Cancer Treatment Update

Real Progress At Last!

Marty Yellin 2024

DISCLOSURE

I am not an Oncologist nor a MD. I received a Doctorate in Bio-Medical Engineering in 1969 from NYU, and I spent 4 years at NYU Medical School from 1999 to 2003, studying Genetics, CellBiology and Chronic Diseases.

All information herein is based upon discussions with Cancer researchers at NYU and Yale, reading many papers published in journals and over a dozen books over the last 15 years. A partial listing of my sources is given in the last slide

Agenda

- Historical Data
- What is Cancer; How Does it Develop
- What Are The Leading Causes of Cancer
- How Cancer Was Treated Until 2018
- Latest Approaches to Treating/Curing Cancer
- Conclusions

CANCER TREATMENT UPDATE

REAL PROGRESS AT LAST! Hopefully

In 1970 President Nixon declared war on Cancer. At that time over 600000 American died from Cancer each year. In spite of the development of many drugs over the last 50 years, 600,000 Americans still died of Cancer in 2022.

Now, after 15 years of development we have begun to establish new immunotherapy treatments which has finally allowed our own immune system to kill most cancers in our body. Work is progressing so that it is possible that most, if not all, cancers may be curable in the next 10-20 years.

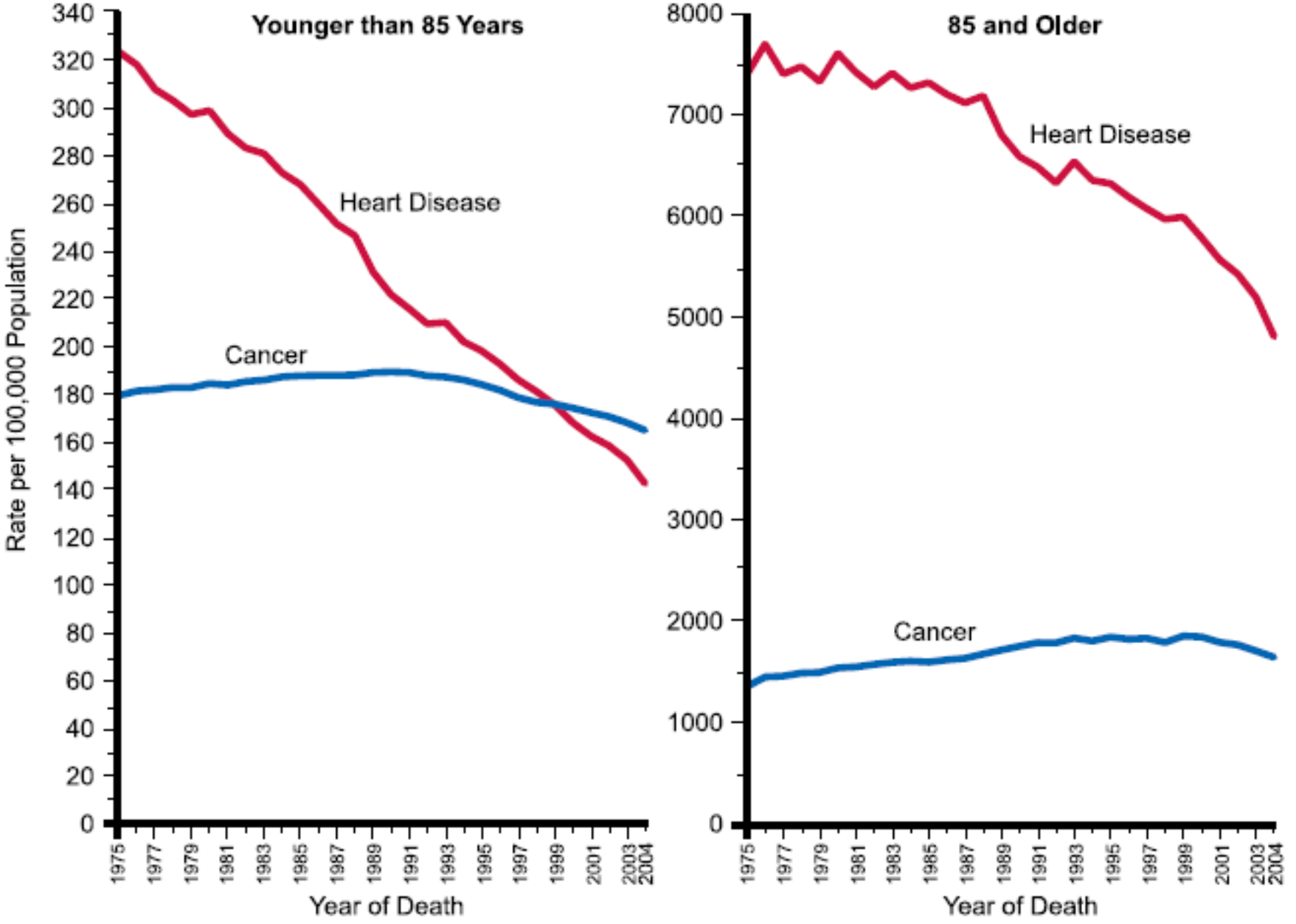
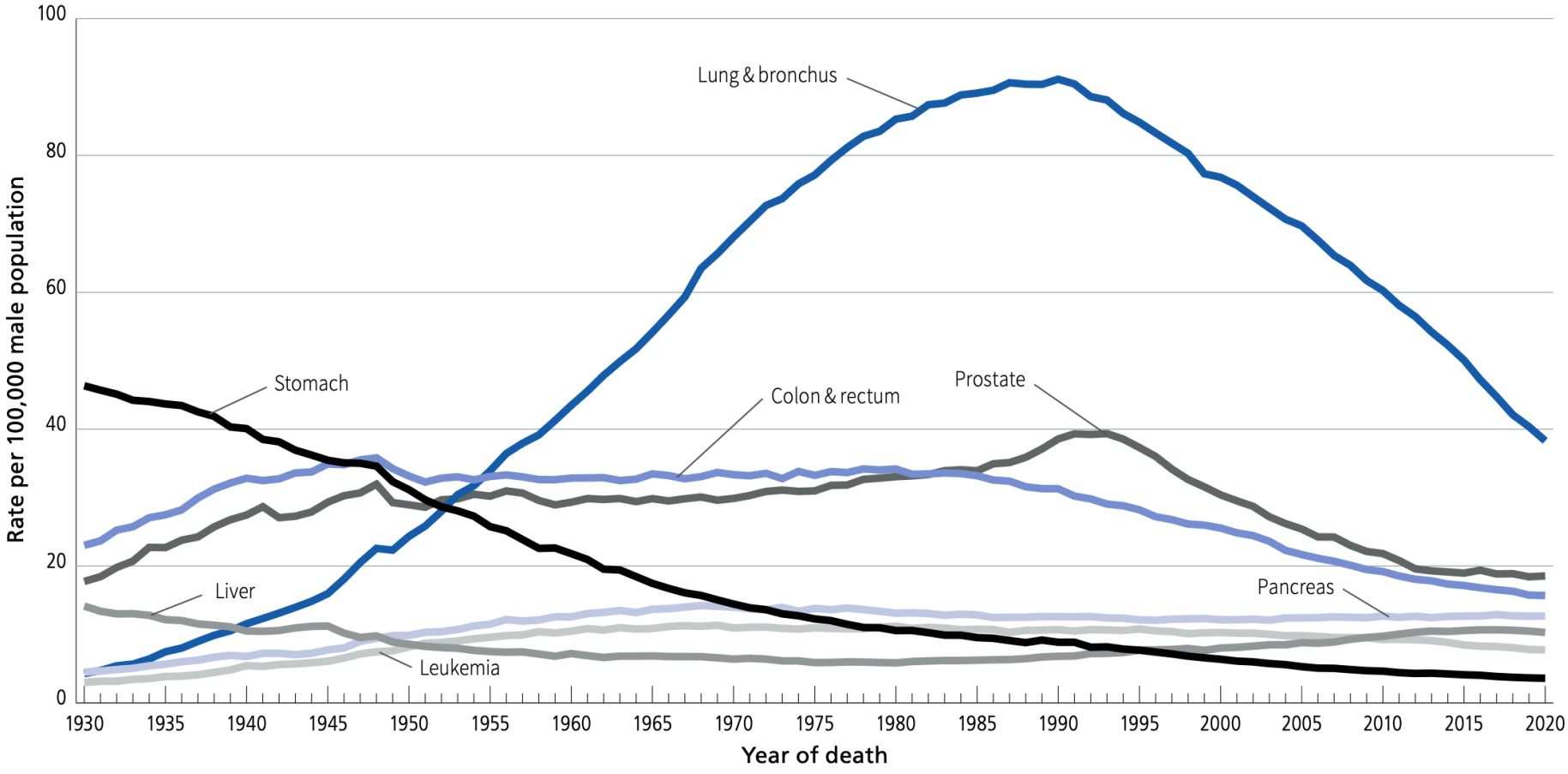

Younger than 85 Years
Heart Disease
Cancer
Rate per 100,000 Population
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2004
Year of Death
85 and Older
Heart Disease
Cancer
8000
7000
6000
5000
4000
3000
2000
1000
0
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2004
Year of Death

Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2020



Leading Sites of New Cancer Cases and Deaths

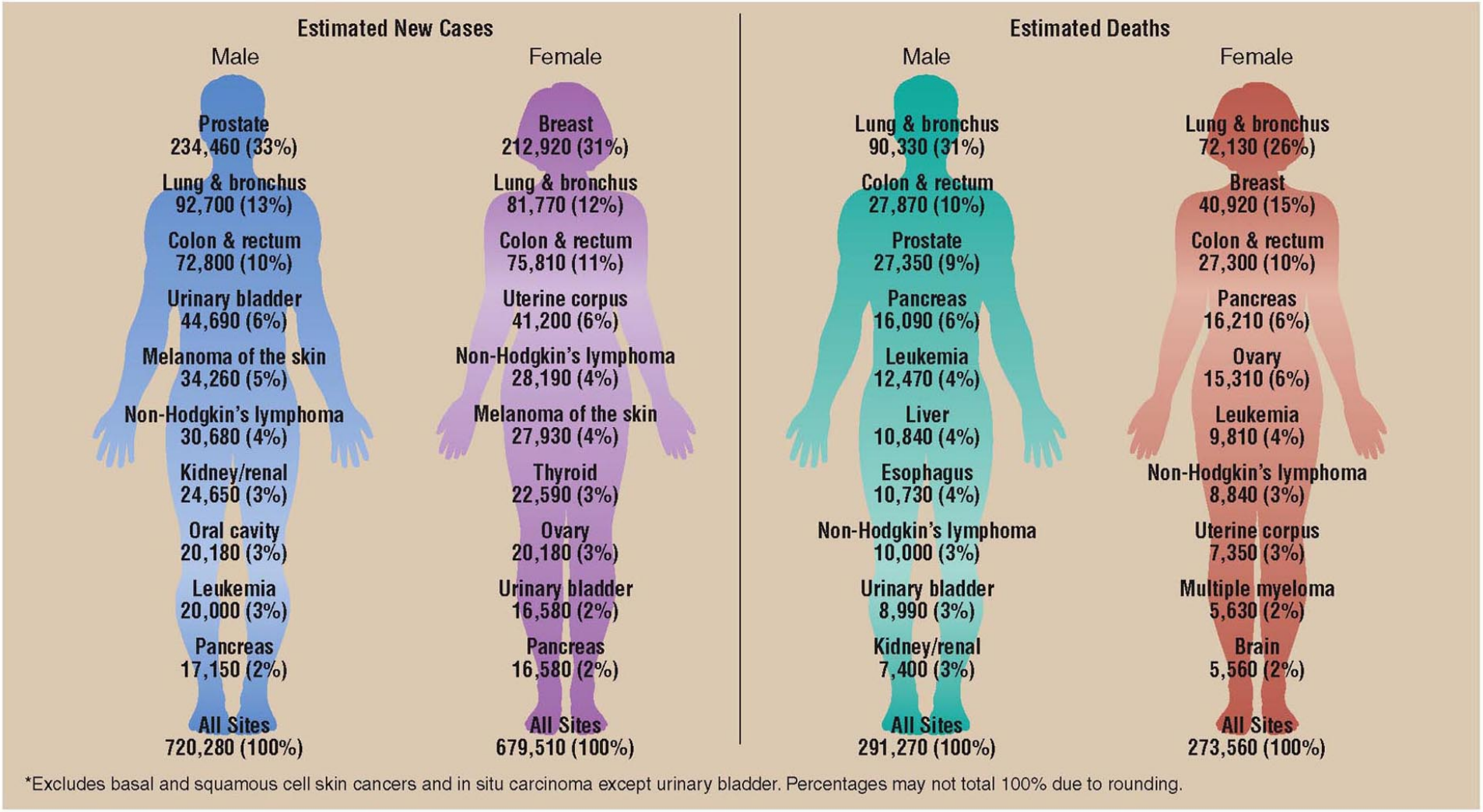
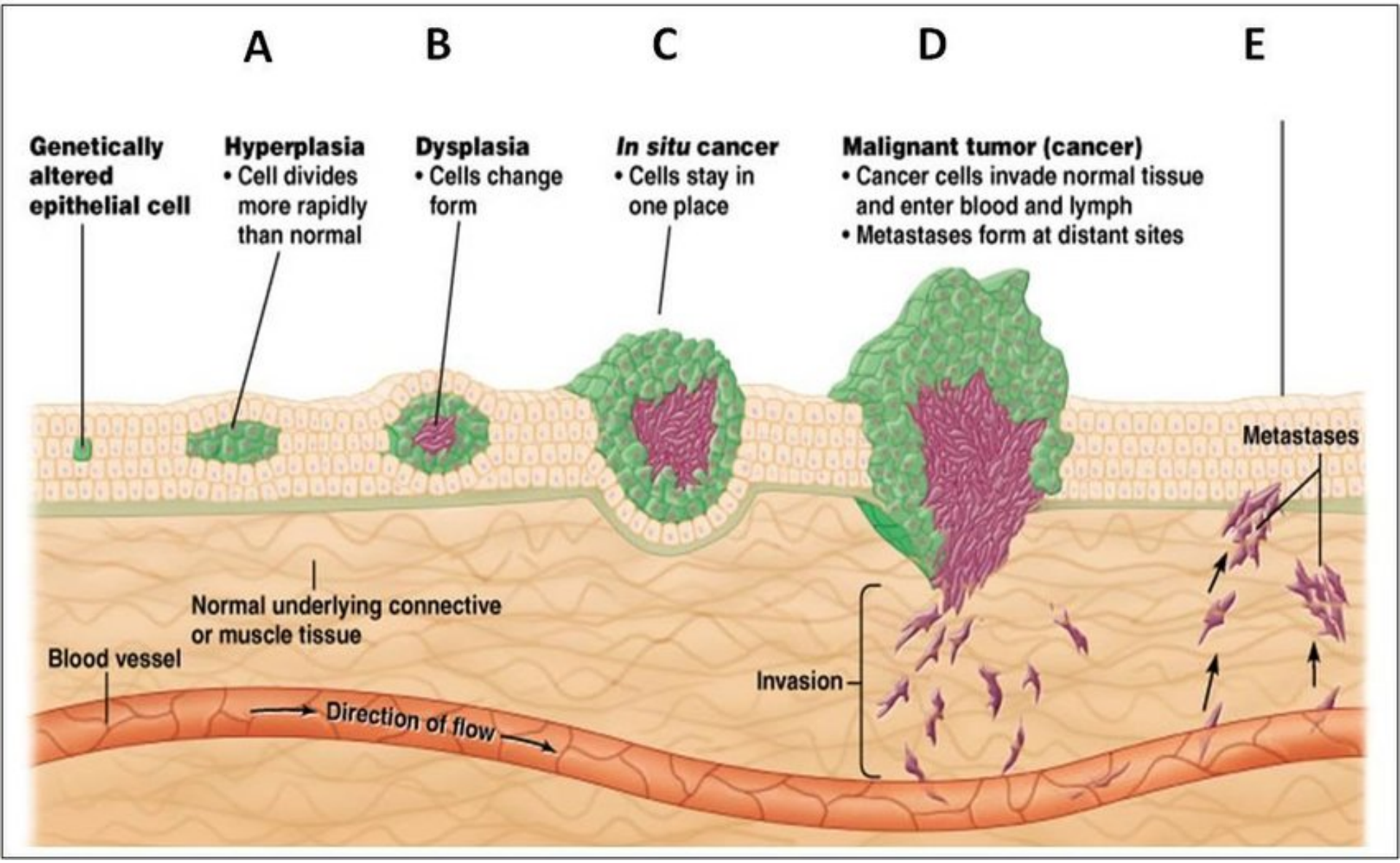


Figure 16.4

What is Cancer?

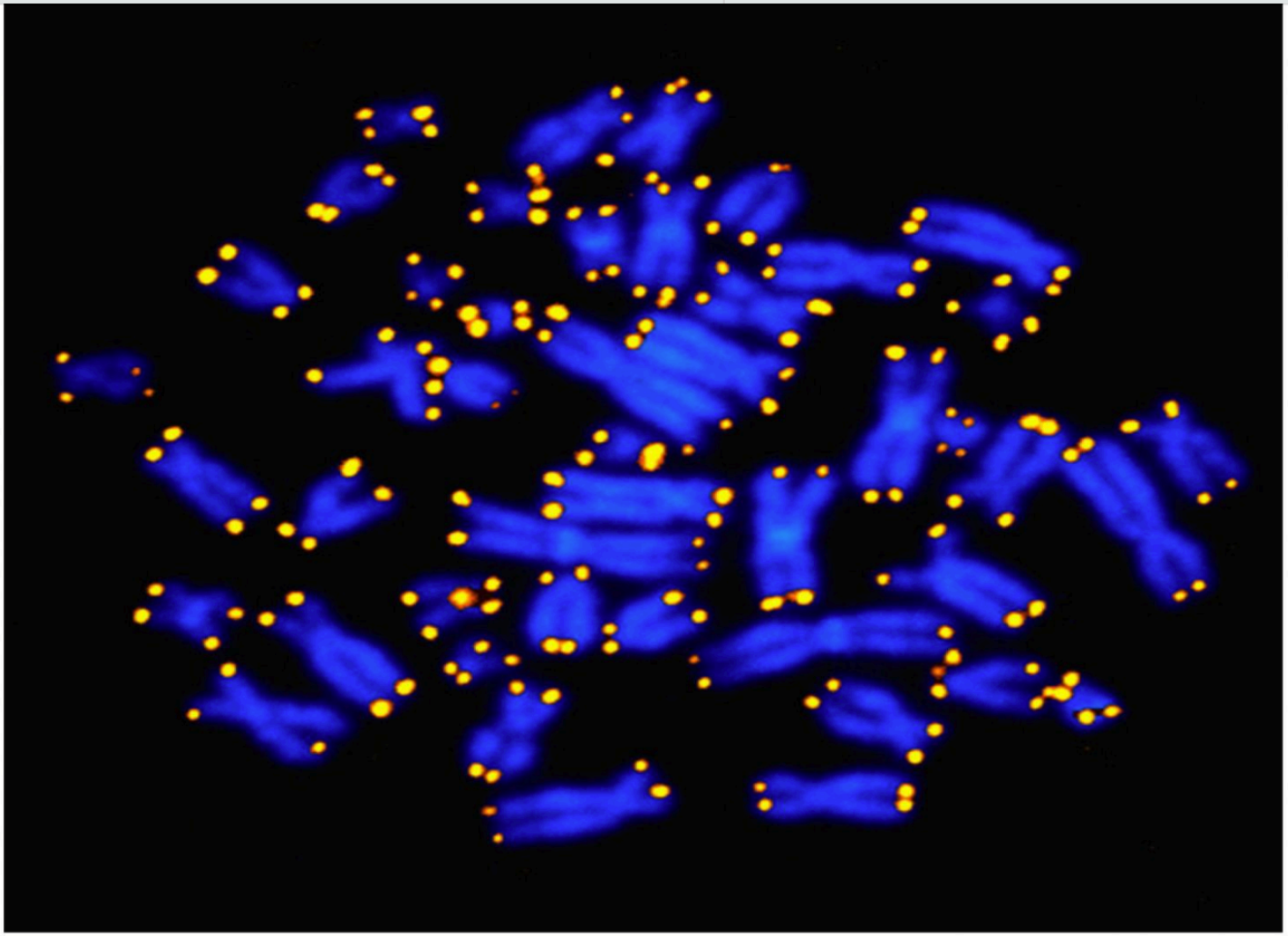
- All types of cancer start because of out-of-control growth of abnormal cells.
- Instead of dying, cancer cells continue to grow and form new, abnormal cells.
- Cancer cells can also invade other tissues.
  - Growing out of control and invading other tissues are what makes a cell a cancer cell.
- In most cases the cancer cells form a tumor. Some cancers, like leukemia, rarely form tumors.


A
B
C
D
E
Genetically altered epithelial cell
Hyperplasia
• Cell divides more rapidly than normal
Dysplasia
• Cells change form
In situ cancer
• Cells stay in one place
Malignant tumor (cancer)
• Cancer cells invade normal tissue and enter blood and lymph
• Metastases form at distant sites
Metastases
Normal underlying connective or muscle tissue
Blood vessel
Direction of flow
Invasion

The 6 Deadly Steps to Metastatic Cancer

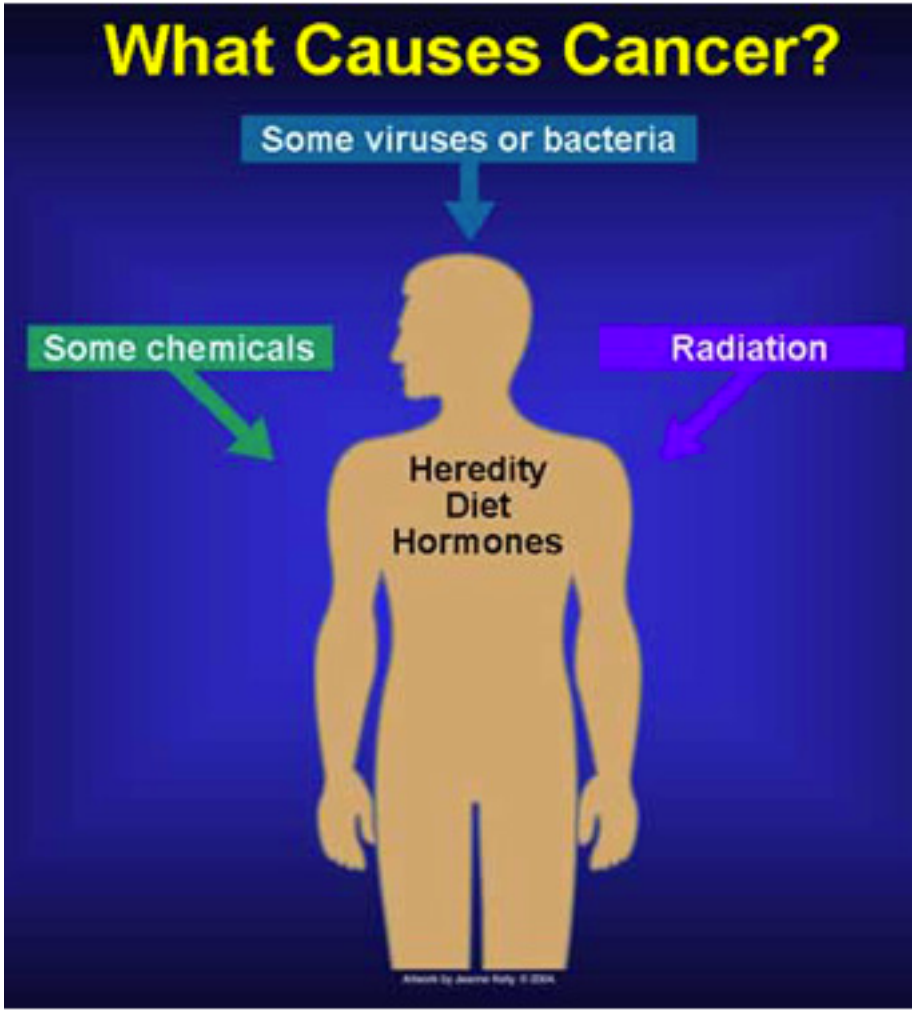
- Oncogenes turn on- Runaway cell reproduction
- Tumor suppressor Genes turn off- no "brakes"
- Cell grows back Telomeres- becomes immortal
- Cell dissolves Tissue- Leaves tissue
- Cell grows blood supply- Allows nourishment
- Cell survives bloodstream to Bone, Liver, Brain, etc.

At this point chance of survival is/(was poor!!)



Blue: Chromosome; Yellow: Telomere

Our cells have 46 chromosomes. Each chromosome has 4 telomeres for a total of 184. Not all telomeres shrink at the same speed though. Some of them shorten faster than others, so some of our telomeres may be long while some of them may be short.


What Causes Cancer?
Some viruses or bacteria
Some chemicals
Radiation
Heredity
Diet
Hormones

Factors Causing Cancer United States*

Factors	% Cancer Deaths
Tobacco	30
Alcohol	3
Diet	32
Food Additives	3
Sexual Behaviour	6
Occupation	4
Pollution	2
Infection	10
Inherited	8

**** National Institute of Health***

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Cancer risk factors you can't control

Still, there are other risk factors that can't be controlled. The greatest of these is aging. The older we get, the greater the risk of developing cancer. Other uncontrollable factors include:

- Previous cancer diagnosis
- Family history of cancer
- Infections or viruses, such as helicobacter pylori (H. pylori) infection, Epstein-Barr virus (EBV, mononucleosis or "mono") and human papillomavirus (HPV)
- Genetics or inherited cancer syndromes, such as Lynch syndrome, or inherited mutations such as BRCA1 or BRCA2
- Weakened immune system, including from autoimmune diseases such as rheumatoid arthritis or lupus, and inherited immune disorders, such as Wiskott-Aldrich syndrome
- Certain prescribed drugs, such as methotrexate or TNF inhibitors, hormone replacement therapy or immunosuppressive drugs used after organ transplants
- Medical conditions, such as diabetes or chronic inflammation

Cancer risk factors you can control

Through decades of cancer research, scientists have determined a range of common cancer risk factors and possible causes. Many are lifestyle choices that may be changed to reduce the risk. Some of the most common controllable cancer risk factors include:

- Tobacco smoking, or exposure to second-hand tobacco smoke
- Significant alcohol consumption (more than a glass a day for women or more than two glasses a day for men)
- Lack of physical activity
- Obesity
- Poor eating habits, including a diet high in meat, fat and/or processed foods
- Sun exposure, or other exposure to ultraviolet light (such as from tanning beds)

How does processed and red meat cause cancer?

Chemicals that are found in the meat, added during processing or produced when cooking it, can increase the risk of cancer.

These chemicals include:

- **Nitrates and nitrites**

These are used to keep processed meat fresher for longer. When we eat them, nitrates and nitrites can become N-nitroso chemicals (NOCs) that can damage the cells that line our bowel. This damage can lead to bowel cancer. Added nitrates may be the reason why processed meat increases the risk of bowel cancer more than red meat.

- **Haem**

This is naturally found in red meat. When digested, haem also breaks down into the cancer-causing N-nitroso chemicals.

- **Heterocyclic amines (HCAs) and polycyclic amines (PCAs)**

These chemicals are produced when processed and red meat is cooked at high temperatures, which includes grilling or barbequing.

Environmental factors

Environmental factors may also play a role in cancer. Sunlight or ultraviolet light exposure is a major environmental risk factor, though it's one that may be lessened through use of sunscreen and the covering of exposed skin when outside.

Other environmental factors include:

- Radiation exposure, including from radiation therapy for cancer treatment or from nuclear or industrial sources
- Chemical exposure, including carcinogens from asbestos, radon, pesticides, fertilizers, herbicides, insecticides and toxins such as vinyl chloride or polychlorinated biphenyls (PCBs), or from working in the coal, metal or rubber industries

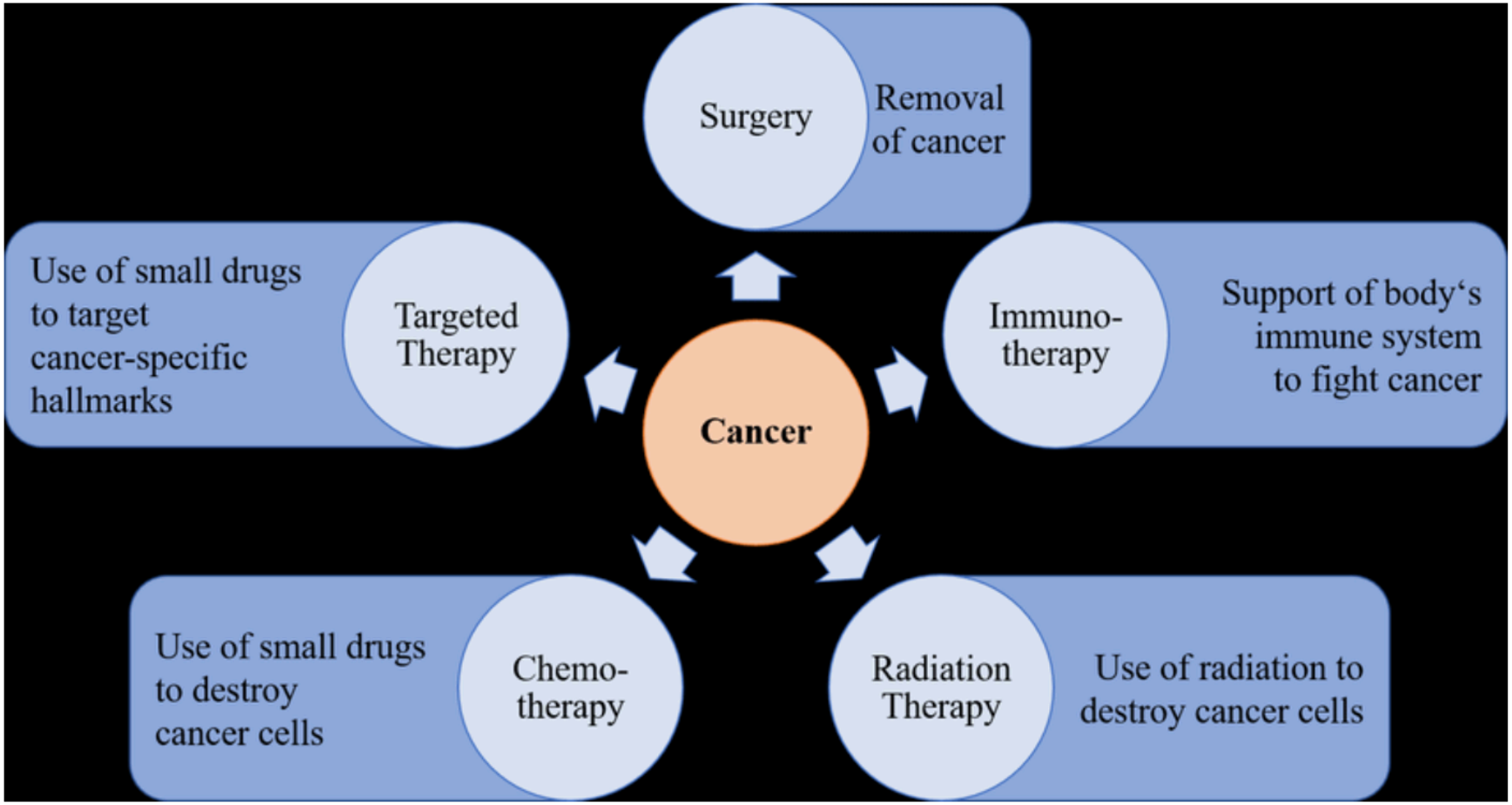
Standard Cancer Treatments

- Surgery
  - Can cure if tumor is local
  - Can make Cancer spread if metastases occurred
  - Risk of infection/nerve damage
- Radiation
  - Similar to Surgery but little chance of infection
  - Can permanently damage nearby tissues
  - Can cause new Cancers
- Chemotherapy
  - Typically it may not cure Cancer, only hold it in bay until cancer becomes immune to drug
  - Terrible side effects including death
  - Very expensive- may add only a few months

Cancer Treatment Update

“Real Progress At Last Hopefully”

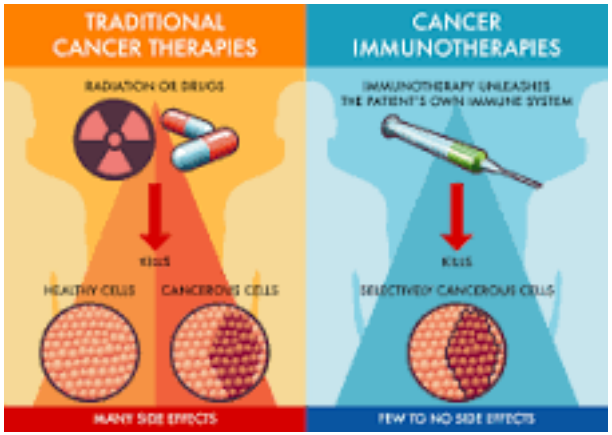
Marty Yellin 8/20/23



Methods of cancer treatment.

New Hope In Cancer Treatments

- Immunotherapy- Immunotherapy drugs are now used to cancers of the bladder, breast, colon, kidney, lung, and prostate, as well as leukemia, lymphoma, multiple myeloma, and melanoma
- Cancer-fighting vaccines- Cancer vaccines, can prevent some types of cervical cancers and certain liver cancers.
- Gene therapy- Gene therapy replaces a faulty gene or adds a new gene in an attempt to cure disease or improve your body's ability to fight disease: Gleevec for Leukemia, Colon Cancer


TRADITIONAL CANCER THERAPIES
RADIATION OR DRUGS
KILLS
HEALTHY CELLS
CANCEROUS CELLS
MANY SIDE EFFECTS
CANCER IMMUNOTHERAPIES
IMMUNOTHERAPY UNLEASHES THE PATIENT'S OWN IMMUNE SYSTEM
KILLS
SELECTIVELY CANCEROUS CELLS
FEW TO NO SIDE EFFECTS

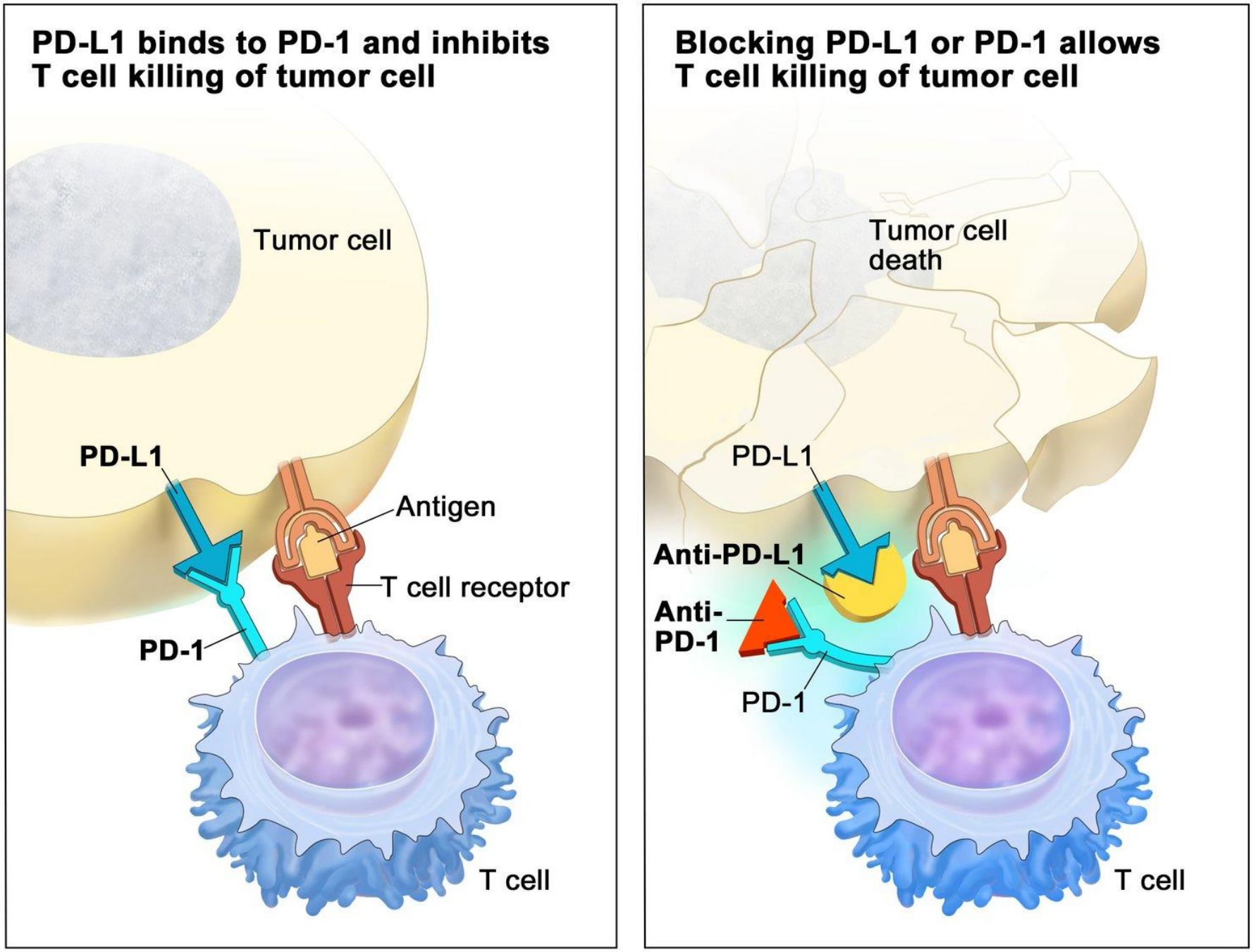
How Does Immunotherapy Work Against Cancer ?

As part of its normal function, the immune system detects and destroys abnormal cells including many cancer cells.

For instance immune cells can be found in and around tumors, a sign that the immune system is responding to the tumor Even though the immune system can prevent or slow Cancer growth, Cancer has ways to avoid destruction by the immune system.
For example they may:

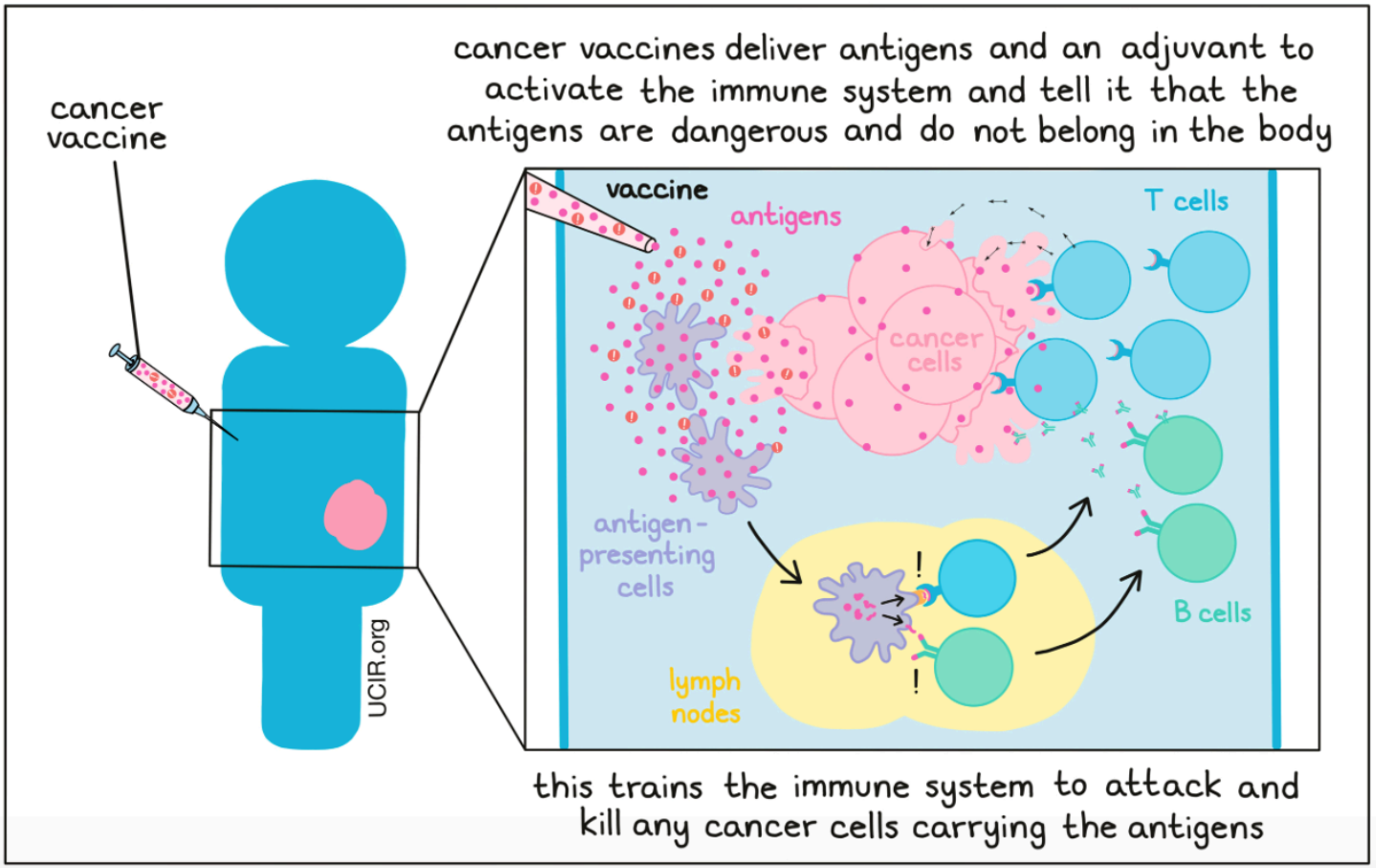
- **‘Have genetic changes making them less visible to the immune system**
- **Have surface proteins that turn off immune cells**
- **Change the normal cells within the tumor so they interfere with how the immune system responds to Cancer cells**

Immunotherapy attempts to overcome these problems

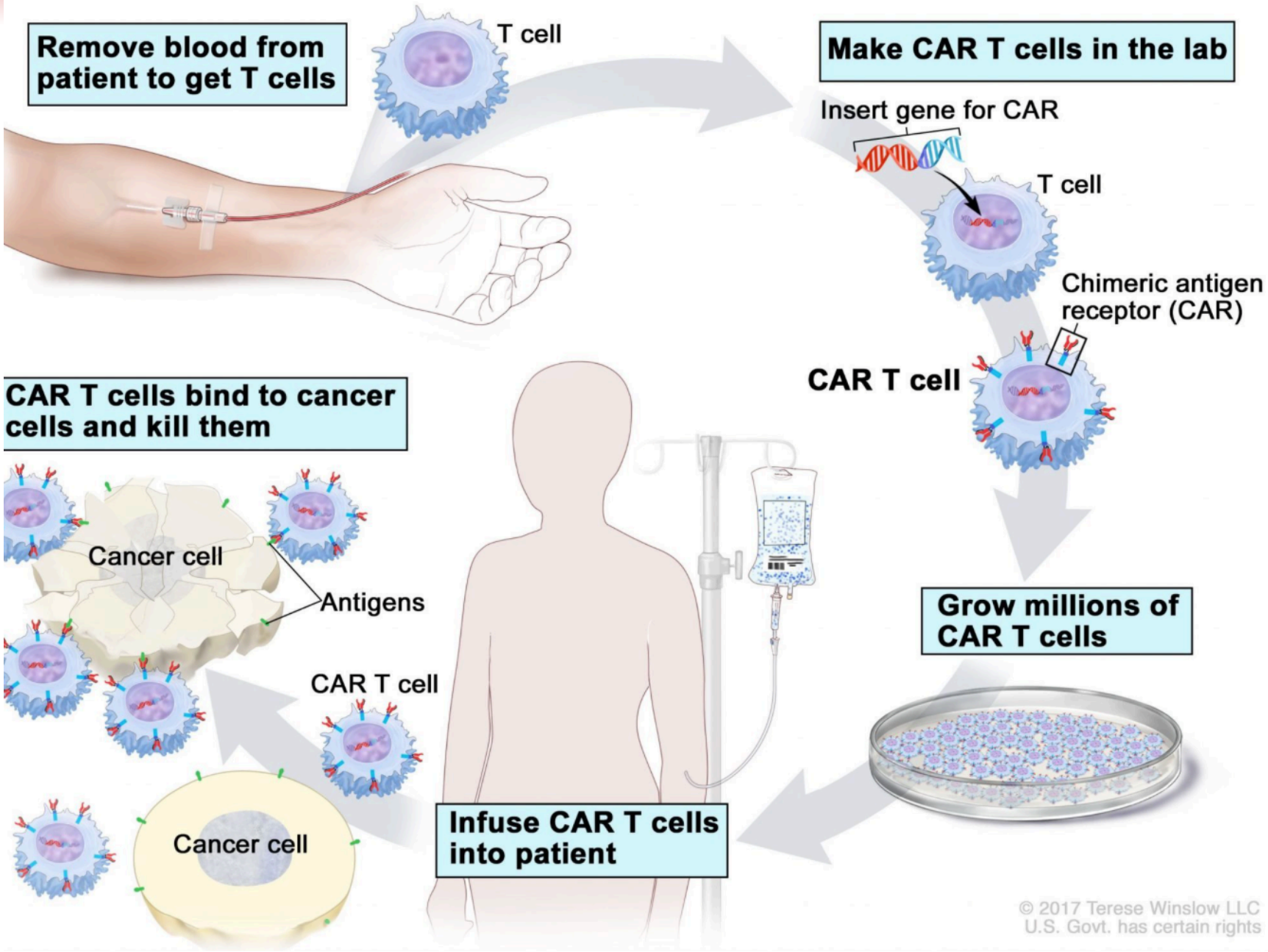


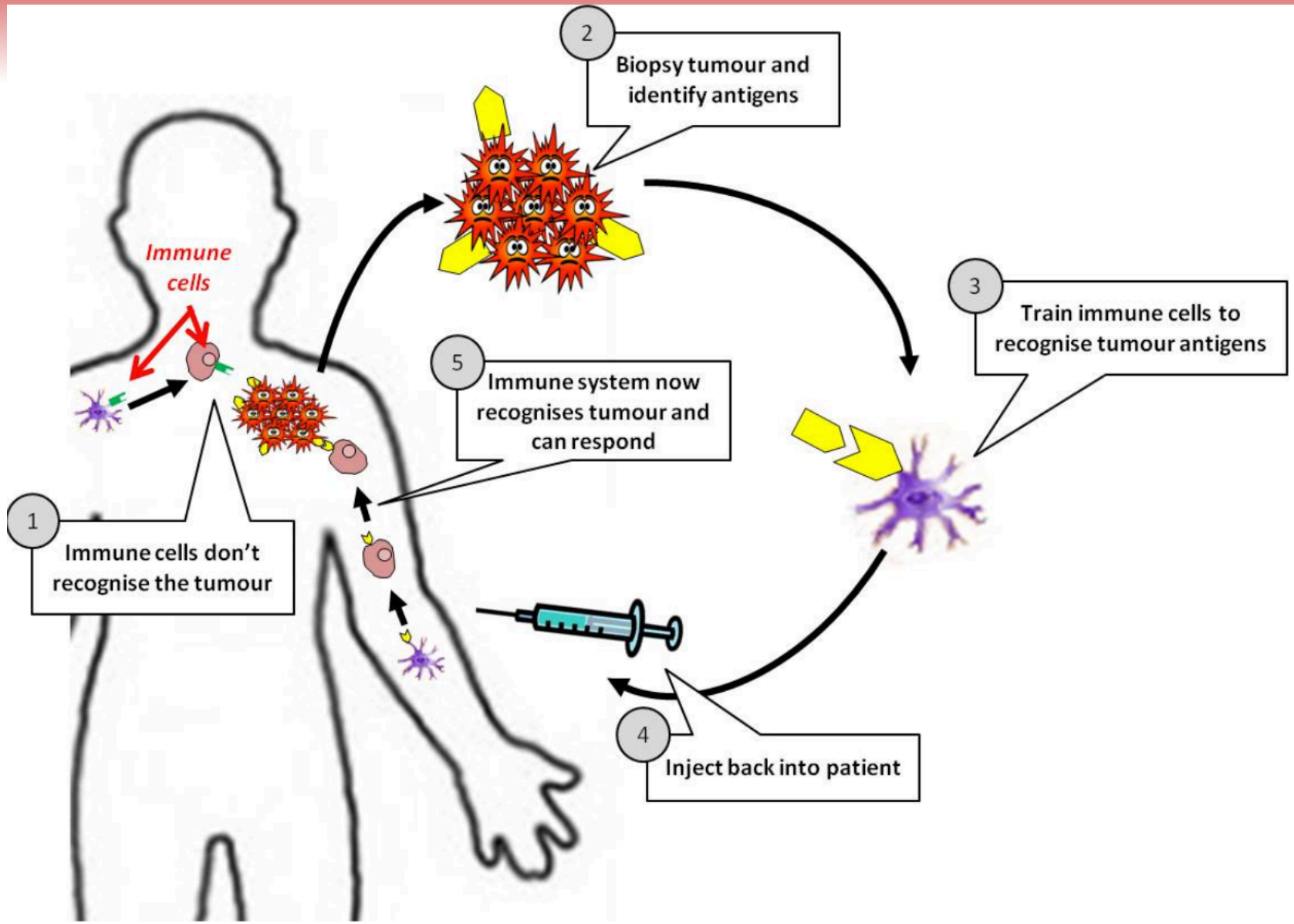
How do cancer vaccines work?

Like vaccines that protect against pathogens, vaccines that treat cancer work by introducing cancer to the immune system in a way that triggers a strong immune response. Developing a cancer vaccine is usually a personalized process that involves identifying and selecting antigens that are unique to a patient's cancer (i.e., not found in normal, healthy cells in the body) and can be recognized by the immune system. Once selected, these antigens can be included in a vaccine. Currently there are many different strategies for both choosing antigens and delivering vaccines.



CAR T-cell Therapy





Biologically Active

Conclusions

- Mutations are always occurring in the body because DNA is not very stable. If it was stable evolution would not have occurred
- Lifestyle changes have a major impact on preventing cancer.
- Finally immunology and gene correcting therapies are leading to ways to defeat Cancer even if it has spread.
- Exciting advances are happening yearly. Most, if not all Cancers may be curable within 10-20 years

HOWEVER

- ***In Some People (about 20%) none of these approaches prevents the Cancer from Recurring. Not enough statistical data exists yet to understand why***

- ***Sometimes the Immune System Overreacts and attacks normal cells that can lead to auto immune diseases and even death. Researchers are trying to learn how to avoid this.***

- ***Right now these procedures are ridiculously expensive. Hopefully there cost will become more reasonable as competition increases.***

.Interviews/Discussions

Dr. Ellen Foxman, *Associate Professor Laboratory Medicine & Immunobiology, Yale.*

Dr.Peter Cresswell, *Eugene Higgins Professor of Cell Biology, Yale*

Dr. Dan Pittman, *T-lymphocyte development, Cancer Immunology, microbiome affects on the Immune System, NYU*

Two Day Conference: *"Advances in Immune-Oncology 2023", NYC*

Tens of Cancer Research Post-Docs that I do volunteer work with at Yale Medical School.

Personal Reading

"The Biology of Cancer" *by Dr. Robert Weinberg*

" Cancer"*, by Dr. Robert McAllister*

" Genes and The Biology of Cancer"*, by Drs.,Harold Varmus and Robert Weinberg*

" An Elegant Defense, *The Extraordinary New Science of the Immune System" by Dr. Matt Richtel*

"The End of the Beginning" *by Dr. Michael Kinch*

The Breakthrough*, Immunotherapy and the Race to Cure Cancer:" by Charles Grabber*