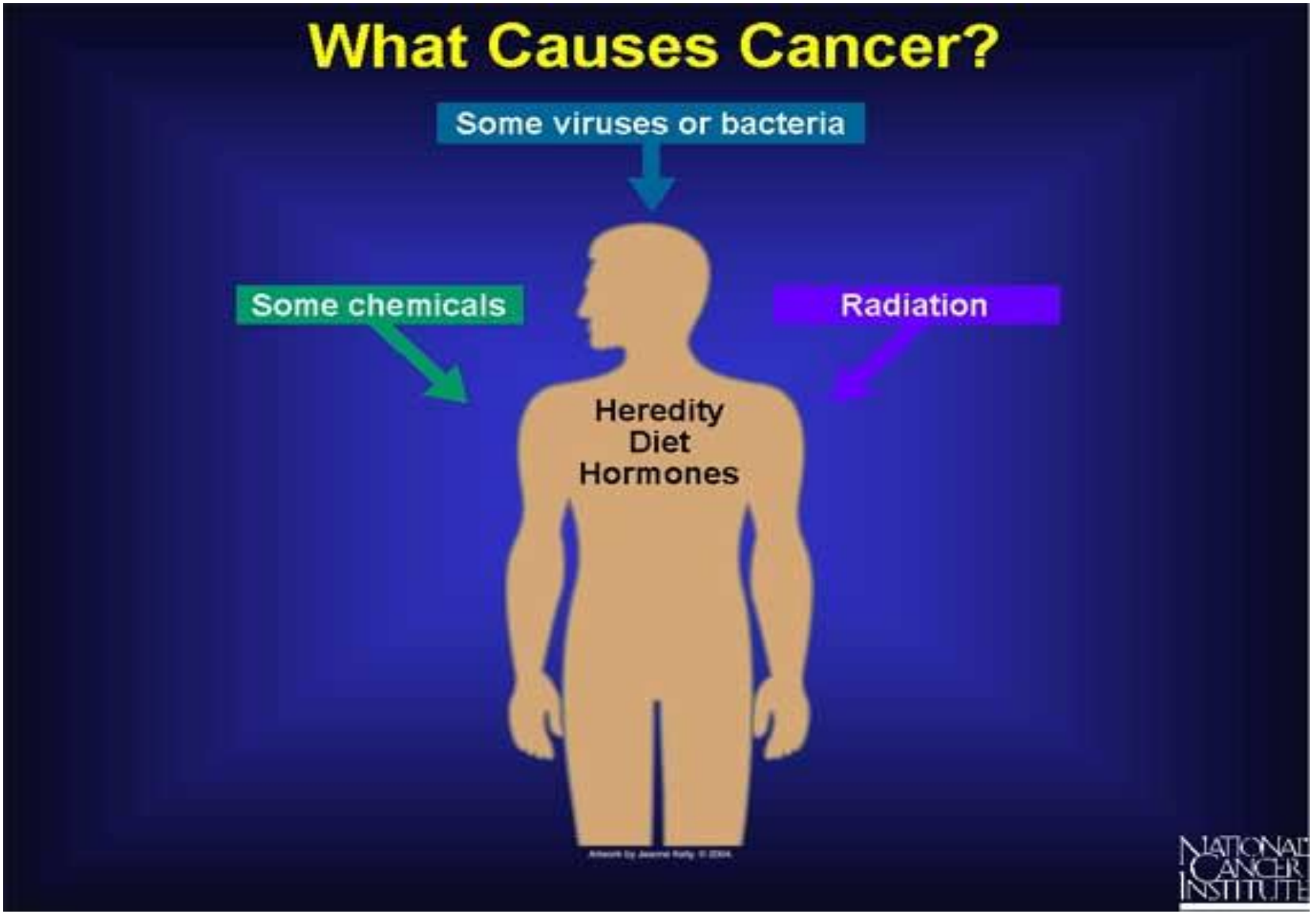
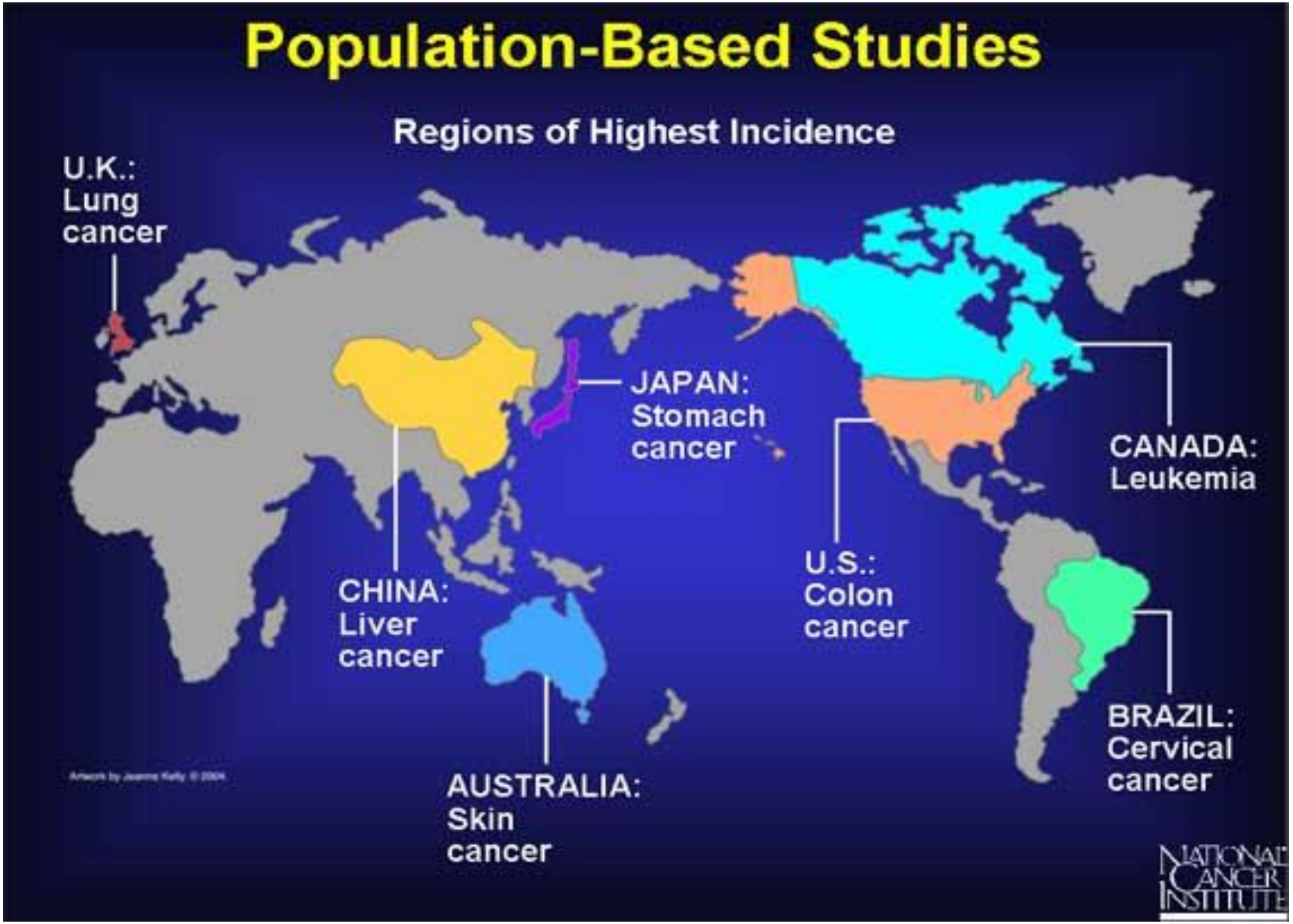
Cancer – Part 2




Population-Based Studies
Regions of Highest Incidence
U.K.: Lung cancer
JAPAN: Stomach cancer
CANADA: Leukemia
CHINA: Liver cancer
U.S.: Colon cancer
BRAZIL: Cervical cancer
AUSTRALIA: Skin cancer
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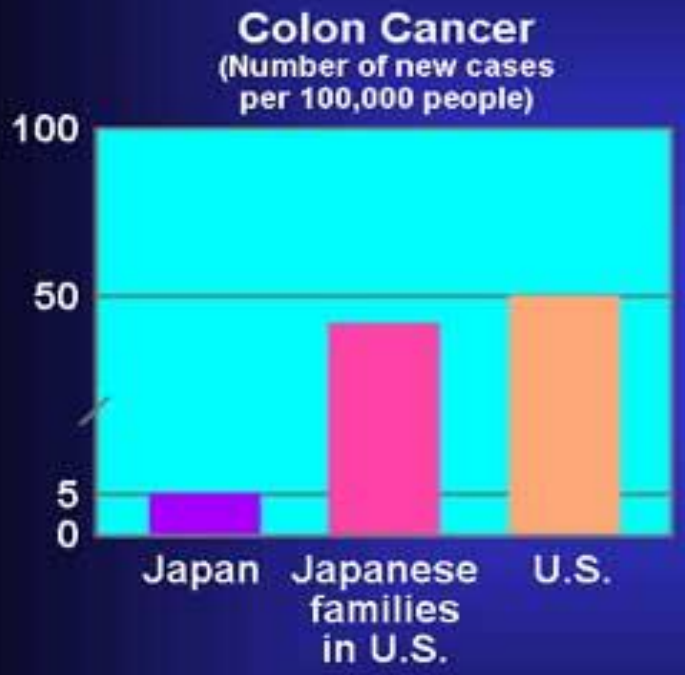
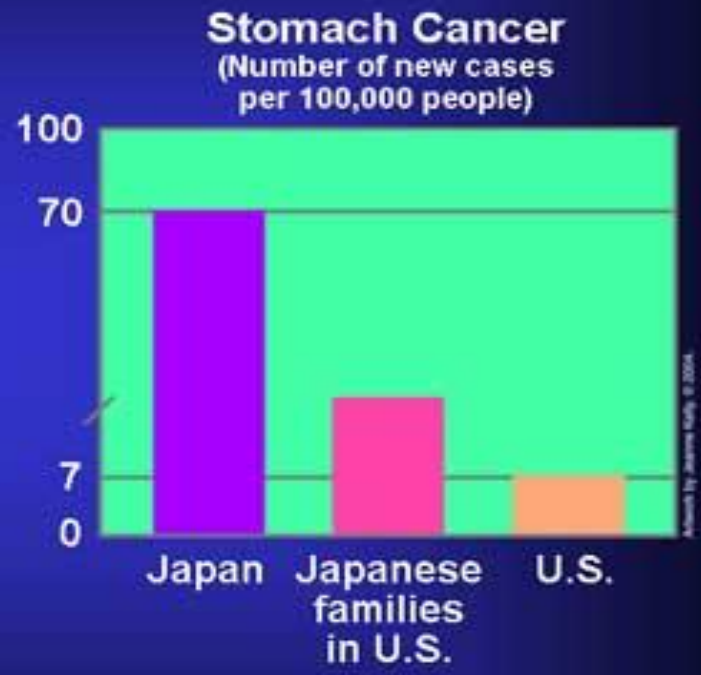
Heredity? Behaviors? Other Factors?





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Tobacco Use and Cancer

Some Cancer-Causing Chemicals in Tobacco Smoke

aminostilbene
arsenic
benz[*a*]anthracene
benz[*a*]pyrene
benzene
benzo[*b*]fluoranthene
benzo[*c*]phenanthrene
benzo[*f*]fluoranthene
cadmium
chrysene
dibenz[*a c*]anthracene
dibenzo[*a e*]fluoranthene
dibenz[*a h*]acridine
dibenz[*a j*]acridine
dibenzo[*c g*]carbazone
N-dibutylnitrosamine
2,3-dimethylchrysene
indeno[1,2,3-*c d*]pyrene
S-methylchrysene
S-methylfluoranthene
alpha-naphthylamine
nickel compounds
N-nitrosodimethylamine
N-nitrosomethylethylamine
N-nitrosodiethylamine
N-nitrosonornicotine
N-nitrosoanabasine
N-nitrosopiperidine
polonium-210

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Low-Strength Radiation

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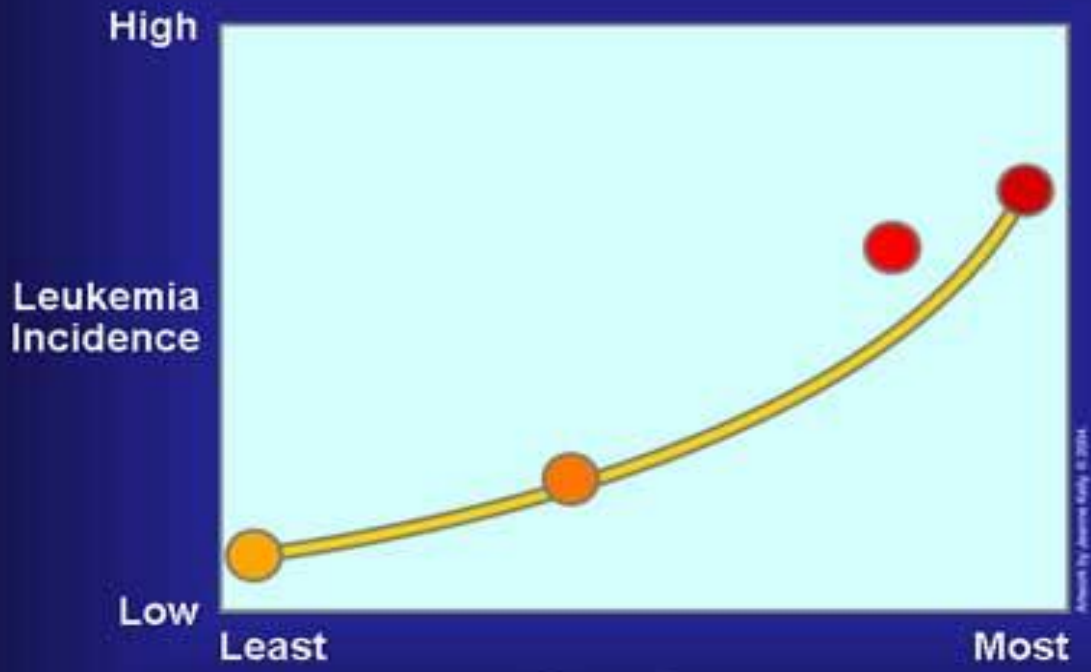
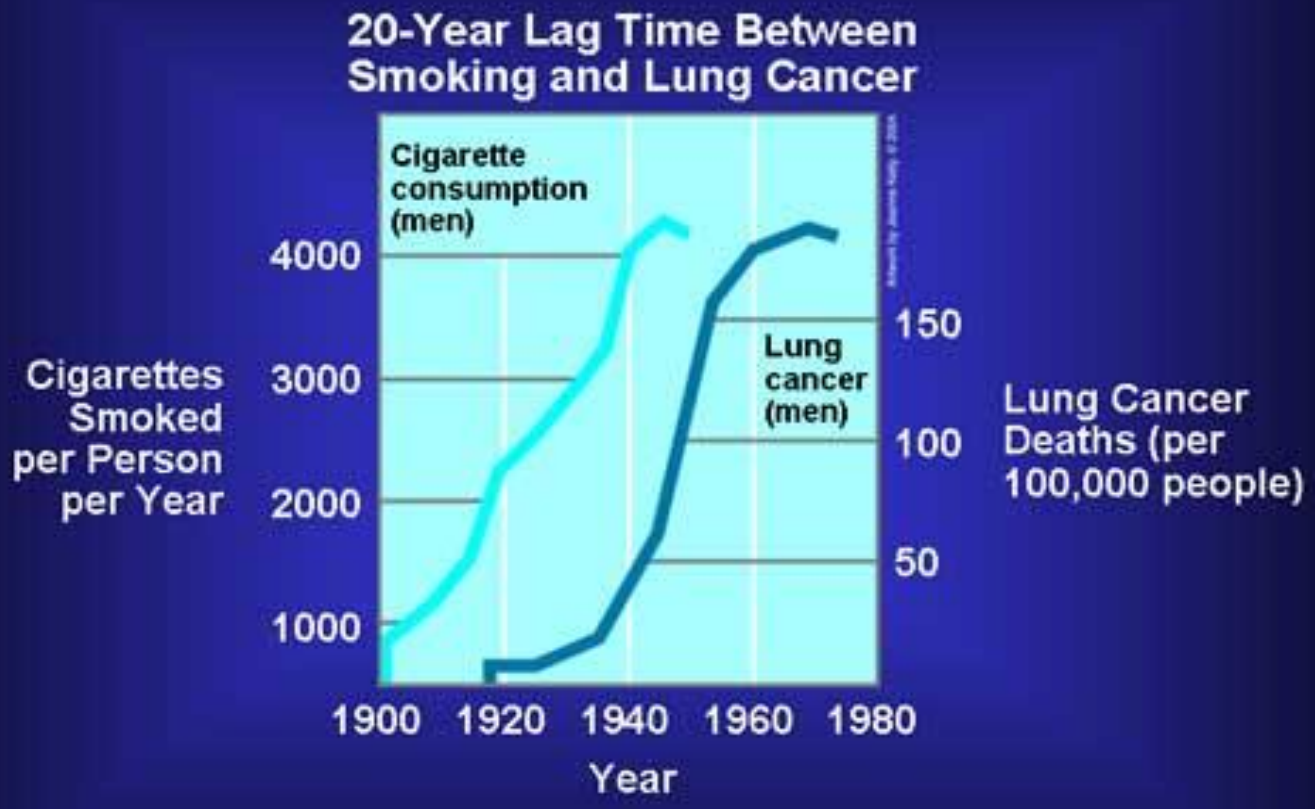
High-Strength Radiation



Lag Time



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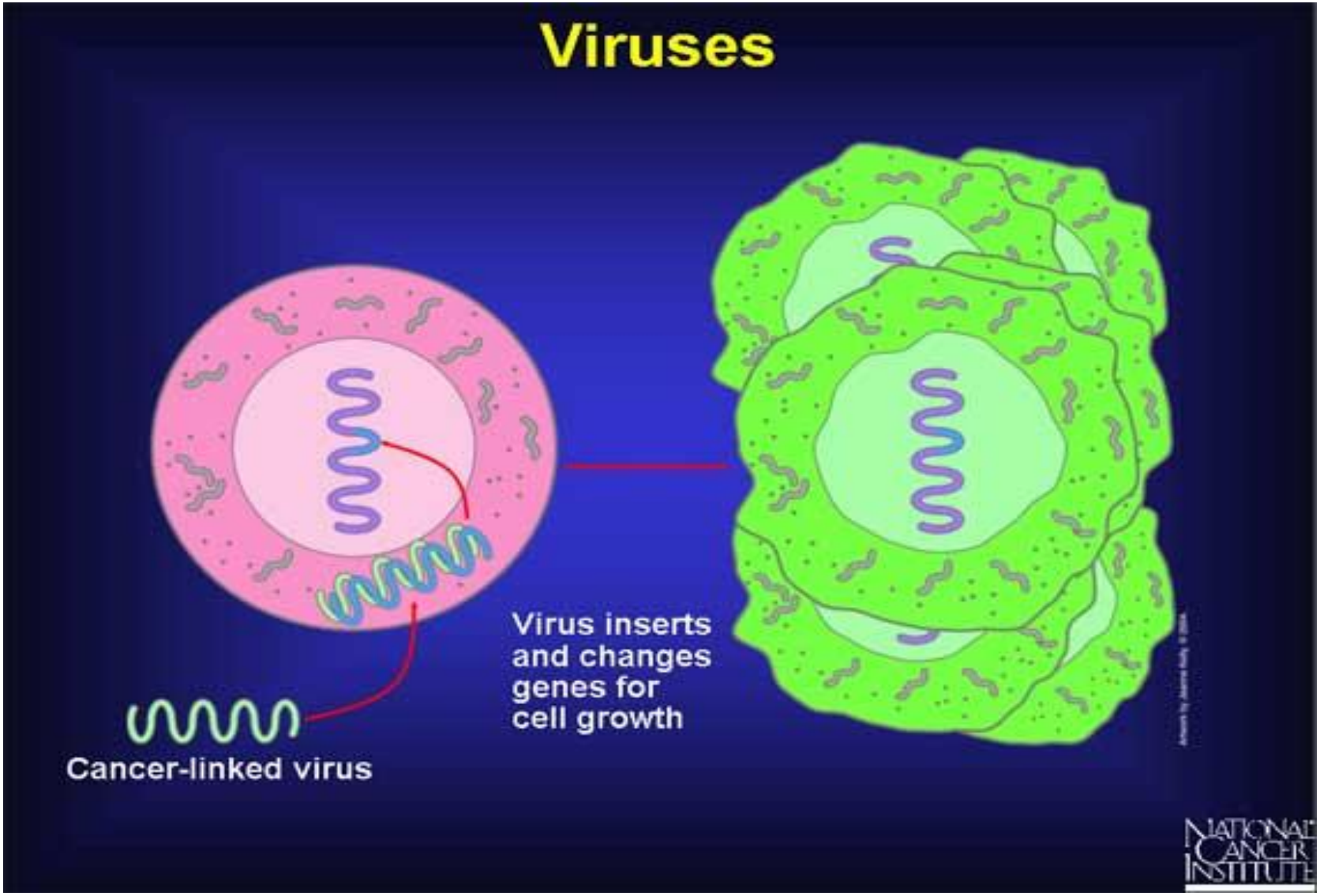
Viruses
Virus inserts and changes genes for cell growth
Cancer-linked virus
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Examples of Human Cancer Viruses

Some Viruses Associated with Human Cancers

Virus	*Type of Cancer*
Epstein-Barr virus	Burkitt's lymphoma
Human papillomavirus	Cervical cancer
Hepatitis B virus	Liver cancer
Human T-cell lymphotrophic virus	Adult T-cell leukemia
Kaposi's sarcoma-associated herpesvirus	Kaposi's sarcoma

Artwork by Joanne Kelly © 2004

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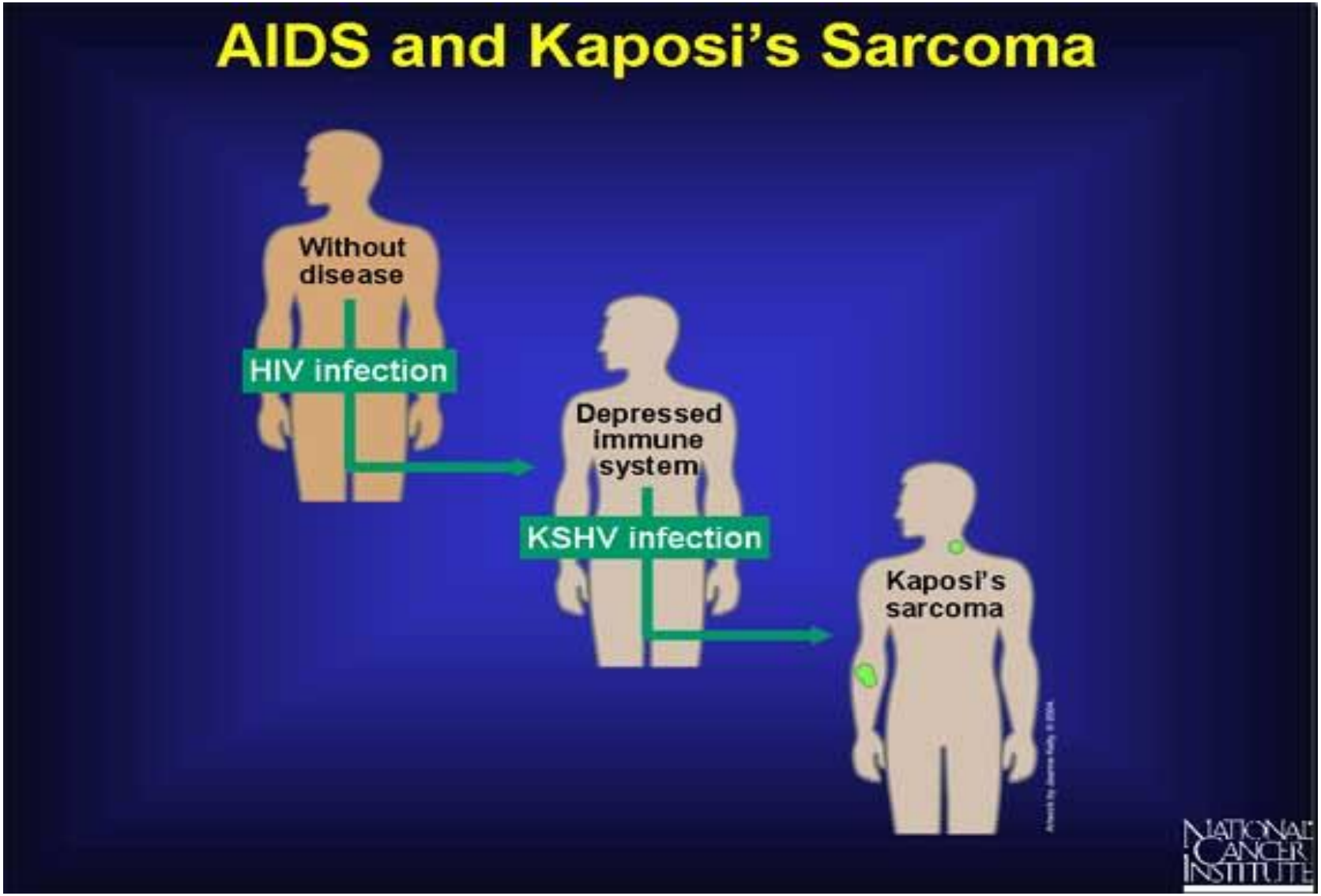
AIDS and Kaposi's Sarcoma
Without disease
HIV infection
Depressed immune system
KSHV infection
Kaposi's sarcoma
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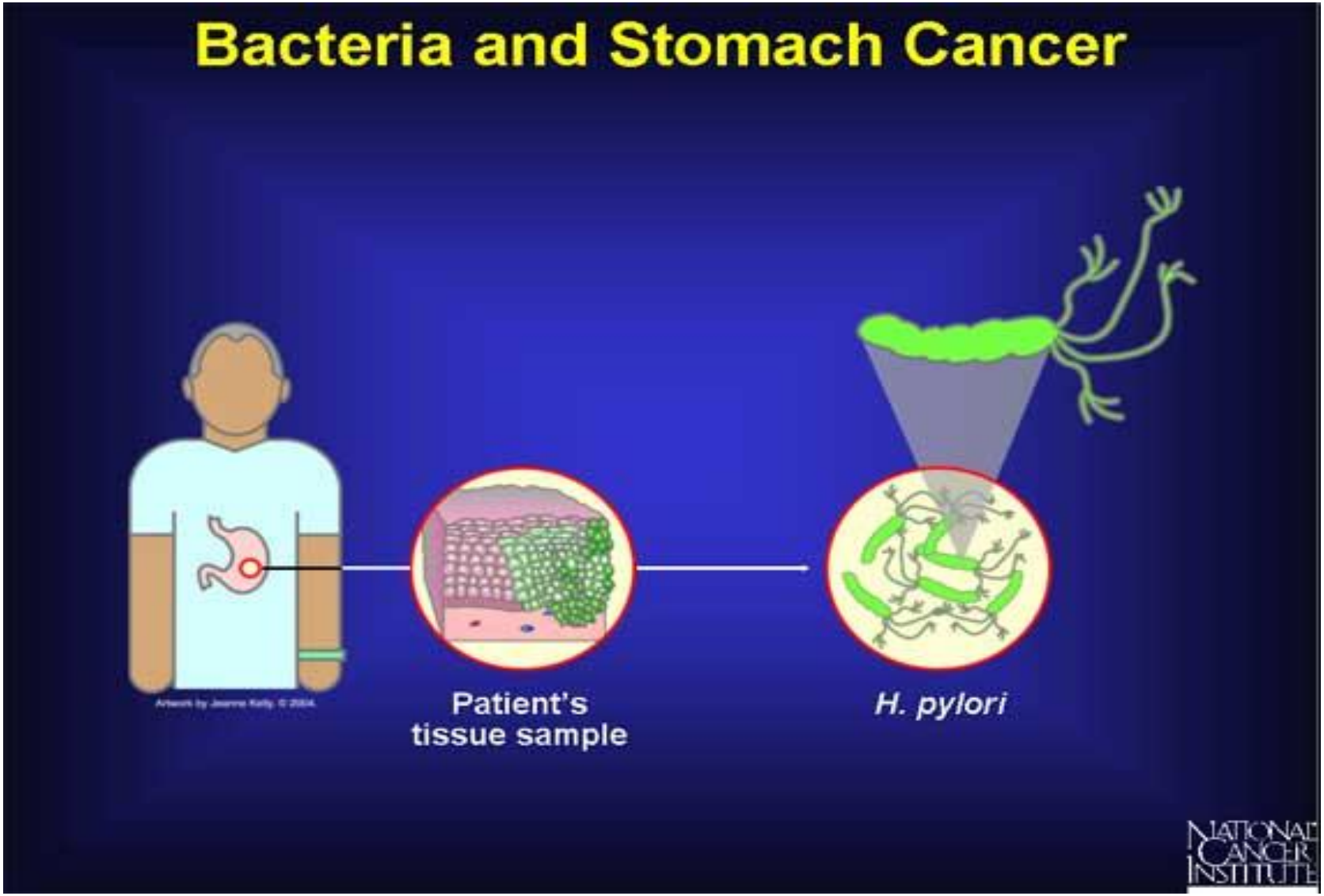
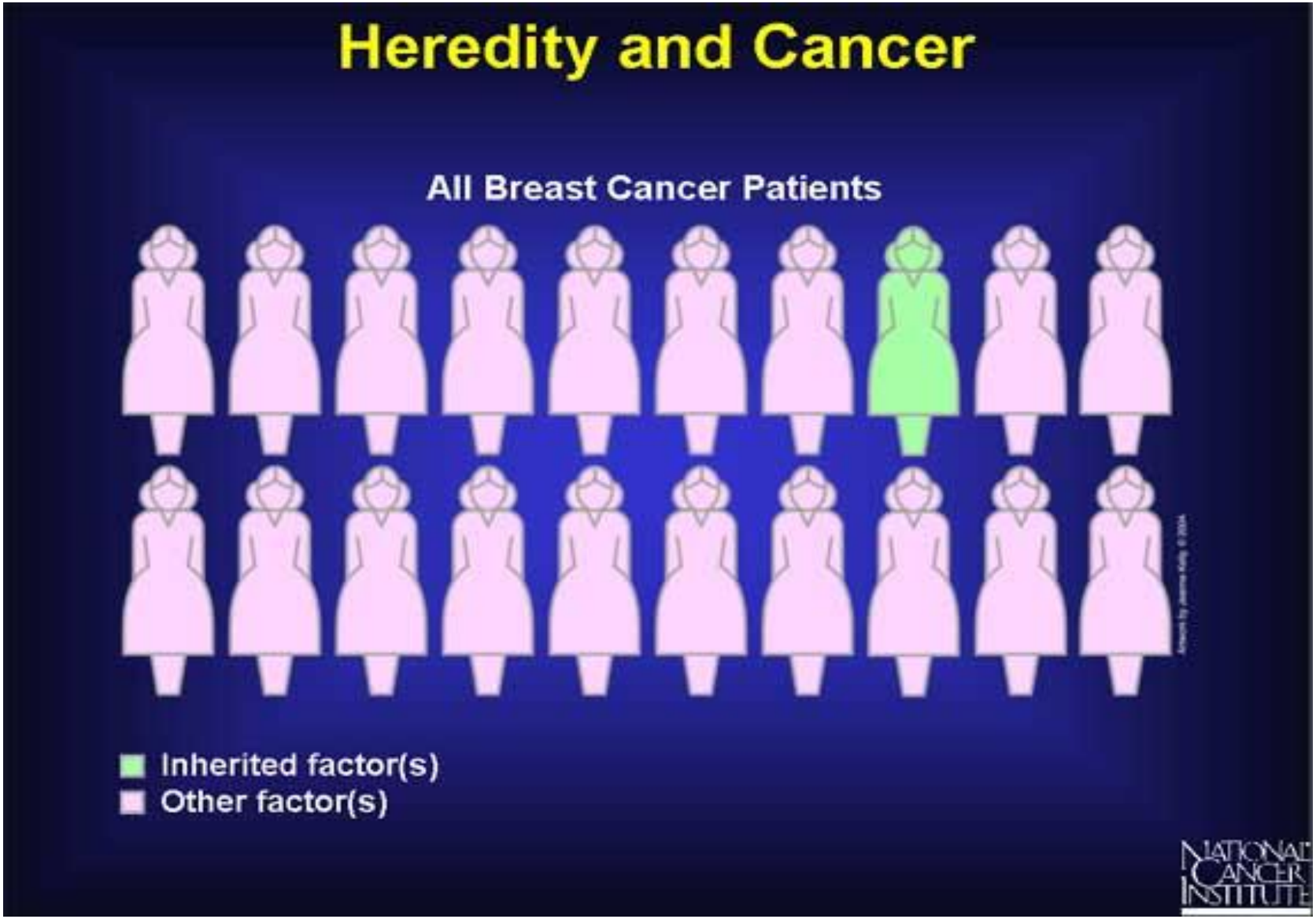

Bacteria and Stomach Cancer
Patient's tissue sample
H. pylori
NATIONAL CANCER INSTITUTE


Heredity and Cancer
All Breast Cancer Patients
Inherited factor(s)
Other factor(s)
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Heredity Can Affect Many Types of Cancer

Inherited Conditions That Increase Risk for Cancer

Name of Condition	*Type of Cancer*
Hereditary retinoblastoma	Retinoblastoma
Xeroderma pigmentosum	Skin
Wilms' tumor	Kidney
Li-Fraumeni syndrome	Sarcomas, brain, breast, leukemia
Familial adenomatous polyposis	Colon, rectum
Paget's disease of bone	Bone
Fanconi's aplastic anemia	Leukemia, liver, skin

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Genetic Testing

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Cancer Risk and Aging

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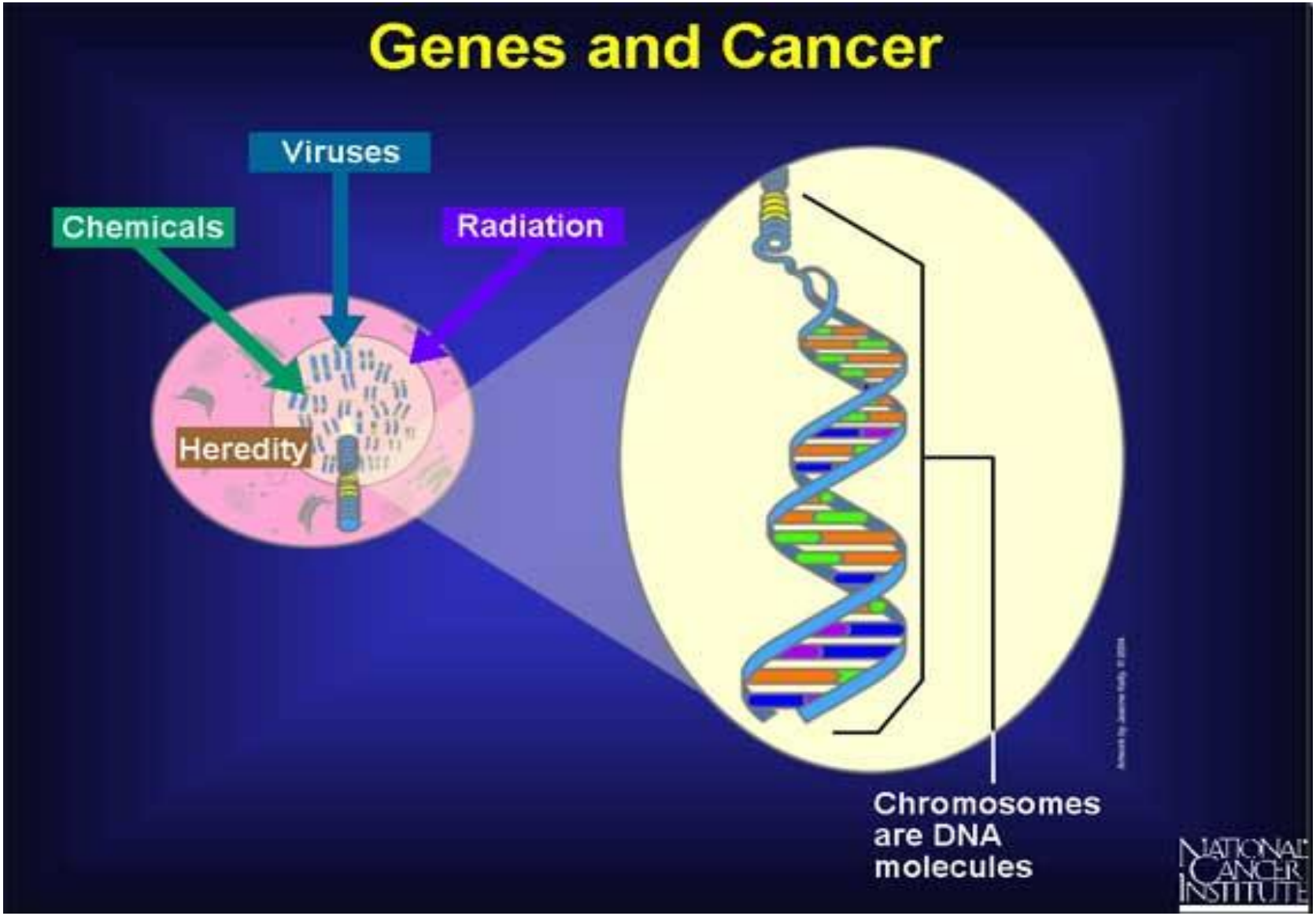
Genes and Cancer
Viruses
Chemicals
Radiation
Heredity
Chromosomes are DNA molecules
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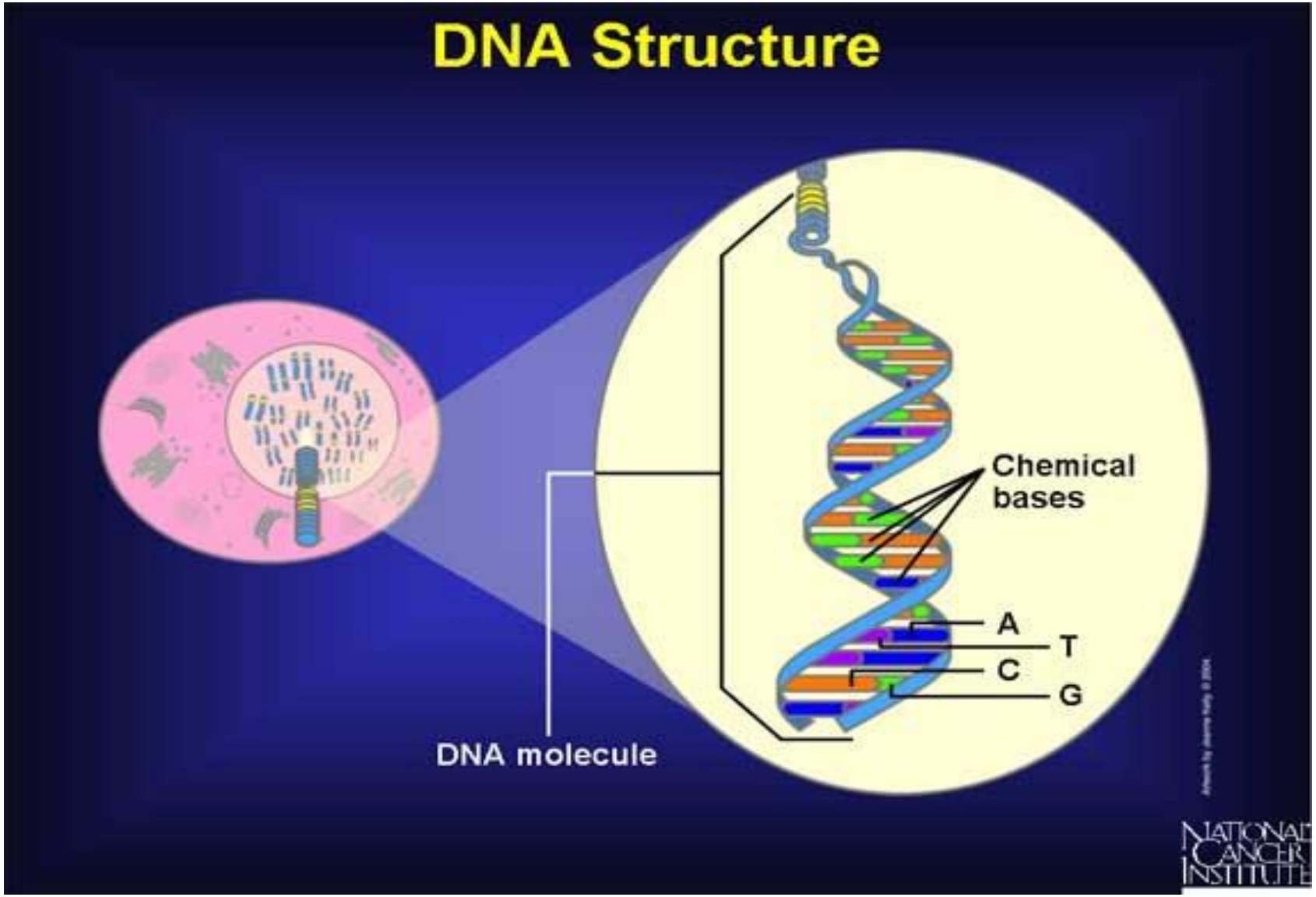
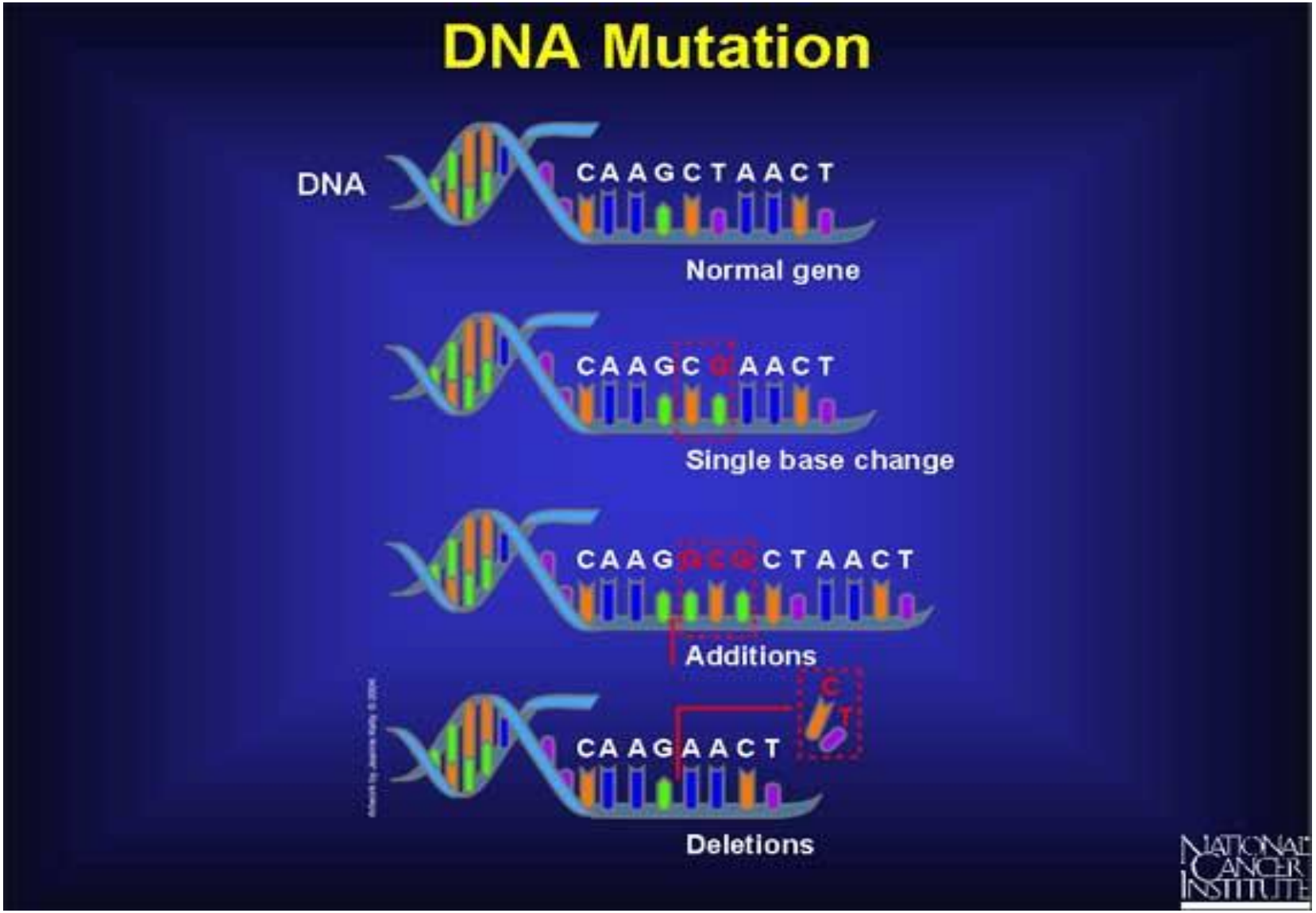

DNA Structure
Chemical bases
A
T
C
G
DNA molecule


DNA Mutation
DNA
C A A G C T A A C T
Normal gene
C A A G C A A C T
Single base change
C A A G C T C T A A C T
Additions
C A A G A A C T
C
T
Deletions
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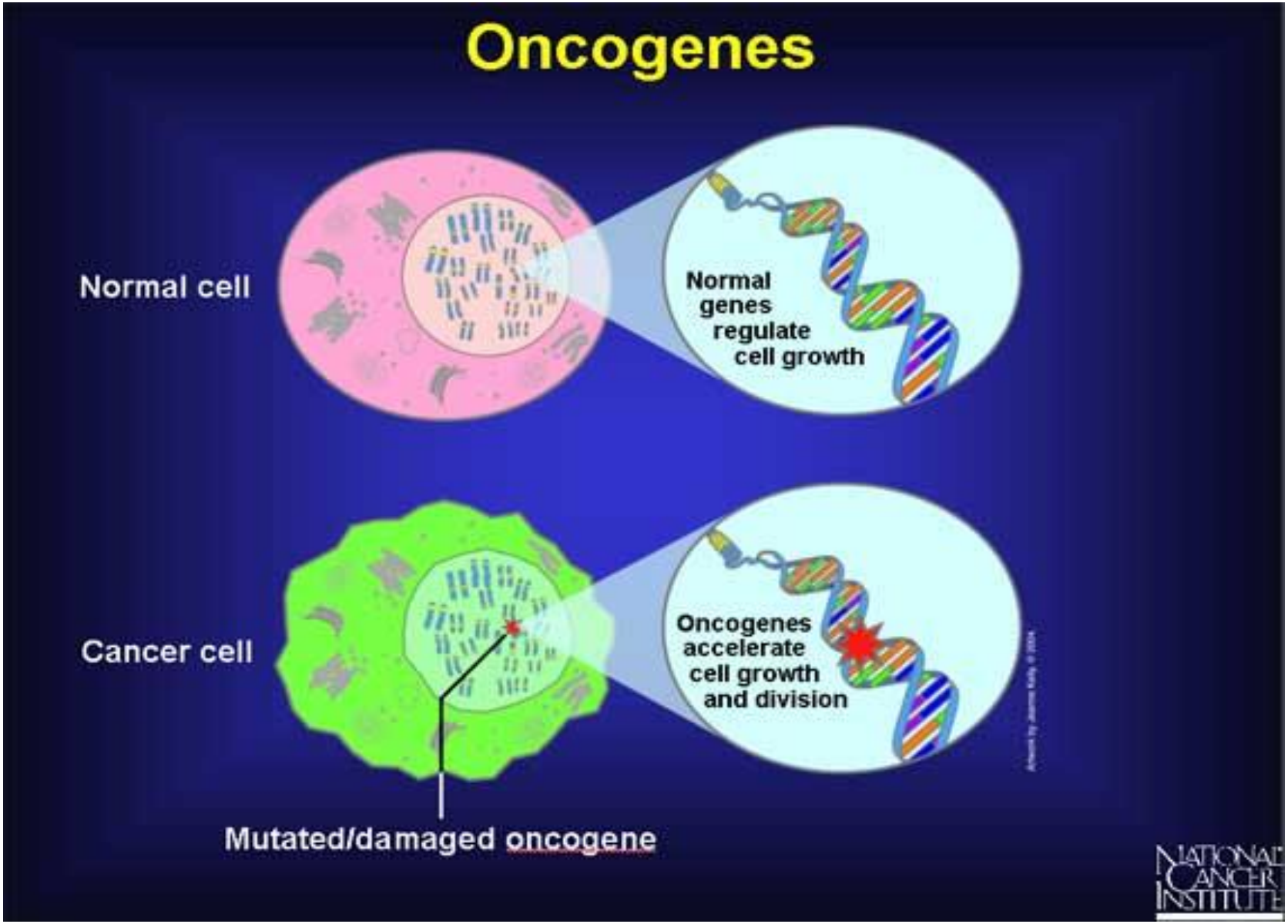
Oncogenes
Normal cell
Normal genes regulate cell growth
Cancer cell
Oncogenes accelerate cell growth and division
Mutated/damaged oncogene
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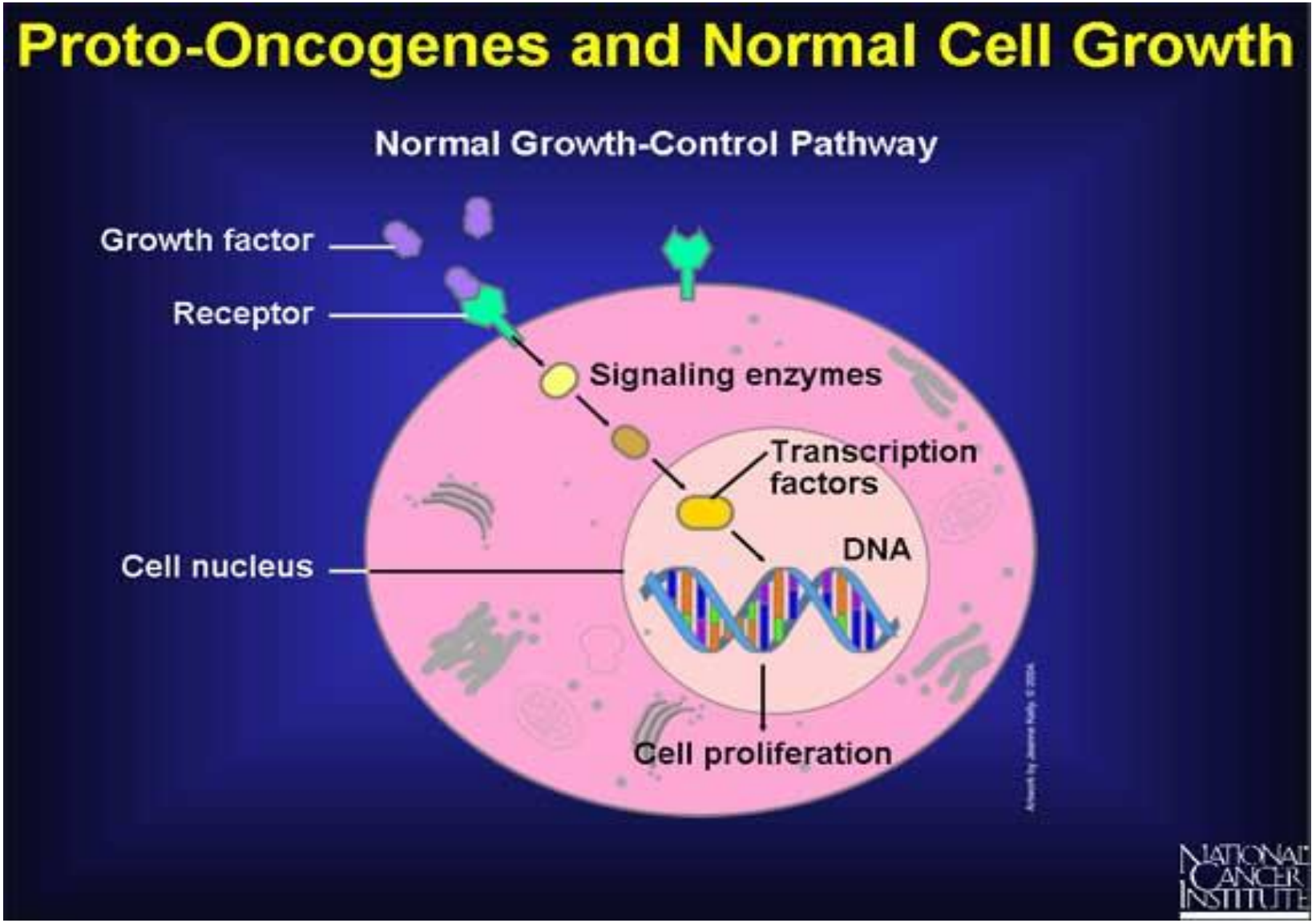
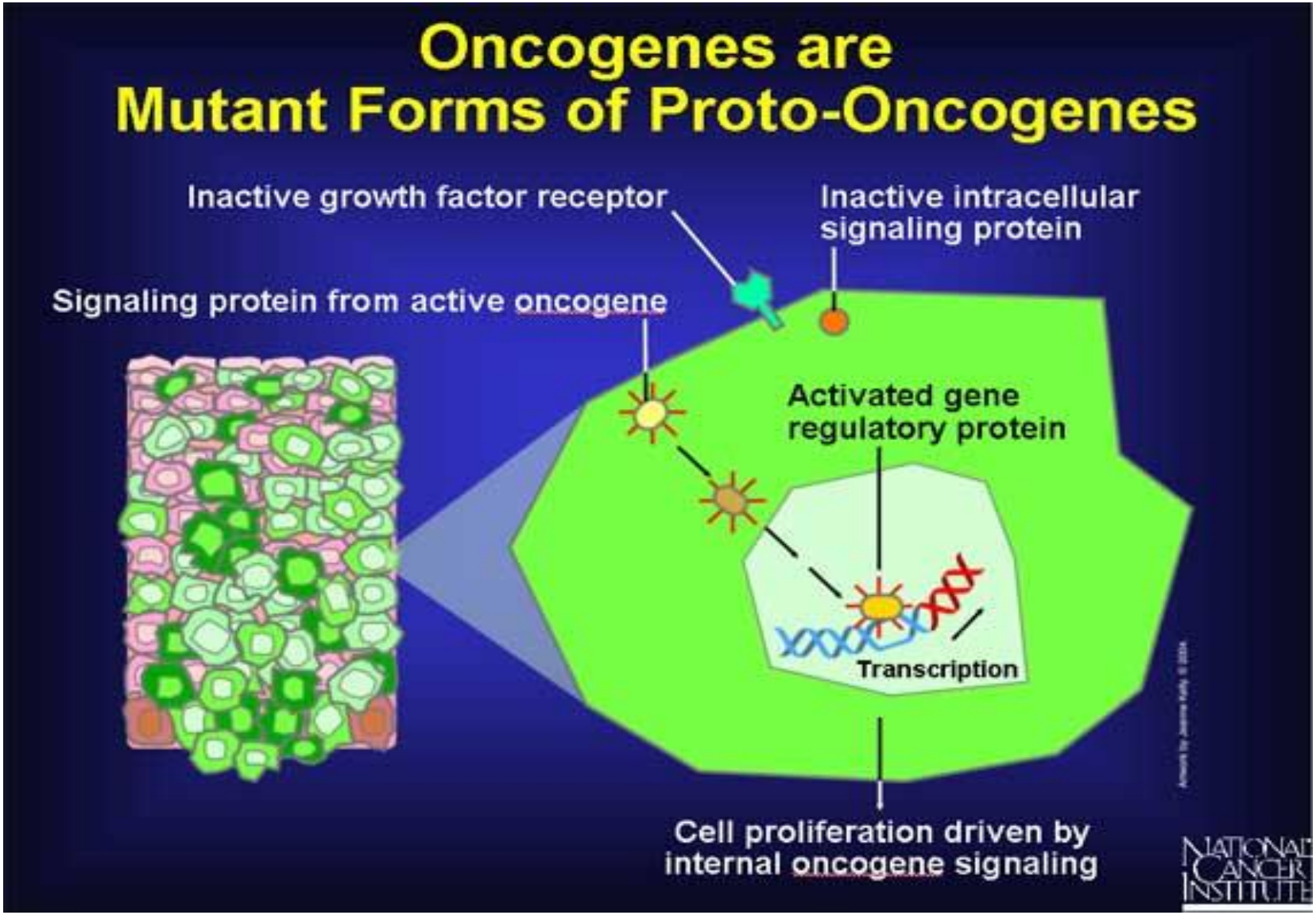
Proto-Oncogenes and Normal Cell Growth




Oncogenes are
Mutant Forms of Proto-Oncogenes
Inactive growth factor receptor
Inactive intracellular
signaling protein
Signaling protein from active oncogene
Activated gene
regulatory protein
Transcription
Cell proliferation driven by
internal oncogene signaling

DNA Mutations – Lecture and Animations

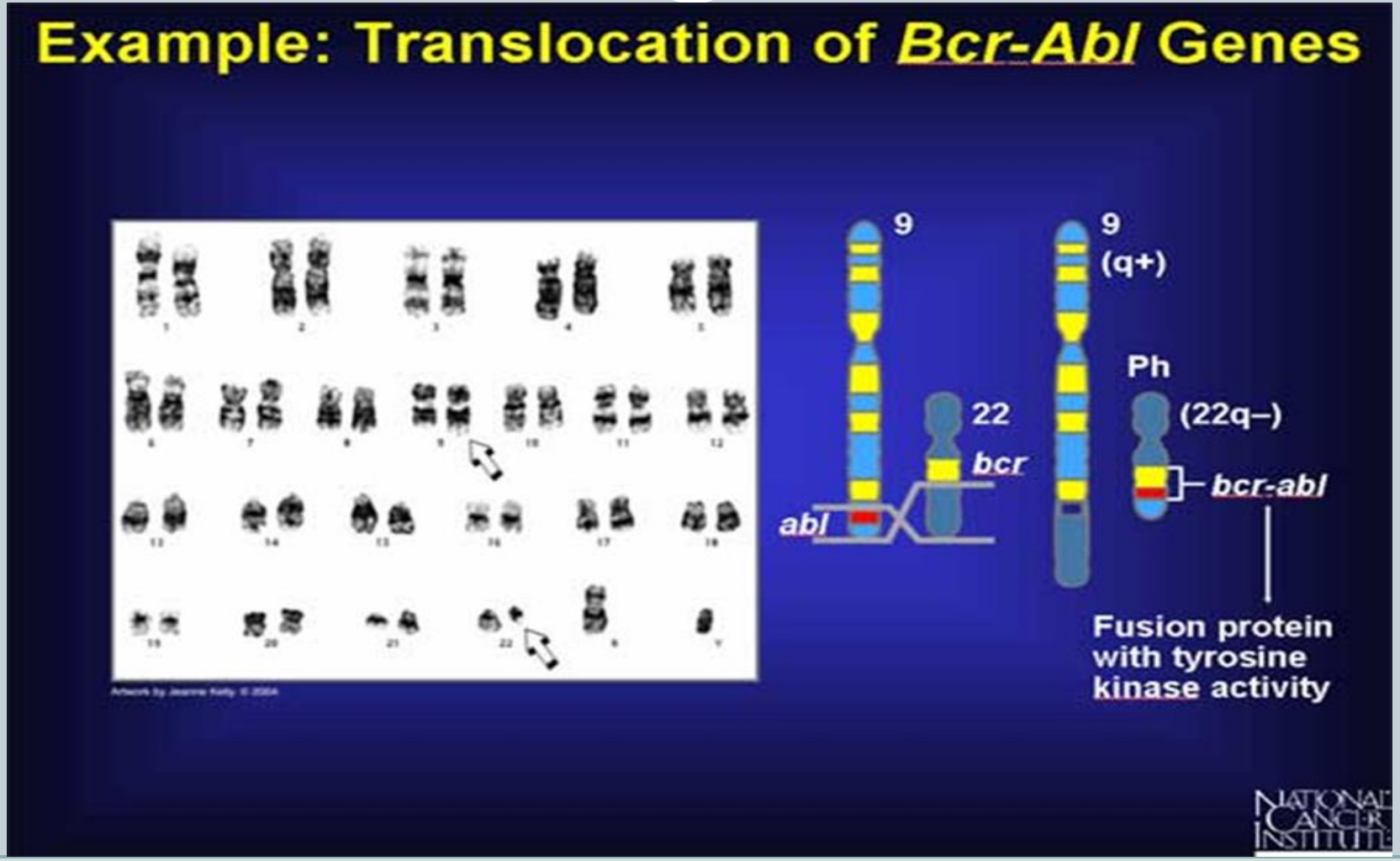
Go to http://www.hhmi.org/biointeractive/ , then at the top of the screen under the **Topic** tab, choose cancer with the drop down menu at the top, and scroll down to:

Cancer as a Genetic Disease, lecture.

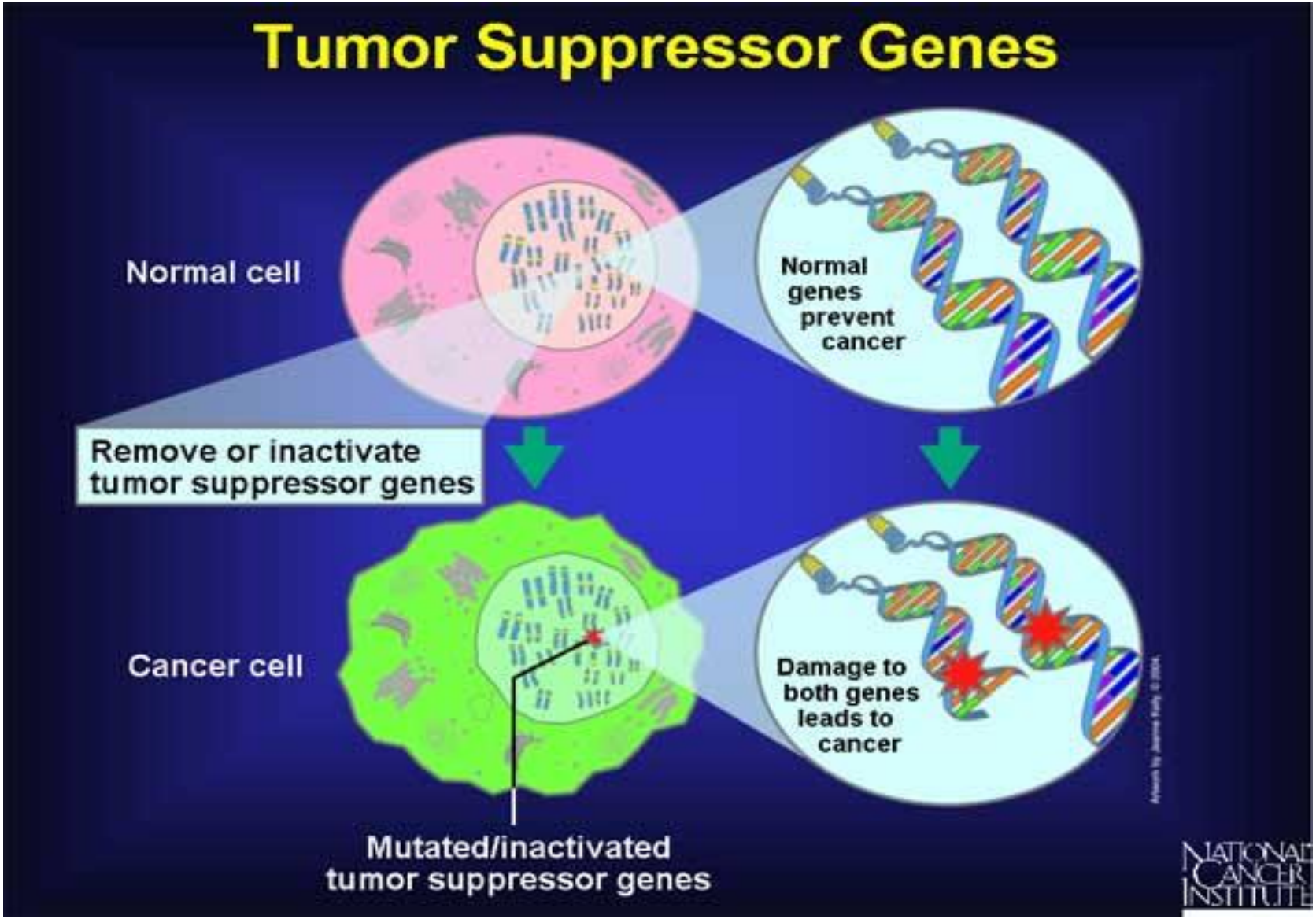
The first half (segments 1-12) is about how cancer is defined as a genetic disease and shows the difference between proto-oncogenes and oncogenes using the Rous sarcoma virus example. Tumor supressor genes are revisited in terms of dominant and recessive mutations in cancer. (22 minutes, 10 seconds).

The second half (segments 18-26) is about using drug therapy (Gleevec) to treat Chronic Myeloid Leukemia (CML) and how to treat patients with Gleevec-resistant CML (21 minutes, 27 seconds).

Cause of Chronic Myeloid Leukemia (CML)



http://www.cancer.gov/cancertopics/understandingcancer/cancergenomics/AllPages


Tumor Suppressor Genes
Normal cell
Normal genes prevent cancer
Remove or inactivate tumor suppressor genes
Cancer cell
Damage to both genes leads to cancer
Mutated/inactivated tumor suppressor genes
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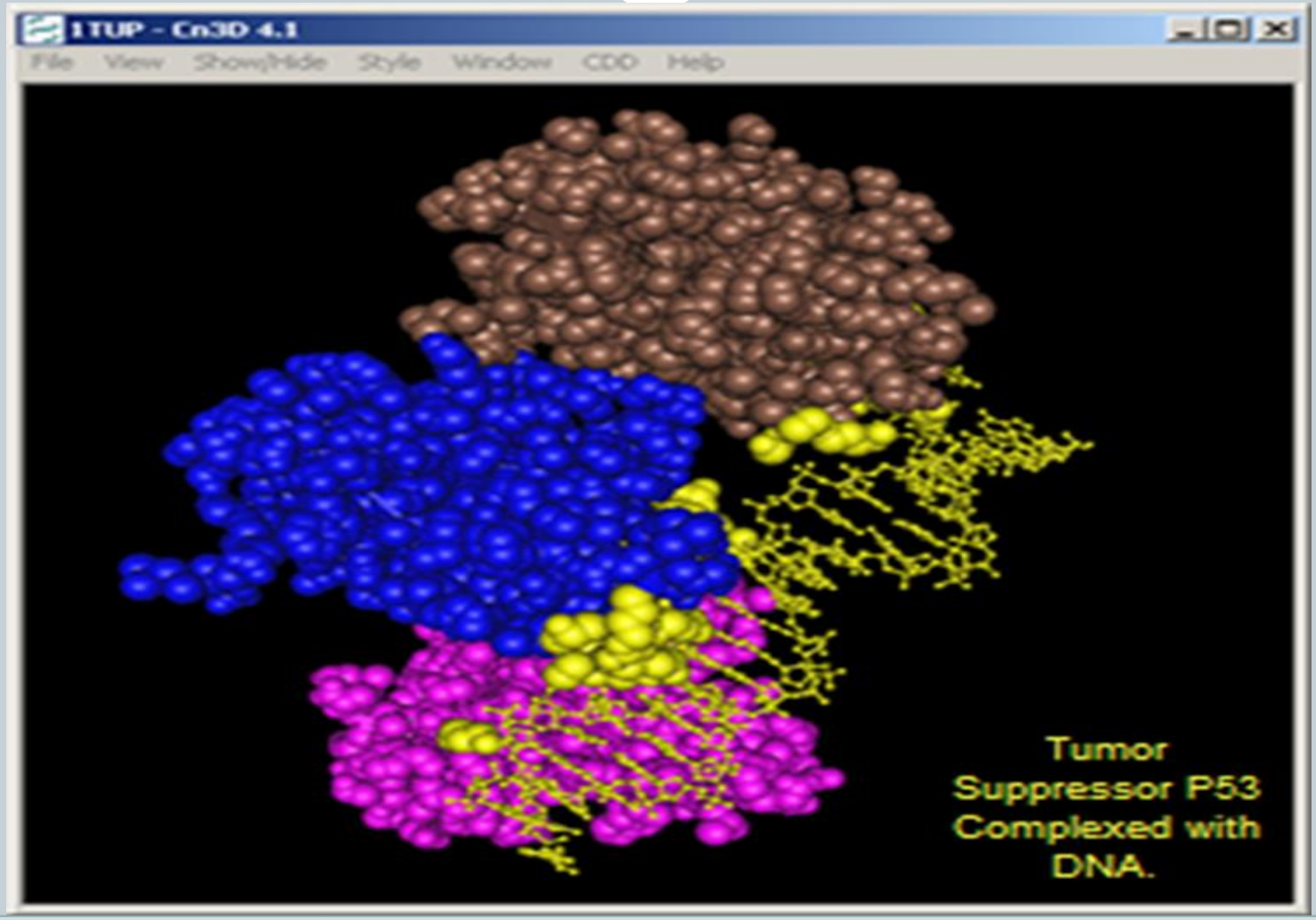
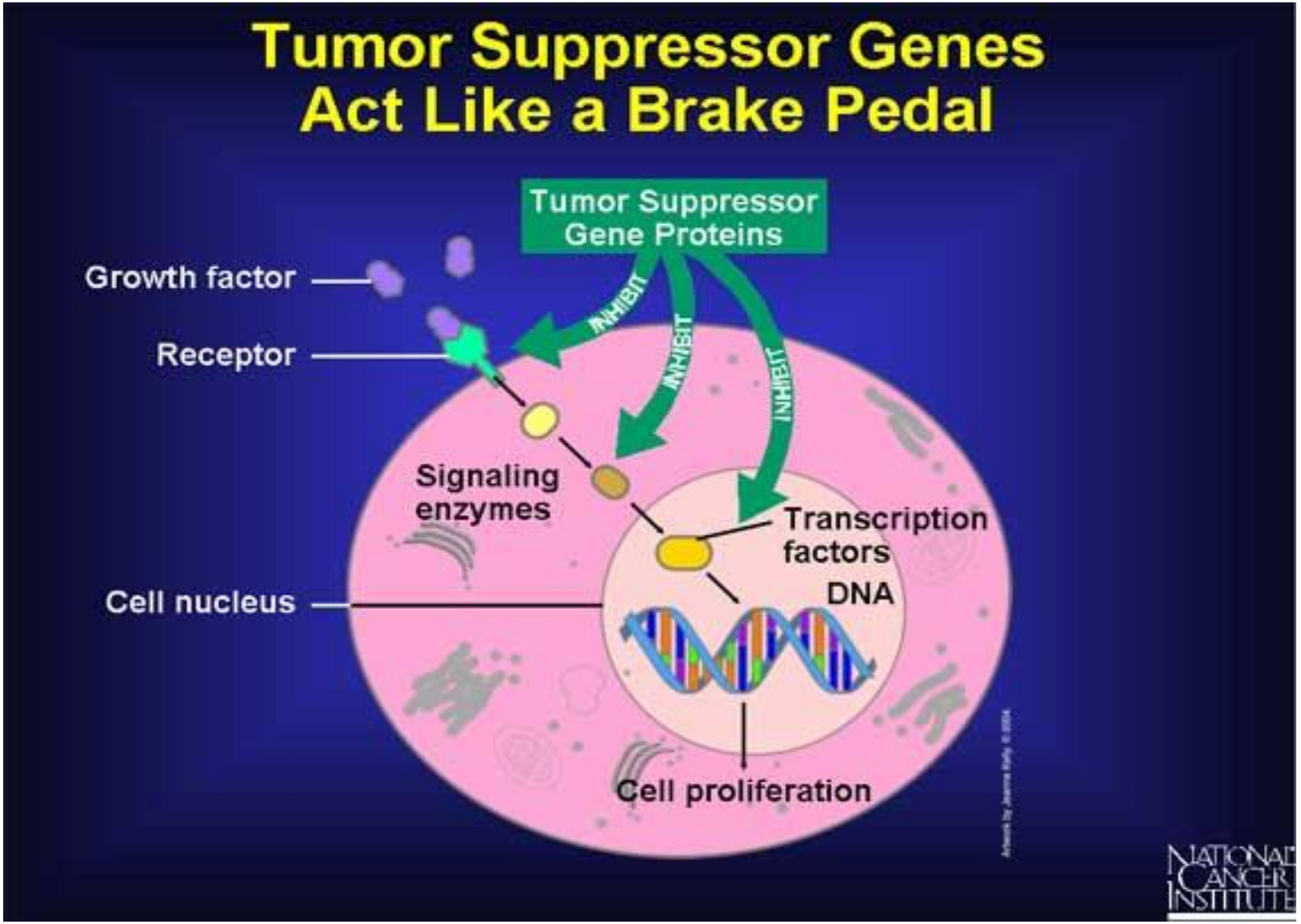
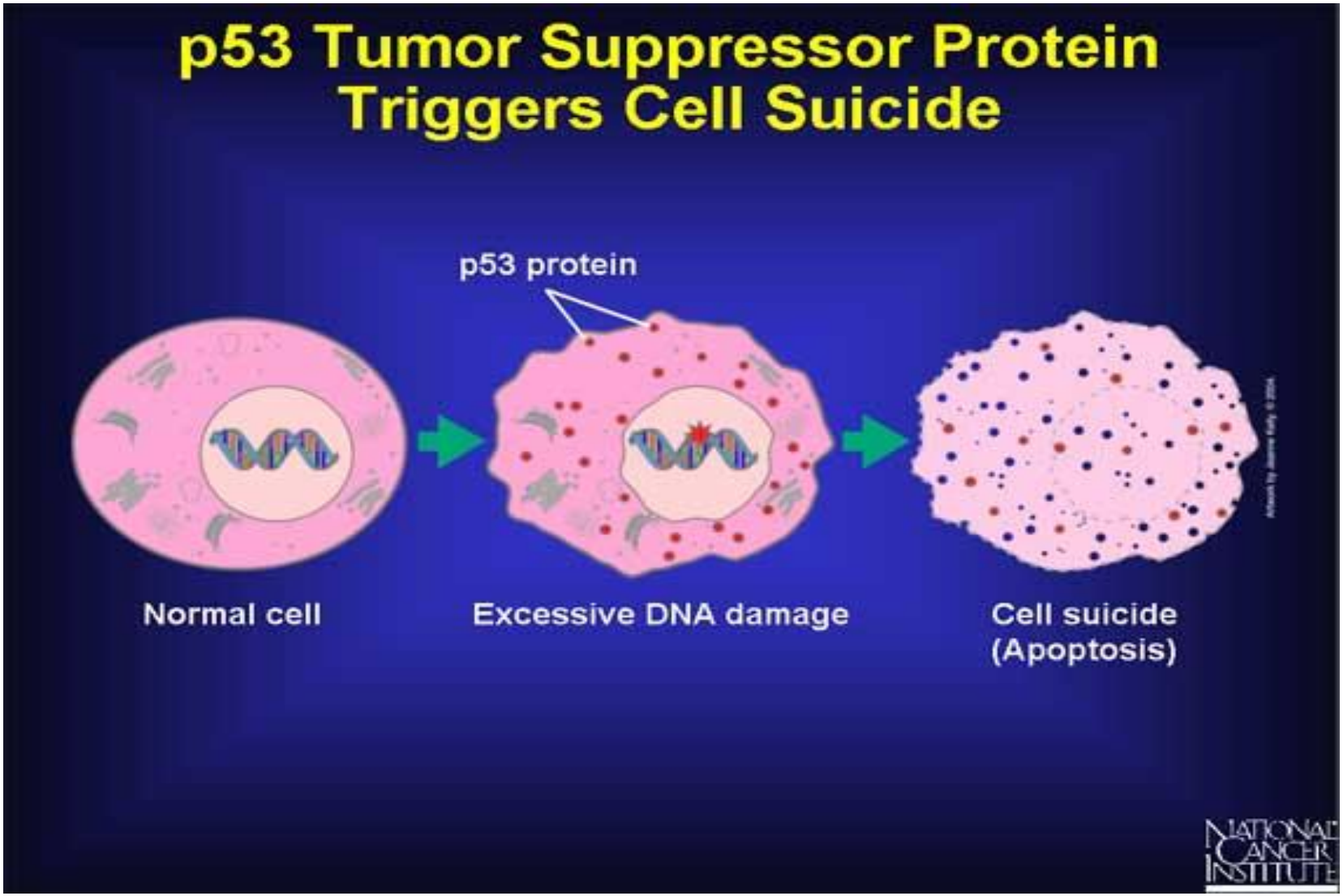
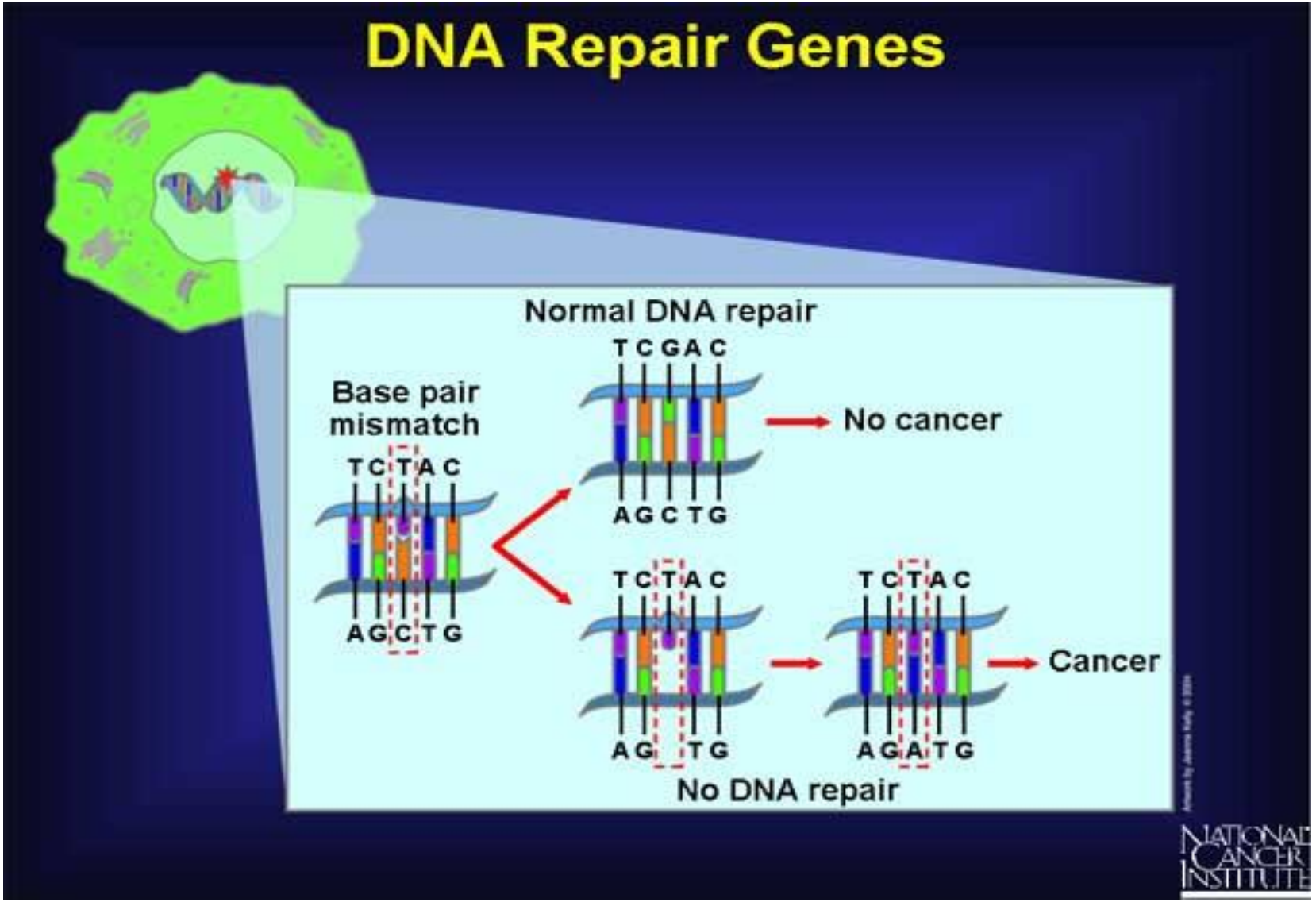
Tumor Suppressor Protein Complexed with DNA



http://www.ncbi.nlm.nih.gov/Structure/MMDB/docs/mmdb_help.html


Tumor Suppressor Genes
Act Like a Brake Pedal
Tumor Suppressor
Gene Proteins
Growth factor
Receptor
INHIBIT
INHIBIT
INHIBIT
Signaling
enzymes
Transcription
factors
DNA
Cell nucleus
Cell proliferation
NATIONAL
CANCER
INSTITUTE


p53 Tumor Suppressor Protein
Triggers Cell Suicide
p53 protein
Normal cell
Excessive DNA damage
Cell suicide
(Apoptosis)
NATIONAL CANCER INSTITUTE


DNA Repair Genes
Normal DNA repair
Base pair mismatch
T C T A C
A G C T G
T C G A C
A G C T G
No cancer
T C T A C
A G T G
T C T A C
A G A T G
Cancer
No DNA repair
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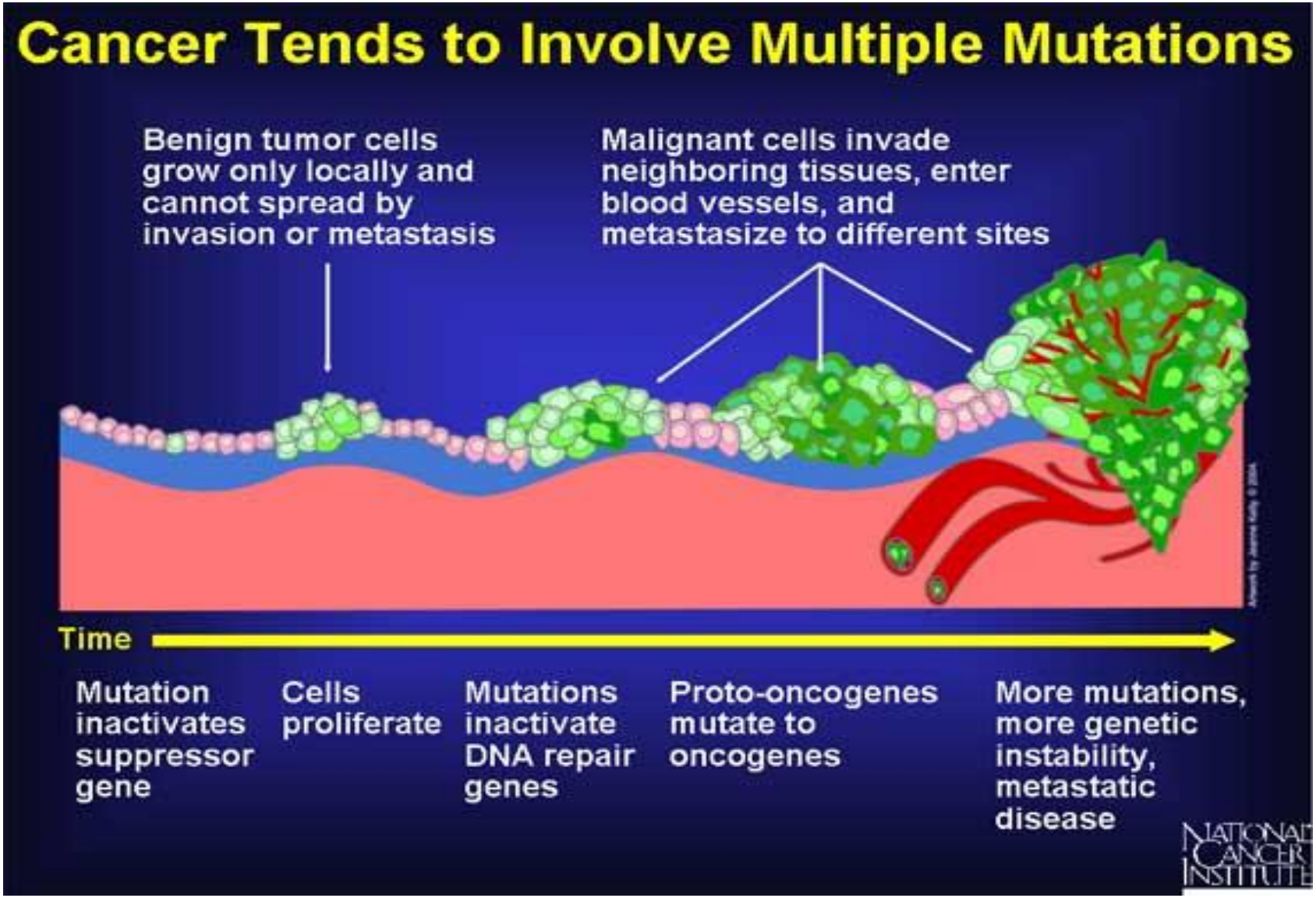
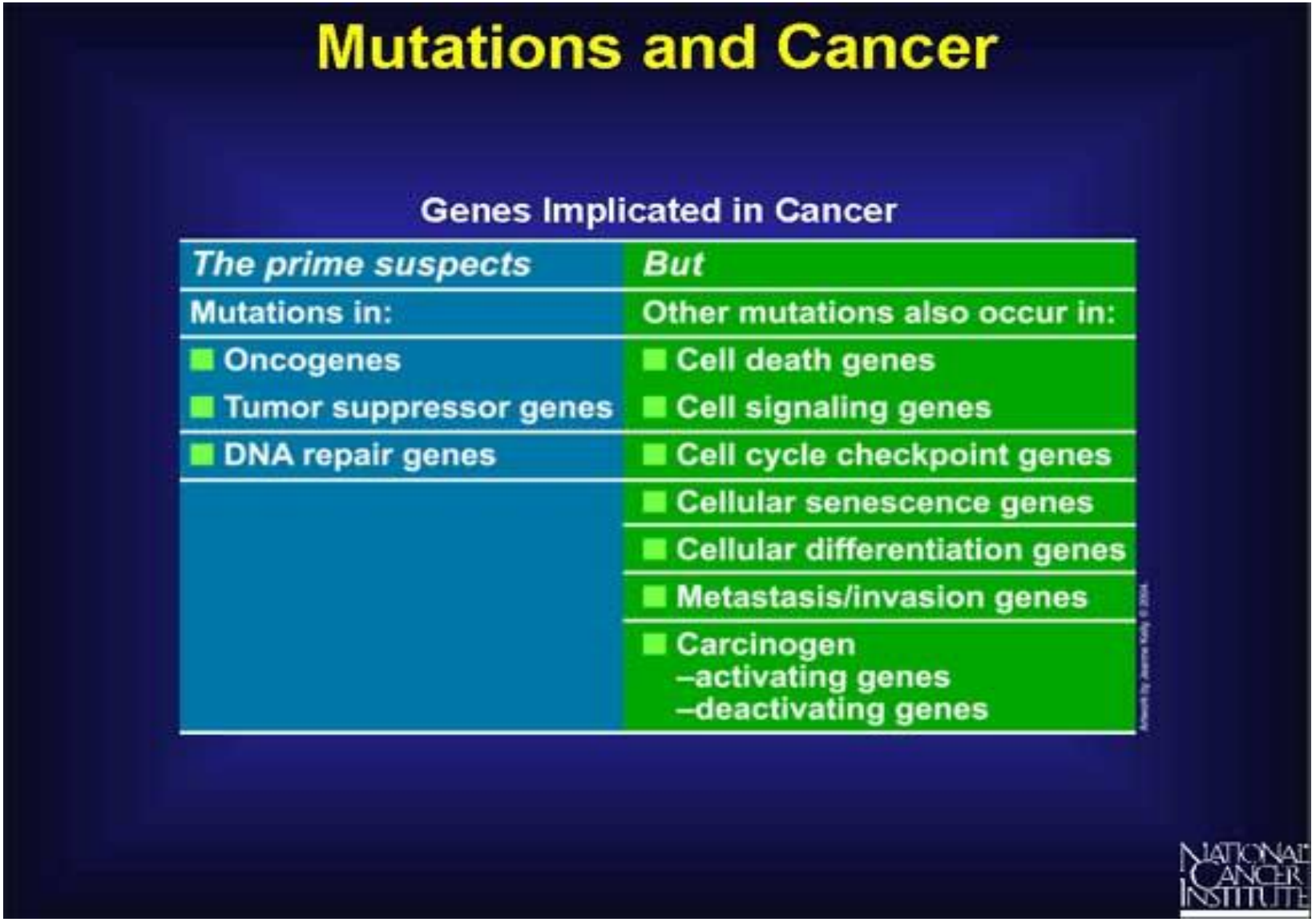
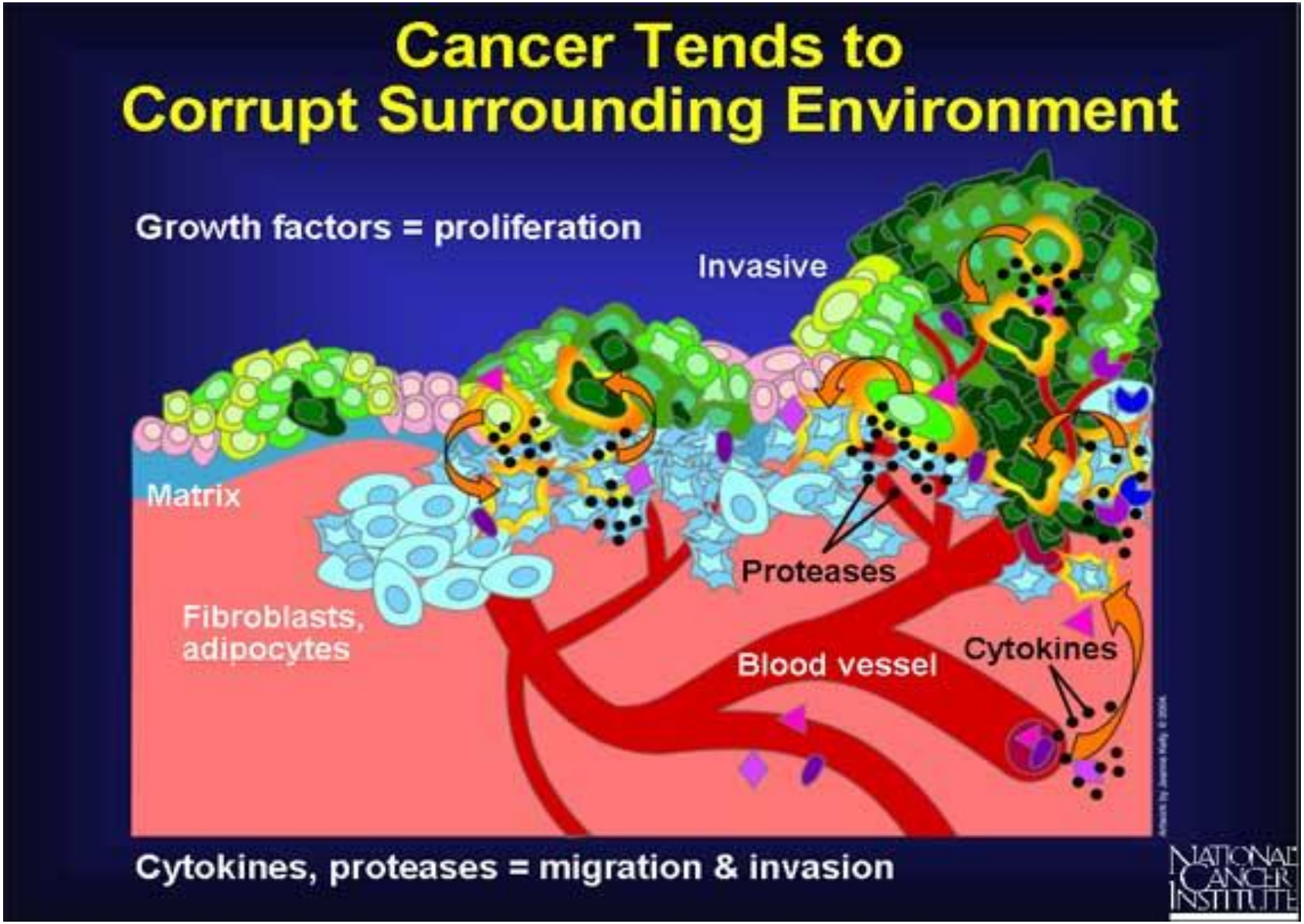
Cancer Tends to Involve Multiple Mutations



Mutations and Cancer




Cancer Tends to
Corrupt Surrounding Environment
Growth factors = proliferation
Invasive
Matrix
Proteases
Fibroblasts,
adipocytes
Blood vessel
Cytokines
Cytokines, proteases = migration & invasion
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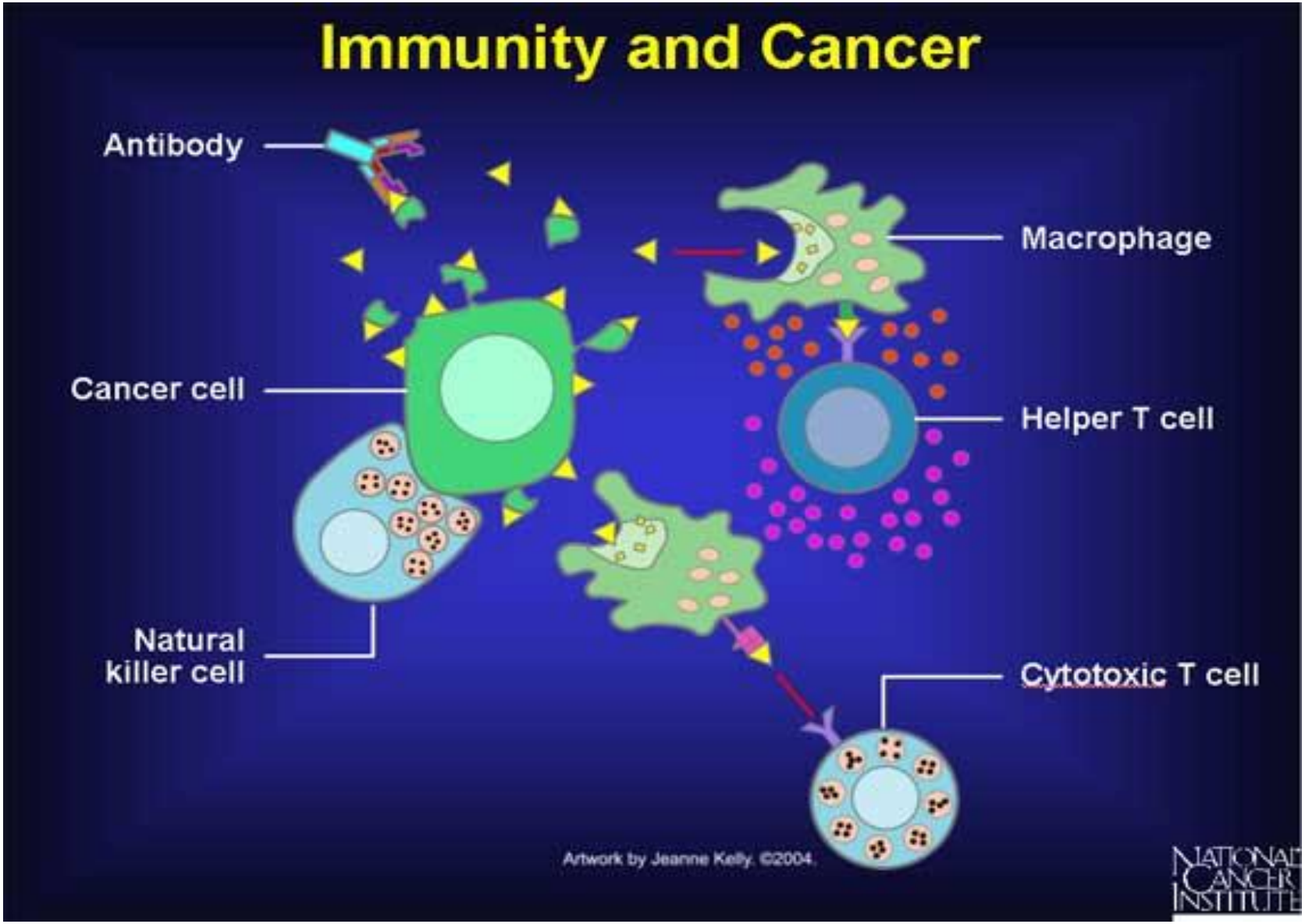
INSTITUTE


Immunity and Cancer
Antibody
Macrophage
Cancer cell
Helper T cell
Natural killer cell
Cytotoxic T cell
Artwork by Jeanne Kelly. ©2004.
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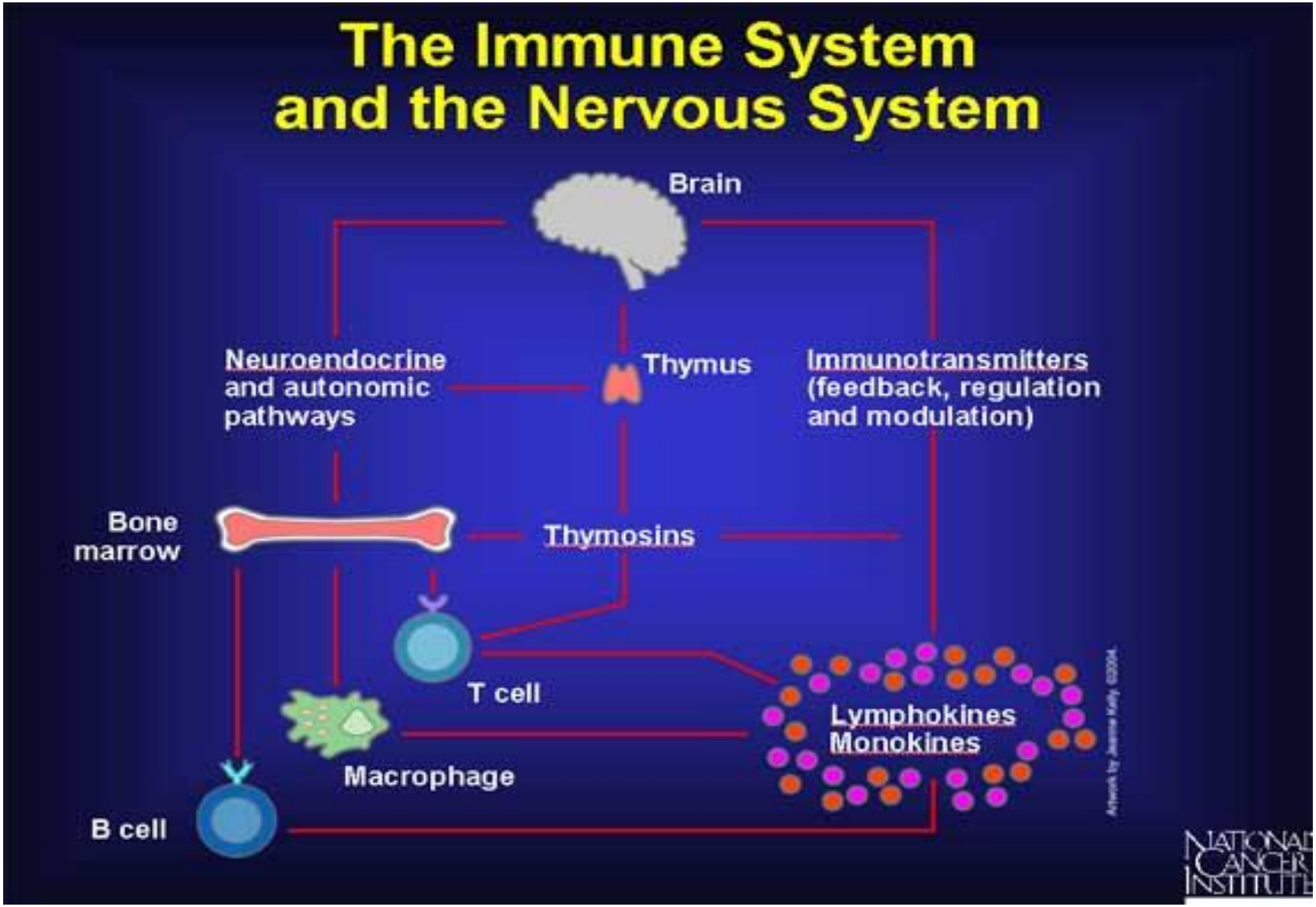
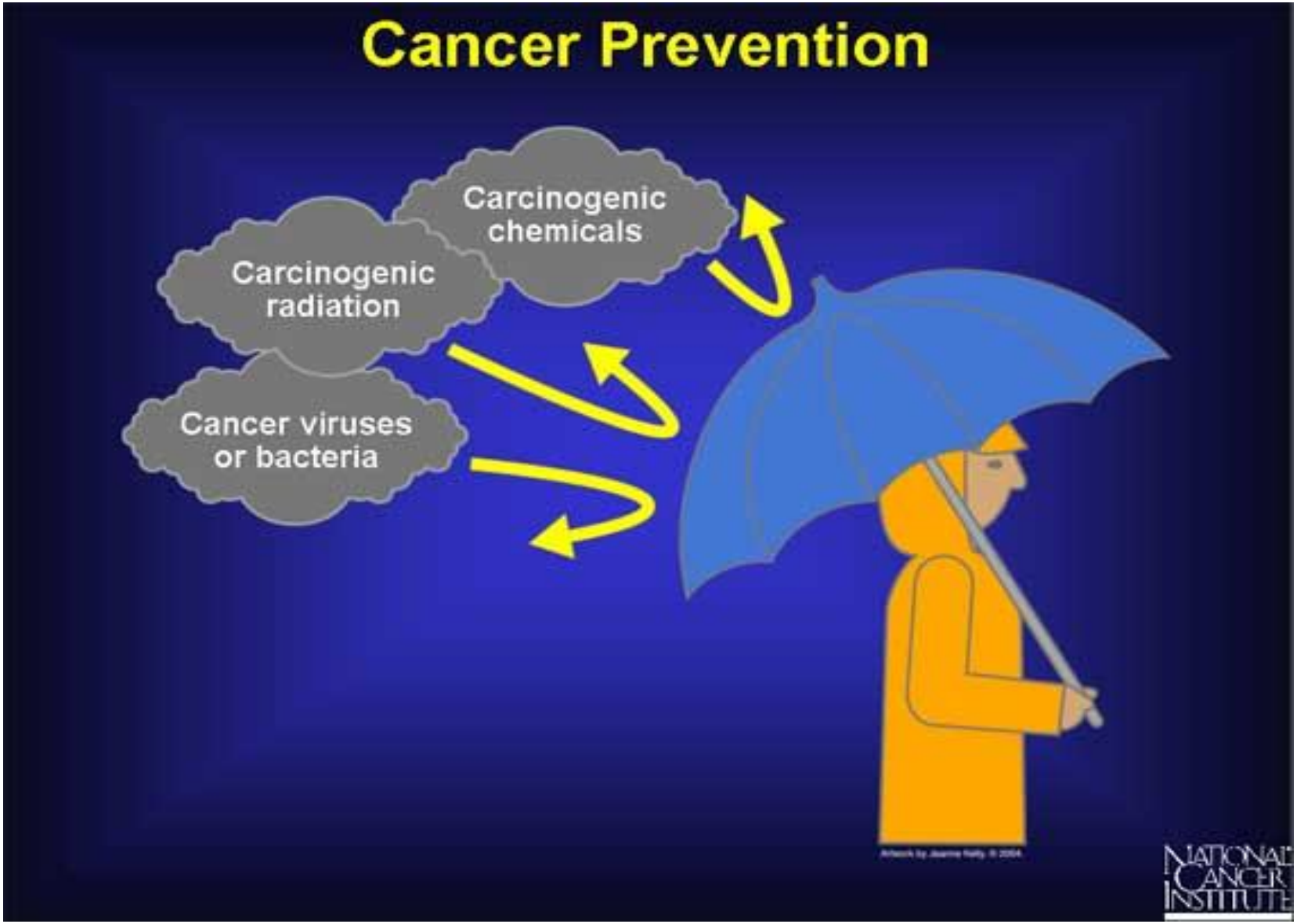

The Immune System
and the Nervous System
Brain
Neuroendocrine
and autonomic
pathways
Thymus
Immunotransmitters
(feedback, regulation
and modulation)
Bone
marrow
Thymosins
T cell
Lymphokines
Monokines
Macrophage
B cell


Cancer Prevention
Carcinogenic chemicals
Carcinogenic radiation
Cancer viruses or bacteria
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Avoid Tobacco

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Protect Yourself From Excessive Sunlight

Artwork by Jeanne Kelly. © 2004.

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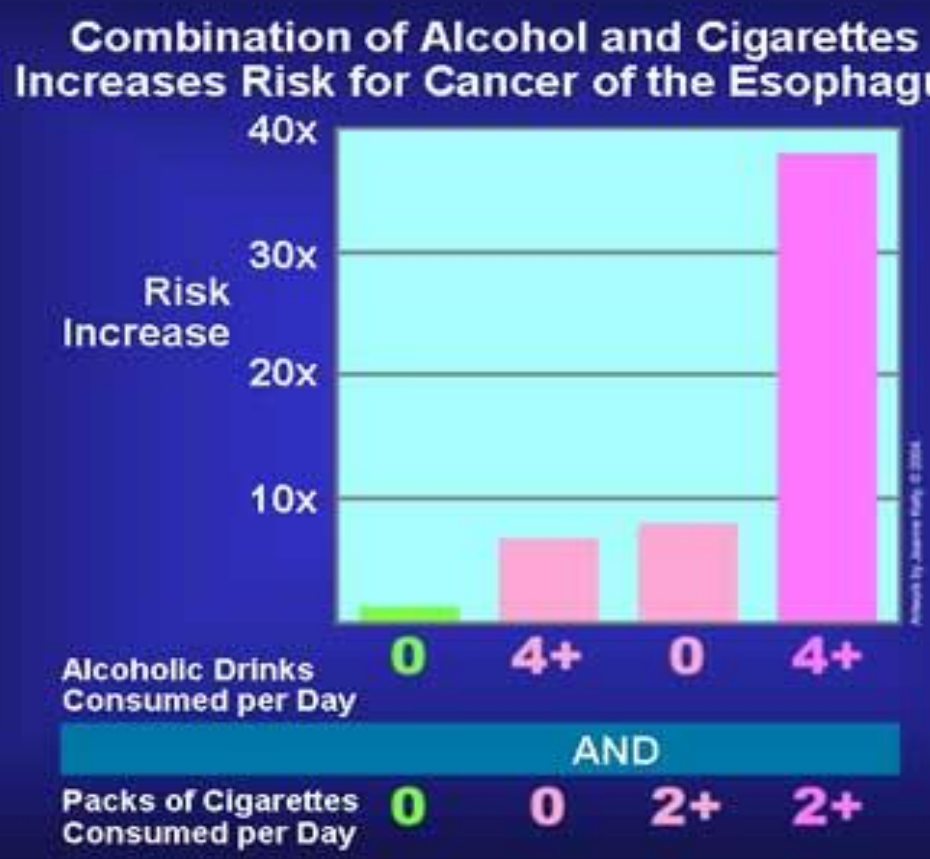
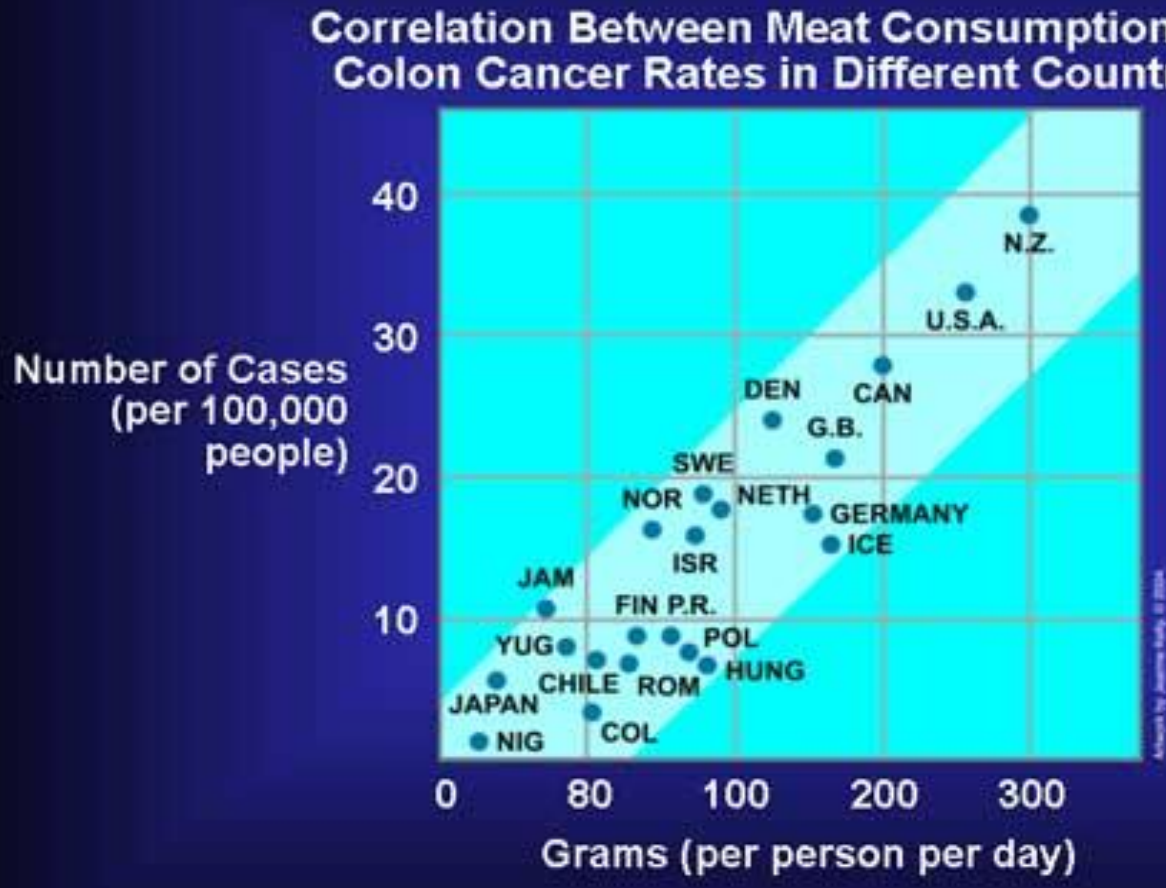
Limit Alcohol and Tobacco



Diet: Limit Fats and Calories



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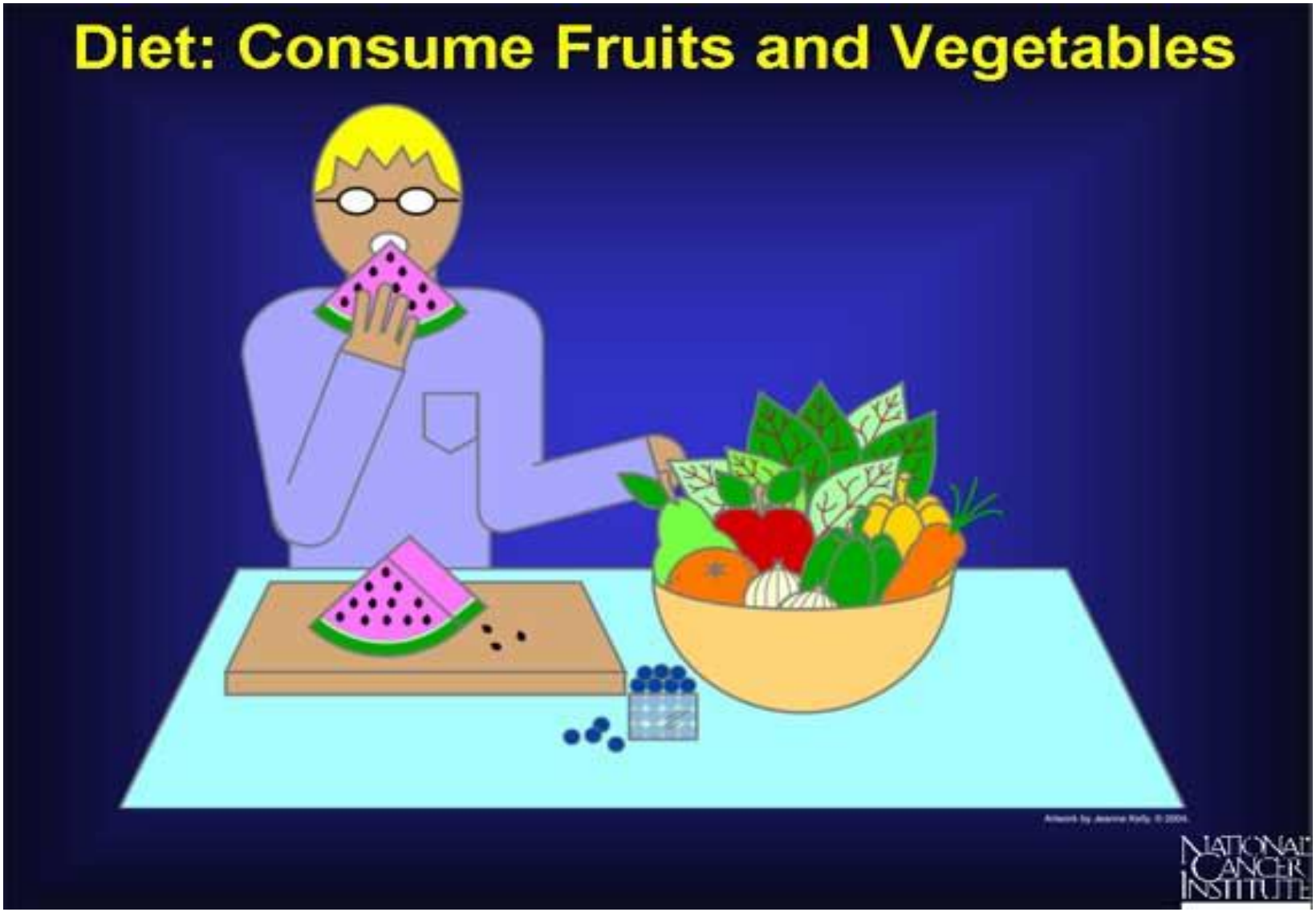
Diet: Consume Fruits and Vegetables
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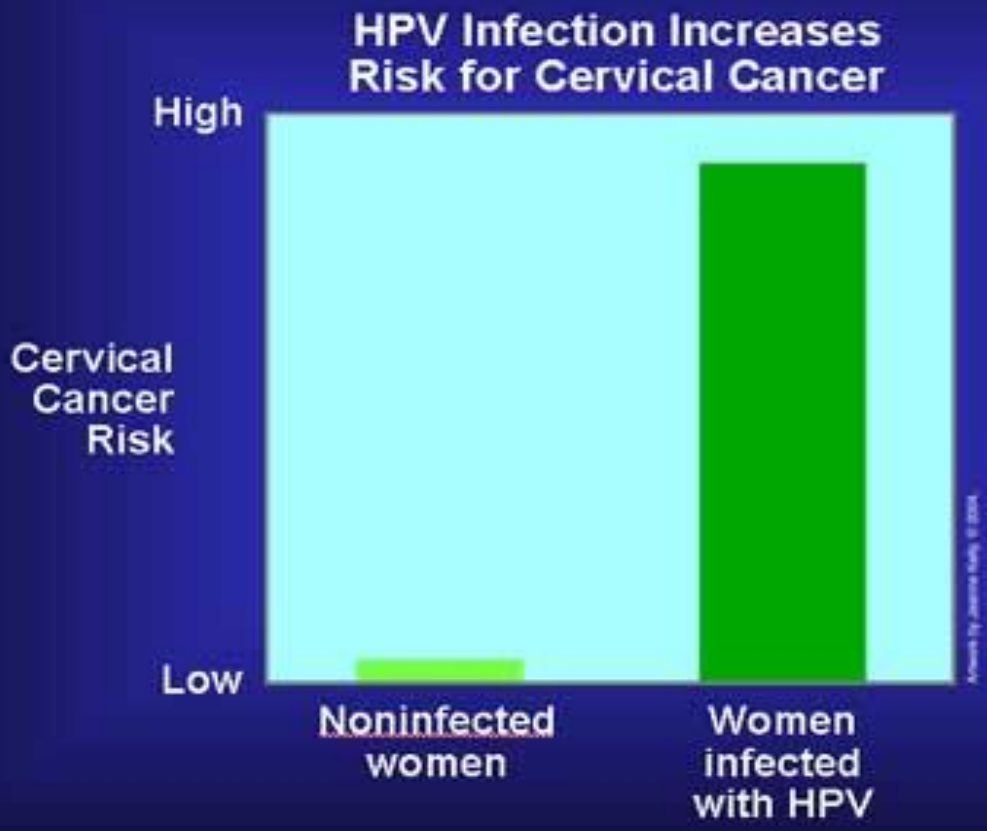
Avoid Cancer Viruses



Avoid Carcinogens at Work

Some Carcinogens in the Workplace

Carcinogen	Occupation	Type of Cancer
Arsenic	Mining, pesticide workers	Lung, skin, liver
Asbestos	Construction workers	Lung, mesothelioma
Benzene	Petroleum, rubber, chemical workers	Leukemia
Chromium	Metal workers, electroplaters	Lung
Leather dust	Shoe manufacturing	Nasal, bladder
Naphthylamine	Chemical, dye, rubber workers	Bladder
Radon	Underground mining	Lung
Soots, tars, oils	Coal, gas, petroleum workers	Lung, skin, liver
Vinyl chloride	Rubber workers, polyvinyl chloride manufacturing	Liver
Wood dust	Furniture manufacturing	Nasal

Artwork by Joanne Kelly. © 2004

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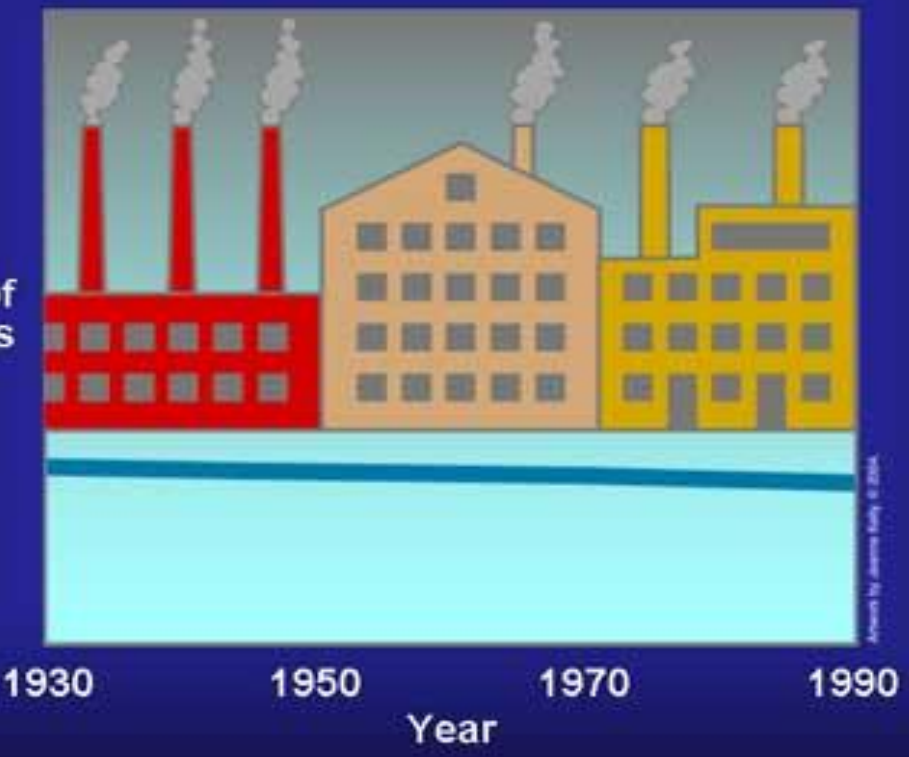
Industrial Pollution



Is There a Cancer "Epidemic"?