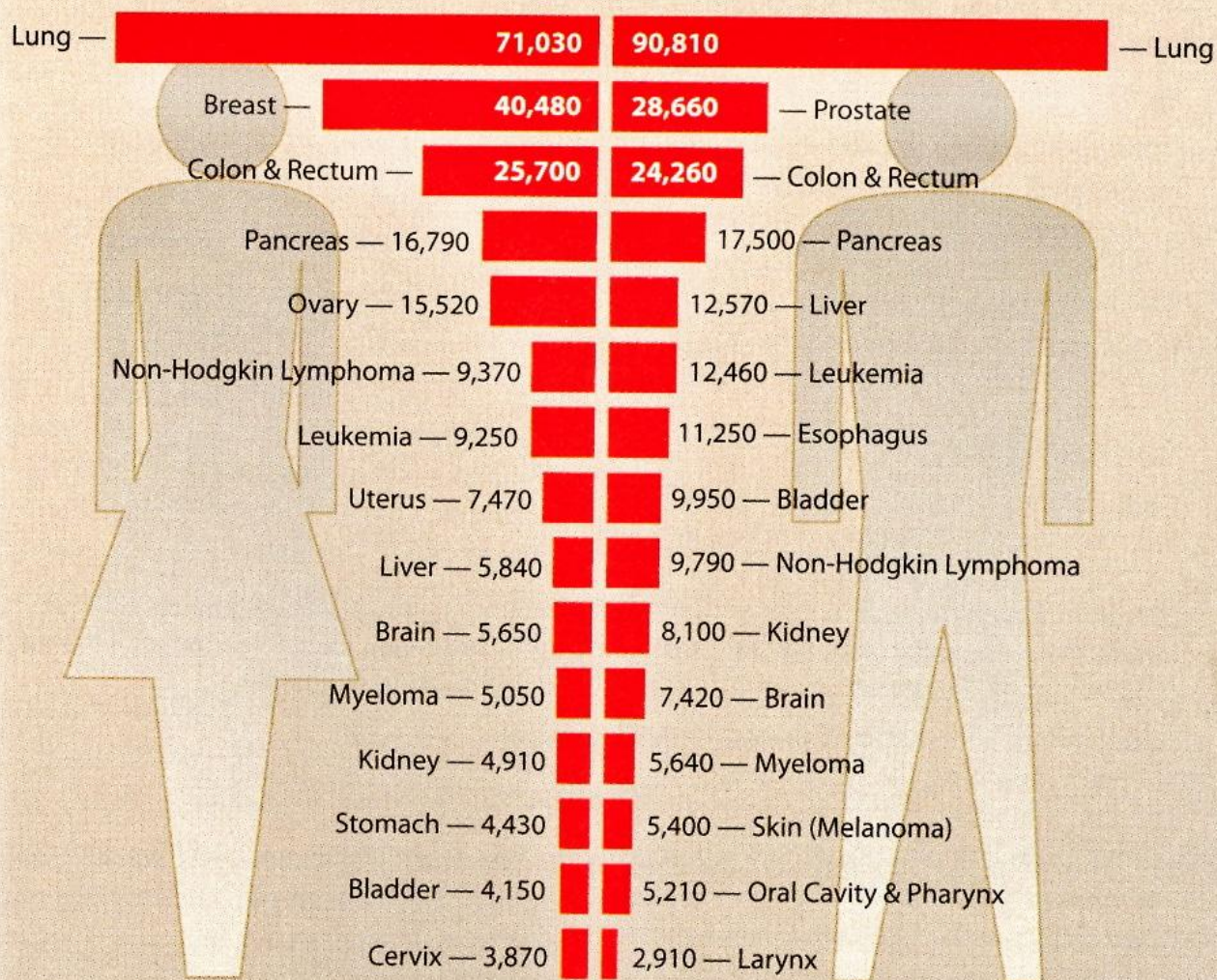


Cancer

Cancer : 2d leading killer

- 1 in 2 men, 1 in 3 women: in North America: cancer during life

LEADING CANCER KILLERS



Estimated number of cancer deaths for 2008.

Source: *Cancer Facts & Figures 2008*, American Cancer Society.

What is cancer?

- Uncontrolled growth/spread of abnormal (malignant) cells: “out of control”
- Your body: 100 trillion cells
- Baby → child → teen → adult
- Cells divide rapidly, growth, adult size

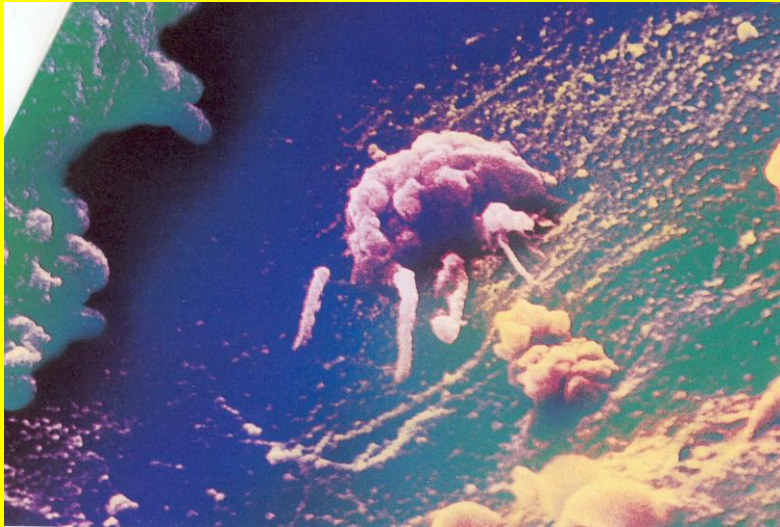
- Adult cells “maintenance mode”
- Divide only: replace dead cells or injury
- Normally delicate balance:
cell growth \longleftrightarrow “programmed
cell death”
(**apoptosis**- orderly process)
- Example: UV damage skin:
peeling

Cancer cells

- No controls to stop dividing
- Crowd out normal cells
- Compete normal cells: **nutrients**
- Cancer cells → **tumor** → destroy
normal cells

Cancer cells **spread**- blood & lymphatic system → other tissues

Metastasis: 90% cancer deaths



Liver Metastases from Lung Cancer

Melanoma chewing through skin collagen

Metastasis

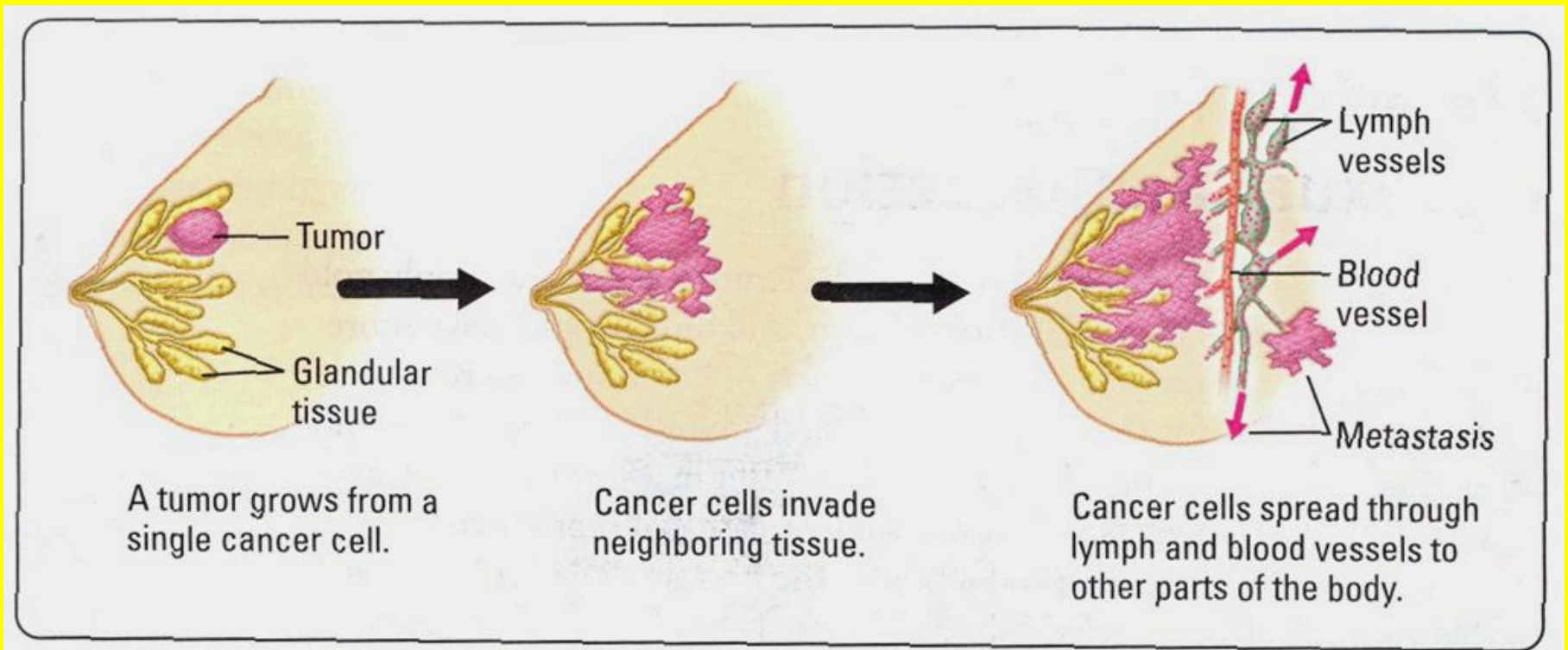


Figure 8.10 Growth and metastasis of a malignant tumor of the breast.

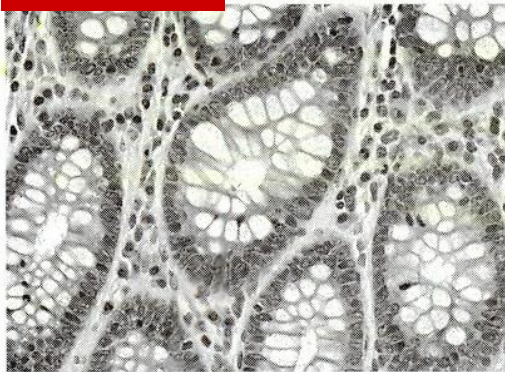
ing. Paclitaxel is made from
ree found mainly in the

Benign (harmless, non-cancerous)

- Tumor: cells grow locally, don't damage healthy tissue

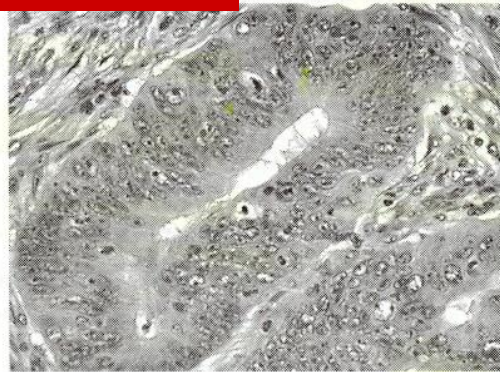


Normal Cells



This slide shows normal tissue cells. The cells are oval shaped, with all of the cells looking similar. They're very well organized into a single layer of cells.

Cancer Cells



This slide shows cancer cells. Cancer cells are stacked up and highly disorganized. They also look very different from each other.

Benign Tumor Cells



This slide shows a benign tumor (fibroadenoma). Unlike cancer, the cells remain well-formed. Benign tumors also don't invade normal surrounding tissue.

Cancer Cells Live Forever **In Vitro**

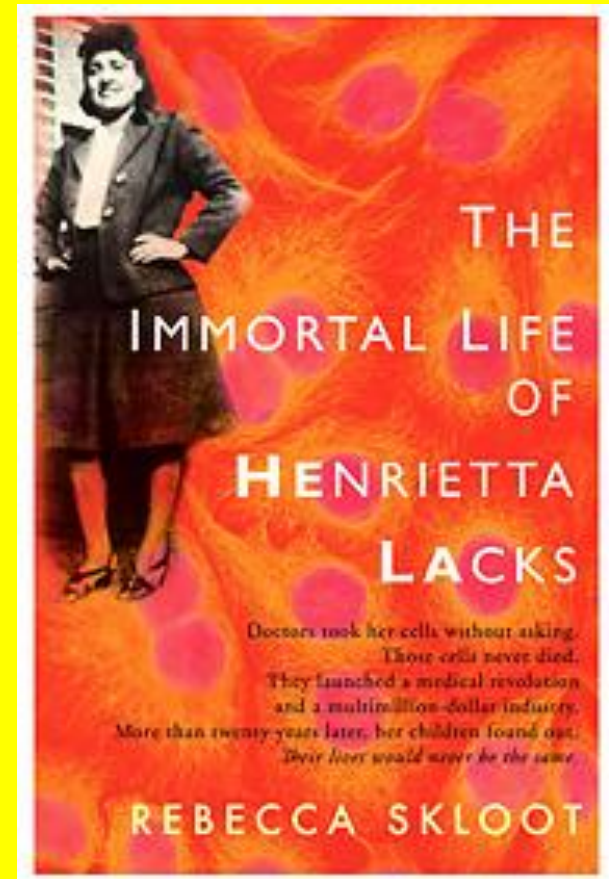
1951 Henrietta Lacks died
aggressive **cervical cancer**
at Johns Hopkins Baltimore

- Doc snip- **cervical tissue:**
gave to researcher
- Family **not** notified
- Her cells “Multiplied like
crazy and never died”
in vitro (NY Times 2/2/10)
- Her cells: **“immortal”**

- Named **HeLa** cell line
- HeLa cells research:
 1. 1st Polio vaccine
 2. Went into outer space:
study: zero gravity
 3. Drug development:
Parkinson's, leukemia,
influenza

2001: Her daughter told about
HeLa cells

- Held **frozen vials** of her mother's cells at Johns Hopkins
- Since 1951, tons of HeLa cells sold for research for \$millions profits by company
- Family received **nothing**
- Today questions: **"tissue rights" & informed consent**



200 different types- cancer

Major types

- Carcinomas- start on outside/inside surfaces- skin/colon (common)
- Sarcomas: start- bone/muscles
- Lymphomas: start- lymph nodes
- Leukemias: origin bone marrow- blood

Slow Development

- Most cancers: **5-40 years** after exposure to cancer-causing agent (**carcinogen**)
- Lung cancer: **25** years after you start smoking

What causes cancer?

Bad combos: **Interaction: lifestyle, environment, genetics**

- Some genes (DNA) normally regulate **cell division/repair**
- Have “potential” to start cancer: **proto-oncogenes**
- Proto= Greek: “first”
- Oncos= Greek: “mass/tumor”

3 steps- cancer development

- 1. Initiation:** DNA mutated
- 2. Promotion:** mutated cell-divides **uninhibited** (no brakes)
- 3. Progression:** cancer cells grow out of control: invade healthy tissue, **metastasize**

Initiation →

Promotion →

Progression →

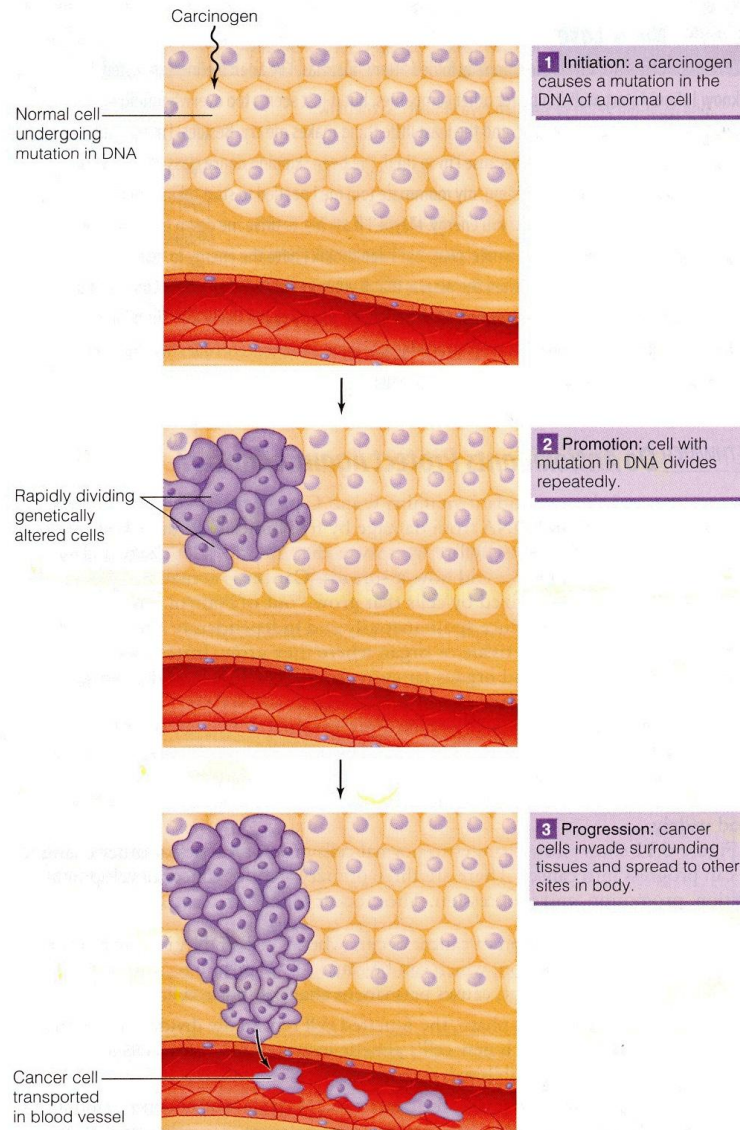

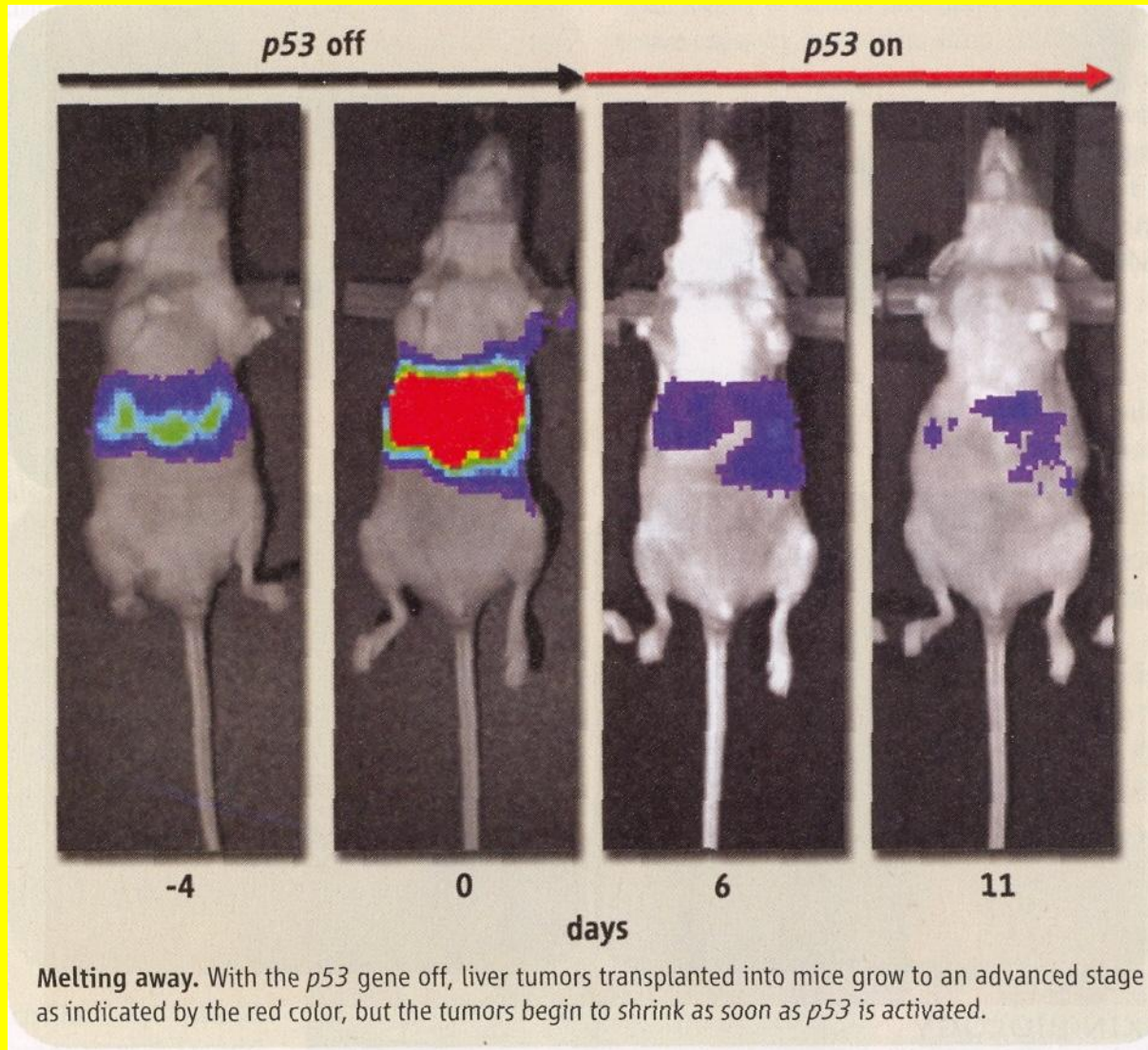


Figure 6.11 Cancer cells develop as a result of a genetic mutation in the DNA of an undifferentiated cell. The mutated cell replicates uncontrollably, eventually resulting in a tumor. If not destroyed or removed, the cancerous tumor metastasizes and spreads to other parts of the body.

Damage to DNA

- Converts proto-oncogenes to **oncogenes**
- Normal cells **oncogenes**  **Cancer cells**
- Other genes: “tumor suppressor”
Stops abnormal cell growth
(brakes)
- Mutation this gene- no longer **guards against** cancer

Suppressor gene: on or off



What do **carcinogens** do?

1. Some: damage DNA (key genes) and **cause** mutations=
tumor initiators
2. Others: **stimulate** cells to divide: **tumor promoters**

Damage to DNA

- 1. Chemicals** (Erin Brockovich,
Woburn,
Civil Action)

Radiation: Good and Bad Effects

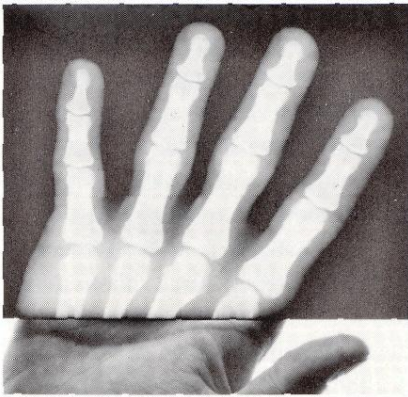
- CT Scans (3-D image)
- 2010 study: screening of **heavy smokers**
- **Early detection**
- ↓ 20% Lung cancer death risk
- **2010 British/Swedish Study:** mammography screening women in 40's: ↓ **26%** breast cancer death

Radiation to **treat** cancer: **Overdoses**
1000 mistakes over 10 years- computer
software/human errors in radiation
beam- linear accelerators: loss of
hair, redness, death

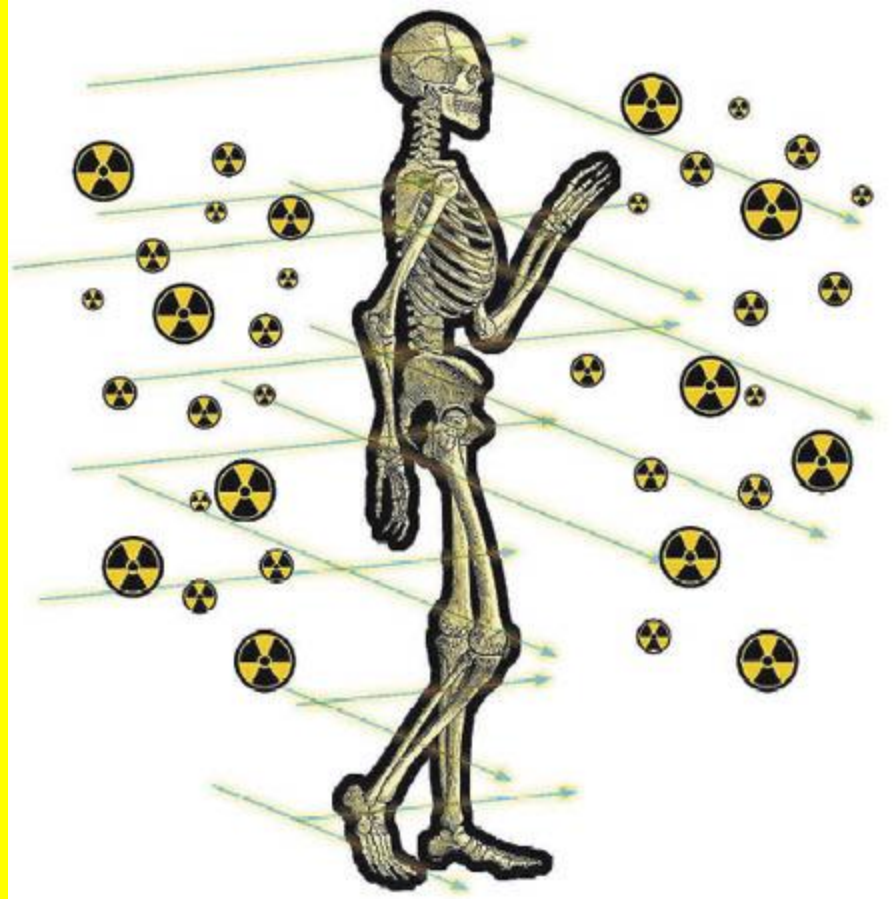
Damage to DNA

2. Radiation: ↑ radiation doses
↑ cancer

Examples: Hiroshima, Nagasaki,
Chernobyl, UV (sun)



X-rays: carcinogens: World Health Organization, Centers Disease Control



“Atomic Cameramen”

Secret

Moviemakers

Nevada Desert 1957

- Filmed atomic bombs
- Knocked cameraman + camera into ditch
- Many died from **cancer**

X-rays: leukemia, thyroid, breast, lung cancers

- Americans- greater exposure to radiation today vs. past
- Medical imaging > natural background radiation
- CT scans > standard X-ray
- Avoid **full body** CT scans
- Keep track: cumulative exposures

Radiation: **1** CAT scan= **400**
Chest X-Rays

Radiation Risk

Comparative exposure

Radiation exposure, measured in millisieverts (mSv), varies depending on the body part, type of procedure, and equipment used to perform the scan. One federal report estimated that a typical chest X-ray (●) exposes a patient to .02 mSv. The average person is exposed to 3 mSv of natural radiation per year, so one chest X-ray equals 2.4 days (●) of natural radiation exposure. Here is how that compares to the exposure of other diagnostic procedures involving radiation.

X-RAY OF THE HEAD
is typically .07 mSv,
equivalent to...

4
chest X-rays

28.5 days
of natural
radiation exposure

CT SCAN OF THE HEAD
is typically 2 mSv,
equivalent to...

100
chest X-rays

243 days
of natural
radiation exposure

BARIUM ENEMA (for visualizing the colon)
is typically 7 mSv, equivalent to...

350
chest X-rays

2.3 years
of natural
radiation exposure

CT SCAN OF ABDOMEN
is typically 10 mSv, equivalent to...

500
chest X-rays

3.3 years
of natural
radiation exposure

SOURCE: US Food and Drug Administration

DAIGO FUJIWARA/GLOBE STAF

Columbia University Study 2007

Concern: **"Super X-Rays"**

Needless CAT scans- especially
children

Cumulative effect ↑ cancer risk

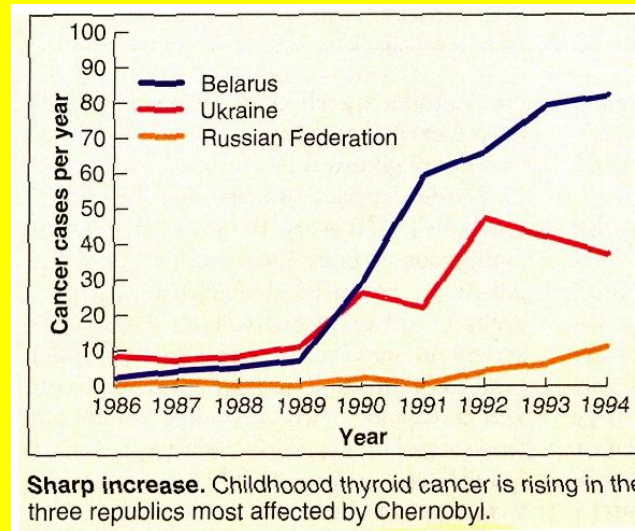
1/3 diagnostic tests: may not be
necessary

1986: Chernobyl (Ukraine): nuclear reactor **meltdown**

- **Plume**: radioactivity (Iodine 131)-
taken up by **thyroid**



- 4 years later dramatic **↑ thyroid cancer children-** Gomel, Belarus-
north of Chernobyl
- Children vulnerable **radiation-induced thyroid cancer (radiosensitive)**
- Direct link: radiation & cancer



Damage to DNA

3. Tobacco use (Babe Ruth)



Undermining an icon. This 1990s anti-smoking ad subverts the imagery of the classic Marlboro cigarette marketing campaign.

Passive smoking causes lung cancer in non-smoker

Damage to DNA

4. **Viruses** (papilloma virus- cervical cancer, Gardasil- new cancer vaccine)

Damage to DNA

5. Genetics

80-90 % cancers: **no** family history

But **if** family history: more frequent, earlier it occurs in relatives: greater your risk

Family history: may increase your
risk

Examples: **cancer susceptibility
genes identified**

A) Colon cancer

B) Prostate cancer

C) Breast cancer

Genetic Testing

- BRCA1 & BRCA2

Gene mutations

Women

- ↑ 56-87% risk breast cancer
- 27-44% risk ovarian cancer
- 2-4% risk pancreatic cancer

Men

- ↑ Risk: breast, pancreatic, prostate



Young people & cancer

- People 15-39: cancer **4th** leading killer
- Testicular cancer rate: increasing- young men
- Thyroid cancer- increasing- young people

Do young people have “**distinctive biologies**” making them more likely to die from cancer?

Young people & cancer

- Diagnosed **later stages-** cancer
- Don't get routine screening-
like older adults
- Young people & doctors don't
expect cancer

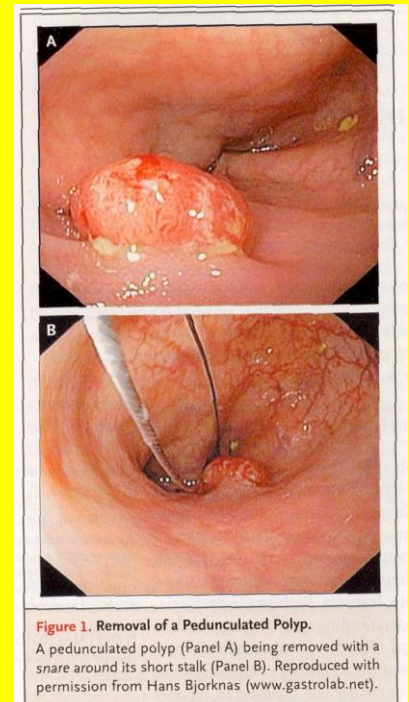
Young people & cancer

- Causes unclear. Few clinical trials. Genetics, environment? Some young people **predisposed**- cancer
- Huge **psychological challenges**: cancer + finishing school, career, starting family

Profile: Dr. Jeff Carezza 29: St. Louis
radiology resident, avid runner

- Weekend: girl friend & he: Miami-
food poisoning → hospital
- Tests: iron deficiency anemia

- Gastroenterologist: “colonoscopy-waste of time”
- Result: large tumor in colon- so big- couldn't get around it with scope
- No family history cancer
- Chemotherapy- now remission



Profile: Asha Mevlana: 22, Los Angeles: lump in breast

- Mammogram: inconclusive
- Doctor: "Don't worry, you're too young for breast cancer."
- Two years later: lump grew-
diagnosis: breast cancer
- Survivor: 31 years old (2007):
professional violinist

Profile: Lauren Terrazzano- Writes “Life with cancer” for Newsday

- “Cancer can be ultimate form of identity theft”
- 36 years old- advanced lung cancer (2004),
3 surgeries
- **Advocacy/support:**
imtooyoungforthis.org

Cancer clusters: random chance or something else?

- Environment, lifestyle, genetics?
- **Epidemiology**: study of patterns of disease distribution (occurrence)

World Health Organization 2008:

Night Shift: a “probable”
carcinogen

↑ Breast &

prostate

cancer: people

working-night

Cause? Effect?

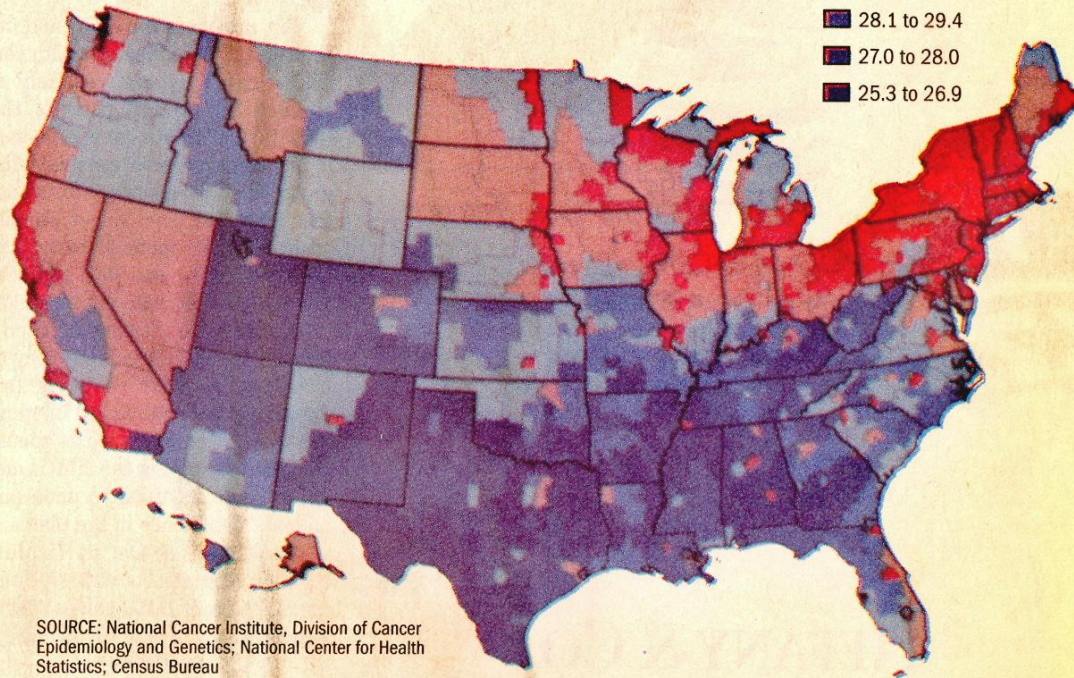
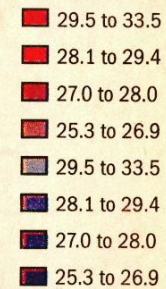
Changes- **Biological clock** (circadian
rhythm)

Women in Northeast: greater deaths from breast cancer than rest of U.S.

Breast cancer death rates

Geographical variations in the death rate from breast cancer, a new study says, are related to lifestyle differences rather than environmental factors. (The map shows only deaths among white women, from 1970 to 1992, since sample sizes for minorities were inadequate.) The National Cancer Institute study found most of the increased risk in the Northeast was attributable to known risk factors such as alcohol consumption and waiting longer to have children.

Deaths per 100,000 white women



SOURCE: National Cancer Institute, Division of Cancer Epidemiology and Genetics; National Center for Health Statistics; Census Bureau

Possible reasons: 87% risk

- Wait longer to have children
- Have no children
- Have menopause later
- ↑ Alcohol intake

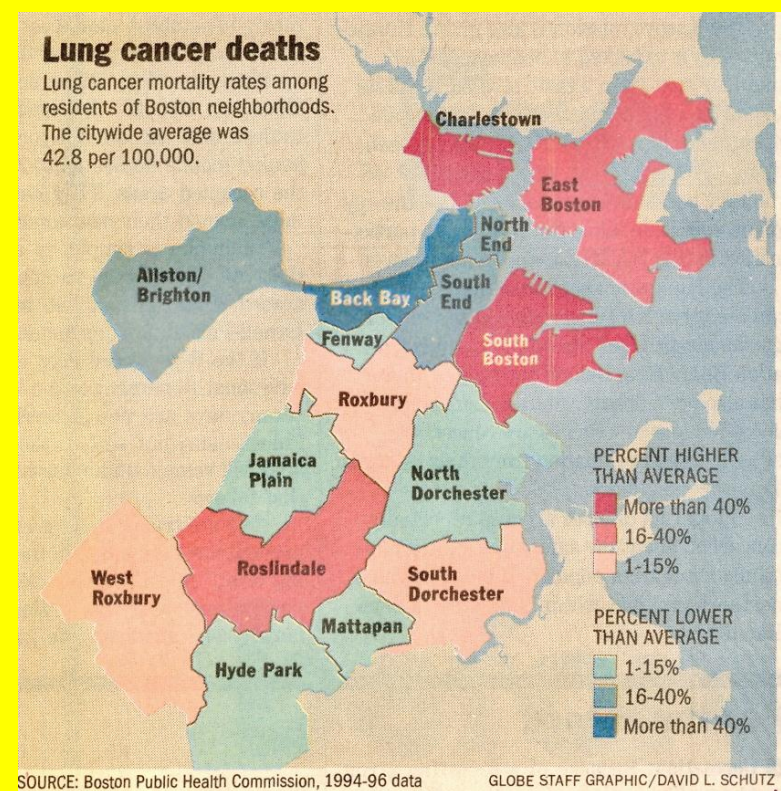
13% risk: unexplained

Women who Breastfeed Babies

**↓ Risk of breast cancer
(before menopause) & ovarian
cancer vs. women who don't
breastfeed**

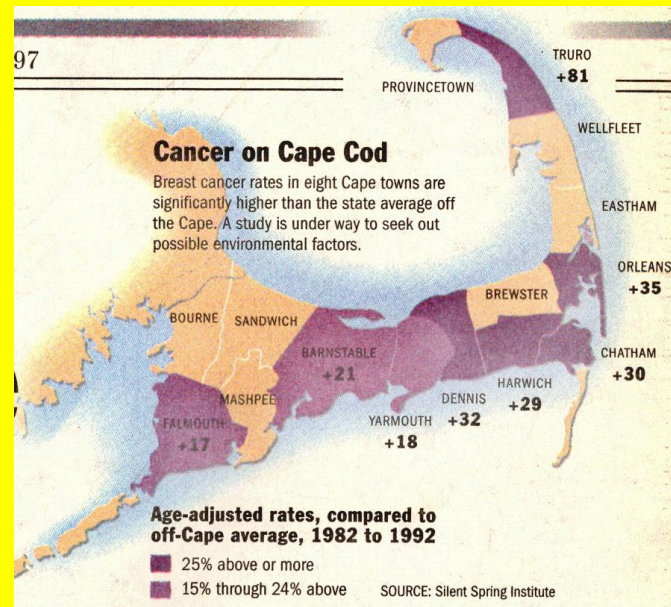
Boston neighborhoods & cancer

- Poorer Bostonians: get more cancer & die from it (1998 study)
- Factors: smoking,
 - ↓ screening,
 - racial differences,
 - ↓ exercise,
 - ↓ health education



1997 study: breast cancer rates- 8 Cape towns higher than state average

- Health officials looked at pesticides, solvents, chemicals
- Cape drinking H₂O: near surface aquifer



- Cheryl Osimo, 41: breast cancer: no family history; coordinator- **Silent Spring**- looking at **environmental factors** causing cancer

Lifestyle: Low risk cancer groups

- **7th Day Adventists**- vegetarians, high fiber diet, no cigarettes, no alcohol
- **Mormons**: no smoking, alcohol, nutritious diet
- **Vegetarians**: also ↓ risk: obesity, diabetes, heart disease, hypertension

Population Studies

- People move from low cancer risk country → high risk country
- Acquire cancer rate: **new country**
- Japan ↑ risk **stomach cancer**
- US ↑ risk **colon cancer**
- Japanese → US ↑ **colon cancer**

Population Studies

Rural African populations: high fiber diet,
rarely see colon cancer

- Move to cities, low fiber diets:

↑ colon cancer

Hispanics: Mexico, Puerto Rico, Cuba

Lower overall cancer rates than non-
Hispanics

- Move to U.S. (Florida)

- **↑ Cancer Rates** ? **Lifestyle changes**

Cancer Warning Signs

- Changes- bowel/bladder habits
- Sores- don't heal
- Unusual bleeding/discharge
- Lumps in breast/elsewhere
- Indigestion/difficulty swallowing
- Changes- warts/moles
- Nagging cough/hoarseness

Cancer: Specific Warning Signs

- Breast cancer
- Cervical cancer
- Colorectal cancer
- Endometrial cancer
- Lung cancer
- Prostate, skin, testicular, throat, urinary tract/bladder

How do you treat cancer?

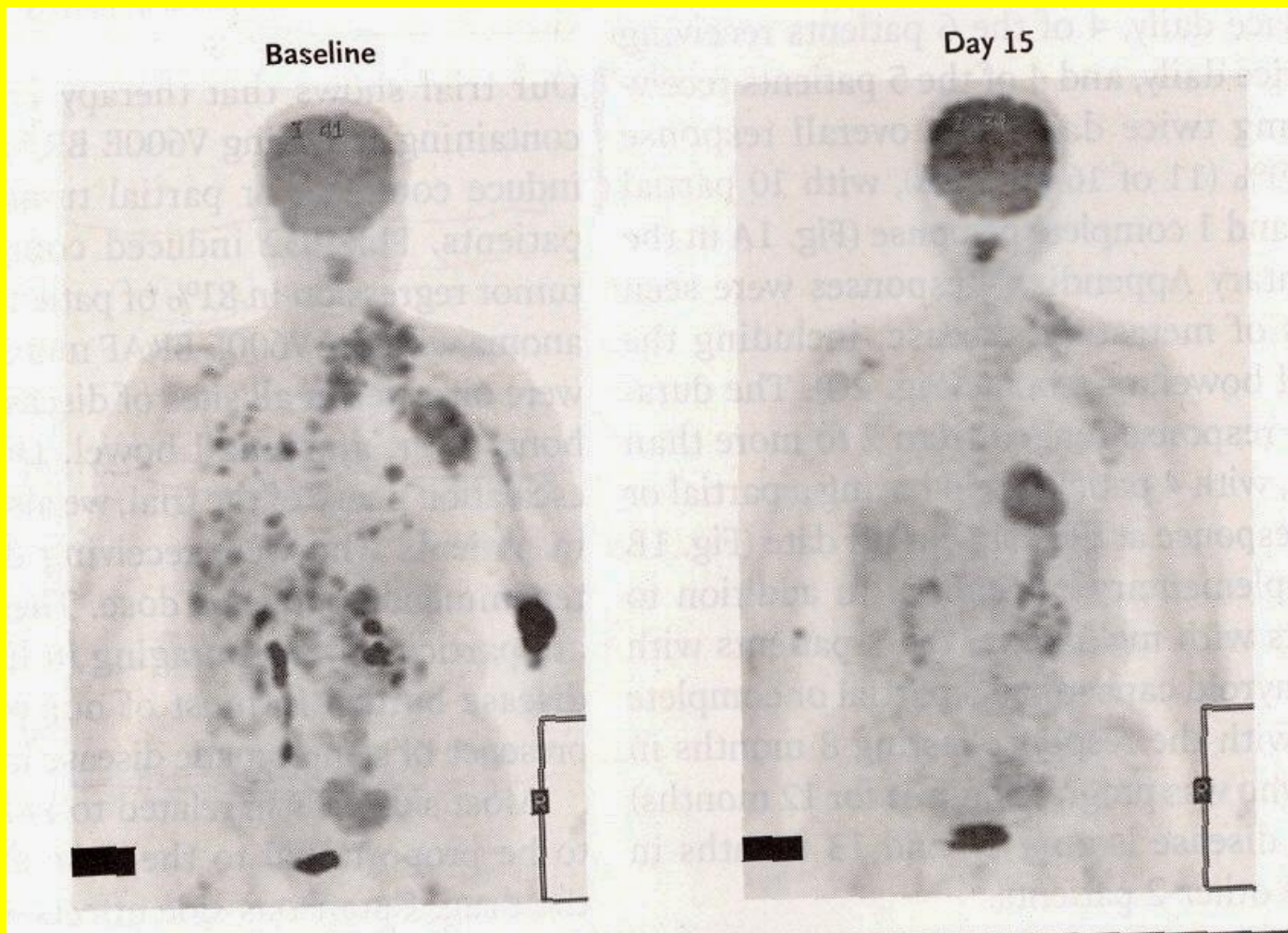
- Surgery
- Radiation
- **Emerging Therapies:** gene, laser, molecular- directed against specific cancer cell enzyme/protein

Melanomas: skin cancers have
specific **gene mutations** (oncogenes):
activate chemical pathway: ↑ mitosis

2010 Massachusetts General Hospital and
other US medical centers

Study: Patients with **metastatic
melanoma**

- Use oral **inhibitor** of cancer pathway
- Called “Oncogene Targeted Therapy”
- **15 days after treatment:
majority patients: complete or
partial tumor regression**



Before pills

After

(Pet Scans)

Two California cousins in study:
Thomas McLaughlin (24) (left)- on pills
2 months- **tumors stop growing**
**“Dude you have to get on these
superpills”**

Cousin- Brandon Ryan (22) (right)
In **Control group**
Started debate
among cancer Docs



How do you treat cancer?

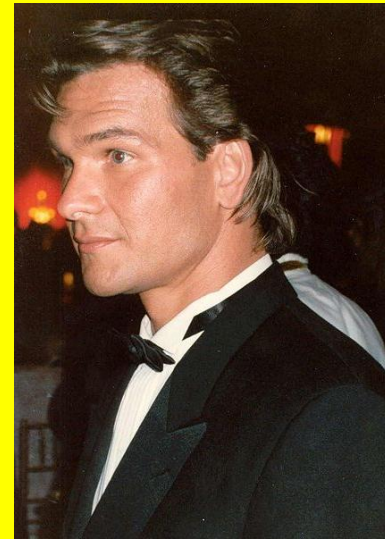
- **Chemotherapy**
- **Immunotherapy**: increases body's natural immune reaction: cancer cells (example- vaccines)
- **Hyperthermia therapy** (106 F)
- **Cryotherapy** (very cold- liquid nitrogen)

How do you treat cancer?

- Angiogenesis inhibitors
angiogenesis=
formation new blood
vessels
- Nexavar- new
liver cancer drug:
cuts off blood supply- tumor

Pancreatic Cancer ↑ Risk: smoking,
family history, being overweight,
sedentary lifestyle

No reliable screening tests



Patrick Swayze

Pancreatic Cancer:

Deadliest of cancers

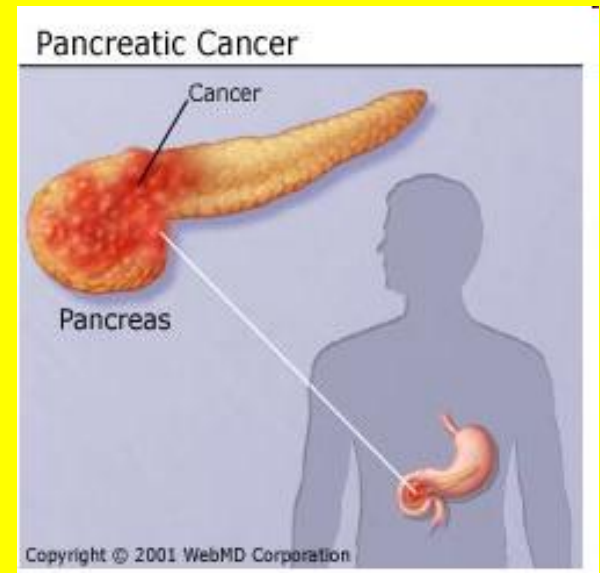
- Unlike most other cancers: pancreas

cancers: “**devascularized**”

(only 10% normal # blood vessels)

Difficult to treat with drugs

- 4 hours/week brief **walk**: reduces risk in overweight/obese people



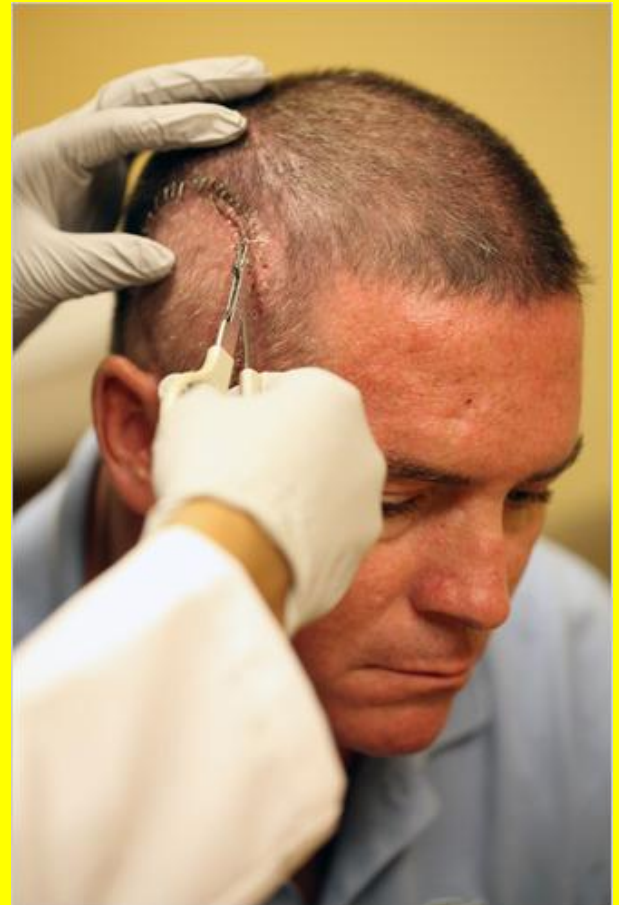
Brain Cancer

Glioblastoma (Senator Kennedy)

Dennis Sugiue- Connecticut:

had surgery,
chemo, radiation

But: tumor grew back



New Treatment

Thread microcatheter
into brain blood
vessels near tumor

- Inject **mannitol**
(sugar alcohol-
chewing gum)
- Opens **“blood brain barrier”** (tight
cells in capillaries- natural defense)



2d: spray **Avastin**

Directly into brain-

High dose

- **Starves tumor**
- Blocks new blood vessel formation
- MRI scans: tumors
fade away

Vanishing Cancers

2009 JAMA study

**Some cancers: stop
growing, shrink, disappear**

- Young man: testicle lump, remove testicle: Docs see scar, no tumor
- Some precancerous cervical cells: change back to normal
- Some breast cancers: disappear
- Growing evidence: some cancers can go **backward**

How do you prevent cancer?

- Don't smoke/use tobacco (30% cancer deaths): mouth, larynx, lung, esophagus, bladder, kidney
Tobacco smoke: **40** different carcinogens, radioactivity

Cigarette Smoke:

Radioactivity:

Polonium

Smoke 1.5 packs/day = 4 chest X-rays

How do you prevent cancer?

- Eat healthy diet: **1/3** cancer deaths related to diet

Stomach, colon, rectum, prostate, uterus, breast

- 2009 Policy & Action for Cancer Prevention Report: **1/3** U.S. Cancers are **Preventable**

How do you prevent cancer?

- Be **physically active**: control your weight

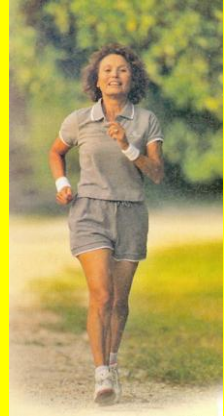
Obesity: ↑ risk prostate, colon, rectum, uterus, breast cancers

- ↑ **Exercise** ↓ **Cancer risk**

- Breast cancer **survivors**:

Exercise (3-5 hr/week):

↓ fatigue/pain ↓ 40% cancer death



“A lifetime of regular exercise may reduce a women’s risk of breast cancer late in life”

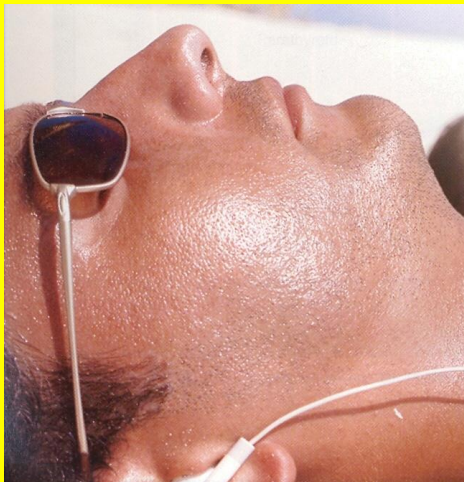
↑ Exercise

↓ Body estrogen

How do you prevent cancer?

- Protect your **skin** from sun:
skin cancer

Sunburns children → melanoma
later in life



How do you prevent cancer?

- **Limit alcohol** ↑ risk cancers: mouth, pharynx, esophagus, larynx. Maybe also: liver, breast, colon, rectum, stomach
- **Deadly combo: smoking + alcohol** (cancers: mouth, esophagus, larynx)

How do you prevent cancer?

- Avoid environmental/occupational carcinogens: second-hand smoke, Air/H₂O/workplace pollutants
- Workers- small paint brushes with **radium** → touch to lips- fine point
- Paint wrist watches- luminescent
- ↑ Lip cancer

Aspirin & Cancer



- People who take aspirin

Regularly ↓ Risk colon tumors

- People diagnosed with colorectal cancer

- **Start** taking aspirin: ↓ **47%** risk dying from cancer

Preventing Cancer's Return

1. Colon cancer survivors

↑ fruits/veggies,
fish, legumes

↓ Risk- cancer
return

vs.

↑ Red/processed
meat, desserts,
fries, refined grains

↑ Risk (3X)

Preventing Cancer's Return

Women breast cancer survivors

5 fruits &
veggies/day
+ physically active
↓ fat intake

↓ Recurrence
Likely to die
↓ (50%)

Preventing Cancer's Return

Men with **prostate cancer**

↑ Vegetarian diet

↑ Chances survival

2009 Swedish study: obese men
(apple pattern)

↑ Risk aggressive prostate cancer

Lose weight ↓ Risk

Breast Cancer: Screening (mammograms)

2009: Recommendations of US Preventive Services Task Force

- Low risk women: breast cancer screening age **50** not **40**
- Women 50-74: mammograms every **2** years not **once**/year
- Advise against: regular breast **self-exam**

Currently: American Cancer Society,
National Cancer Institute, AMA: screening
age **40**: every 1 or 2 years

Critics of Recommendations



Dr. Marisa Weiss, Ms. Karen Young-Levi

Breastcancer.org

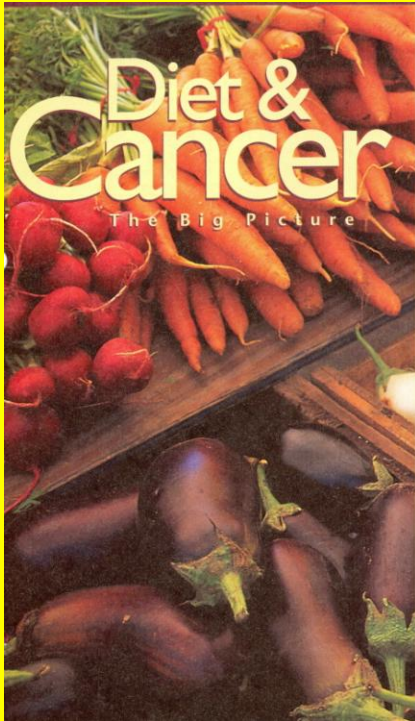
Diet & cancer

- 1/3 cancer deaths: related- diet
- **Obesity:** 14% cancer deaths-

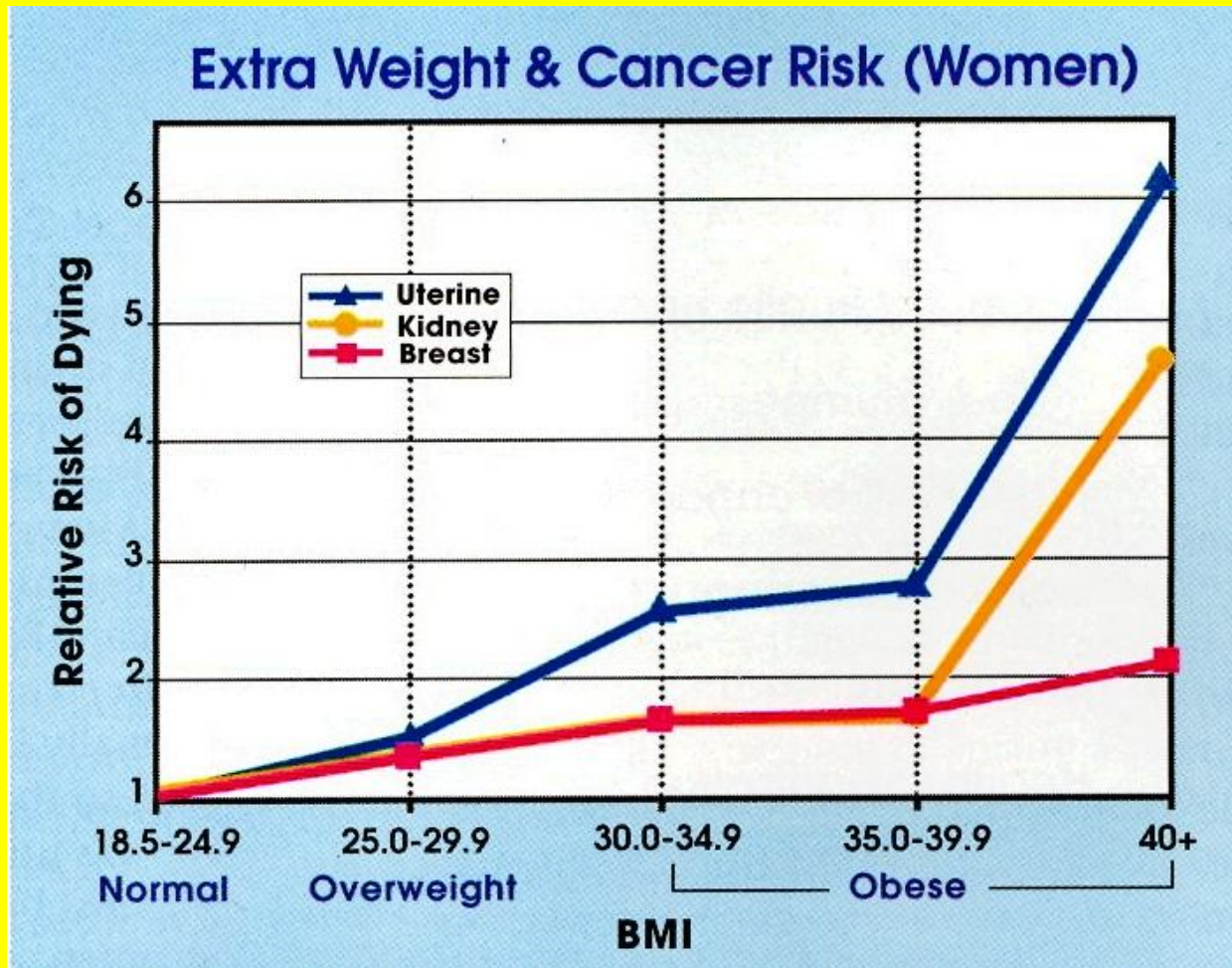
men

20% cancer deaths-

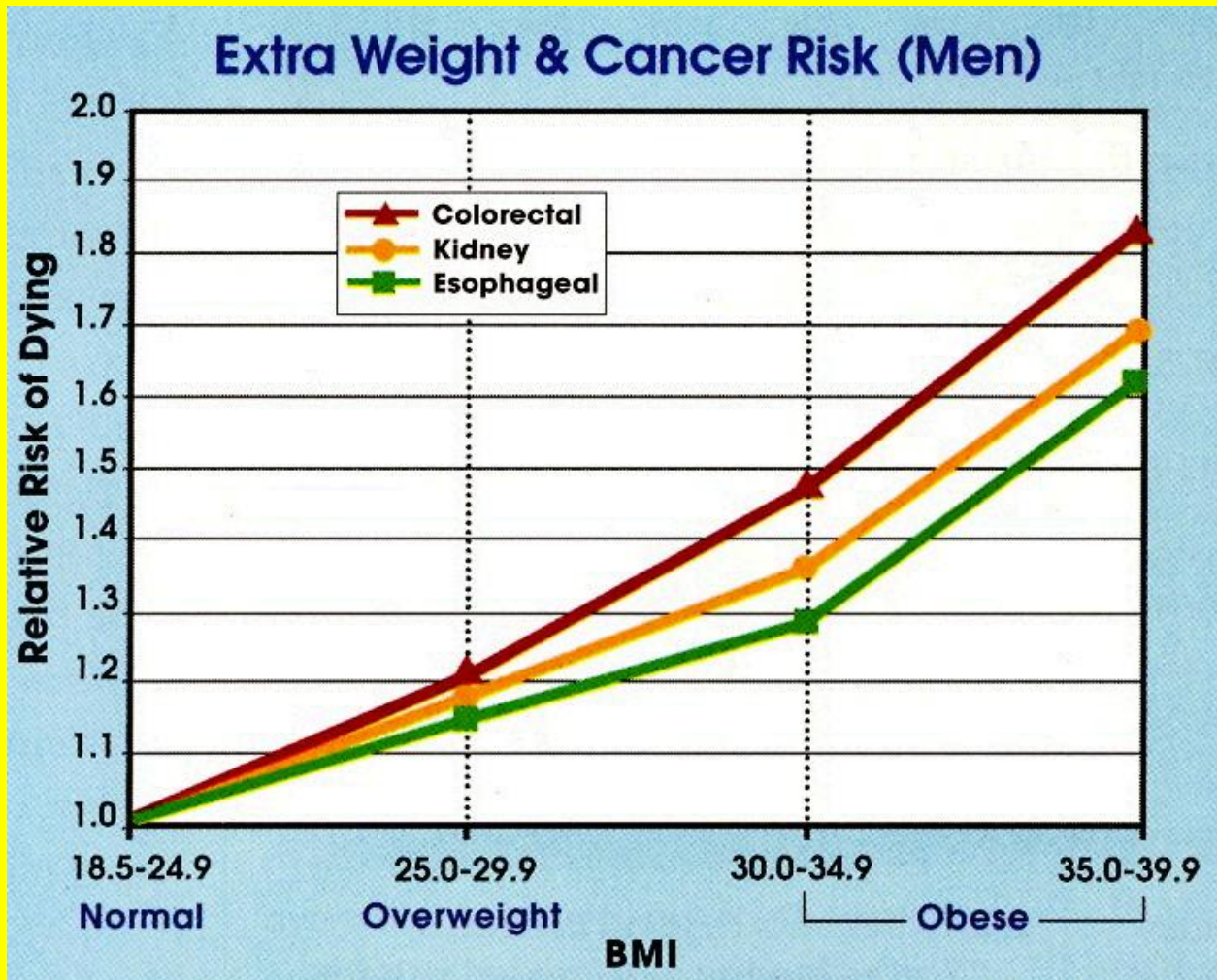
women



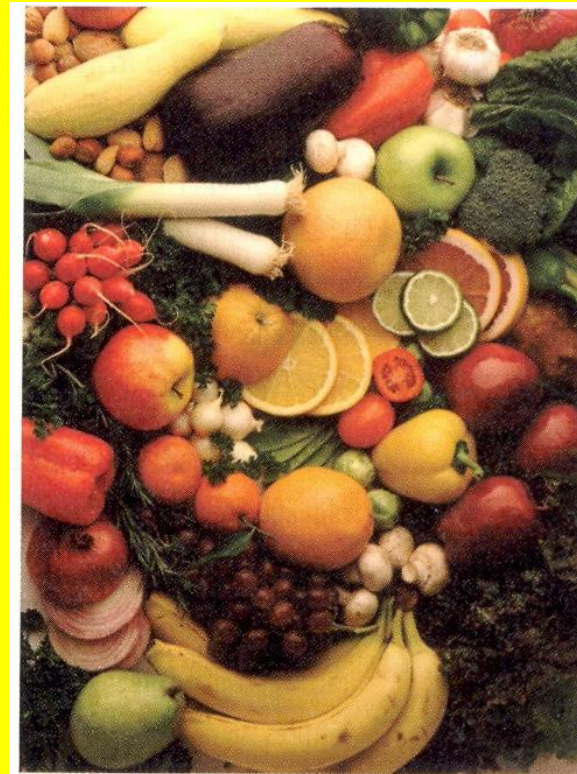
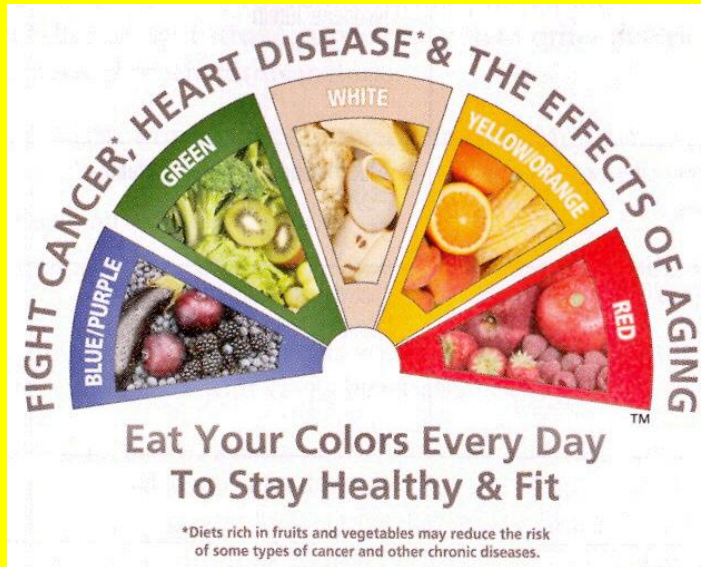
Women, Weight & Cancer



Men, Weight & Cancer



Fight cancer with colors: phytochemicals

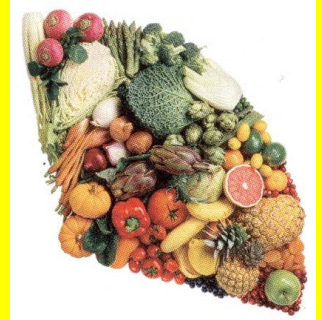


Foods that are high in phytochemicals are easy to recognize by their bright colors.

Cancer prevention foods: Eat these

Whole Food instead of **pills**

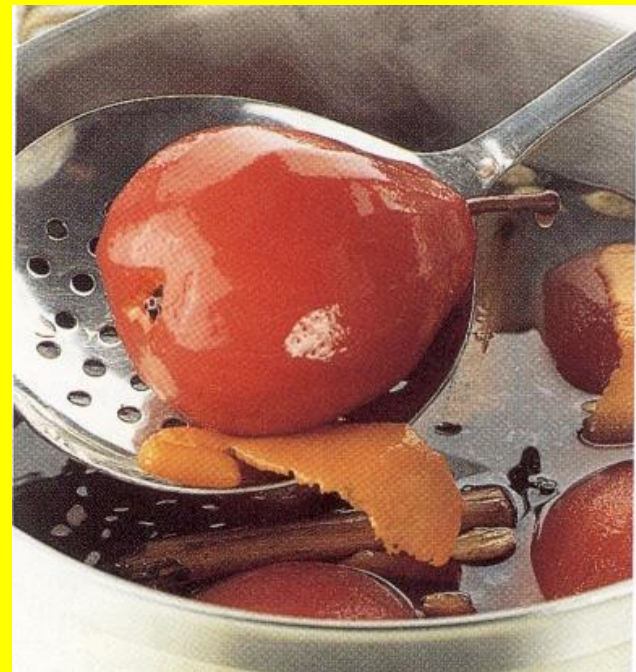
- Fruits & veggies-rich in:



- 1) **Antioxidants** (beta carotene, vitamins C & E):
protect DNA from oxidative damage
- 2) **Phytochemicals** (biologically active chemicals- plants)
- 3) Large doses **Vitamin E** no decrease cancer risk

Cancer prevention foods: Eat these

- **Lycopene** (carotenoid)- **tomatoes**: **may** prevent prostate/pancreatic cancer: men
- Recent studies:
No relationship:
Lycopene & cancer



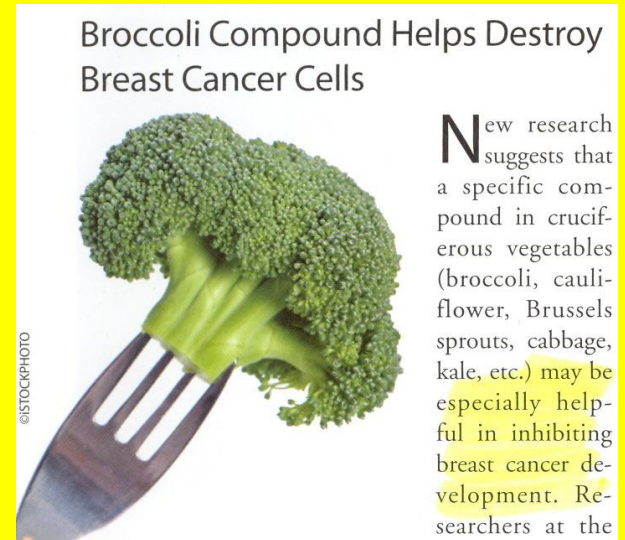
Cancer prevention foods: Eat these

- **Cruciferous veggies:** broccoli, Brussels sprouts, cauliflower-
prevention: lung cancer

- **Berries & red grapes**



Fruit sorbet with fresh berries. Jam-packed with essential vitamins, fruits can be presented in a number of ways, such as this refreshing mixed-fruit sorbet with fresh fruits.



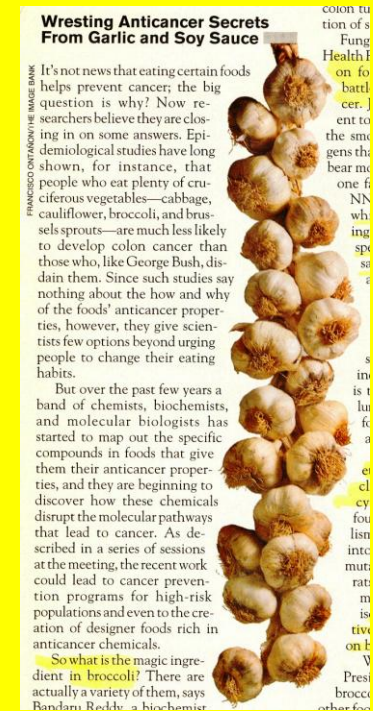
Broccoli Compound Helps Destroy Breast Cancer Cells

New research suggests that a specific compound in cruciferous vegetables (broccoli, cauliflower, Brussels sprouts, cabbage, kale, etc.) may be especially helpful in inhibiting breast cancer development. Researchers at the

©ISTOCKPHOTO

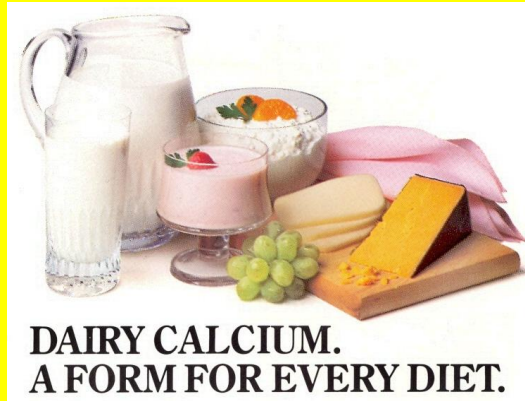
Cancer prevention foods: Eat these

- Onions, garlic: ↓ cancers- colon, rectum, ovaries, prostate, breast, kidney, esophagus, mouth, throat
- Green leafy veggies & root veggies (carrots, sweet potatoes)
↓ stomach cancer



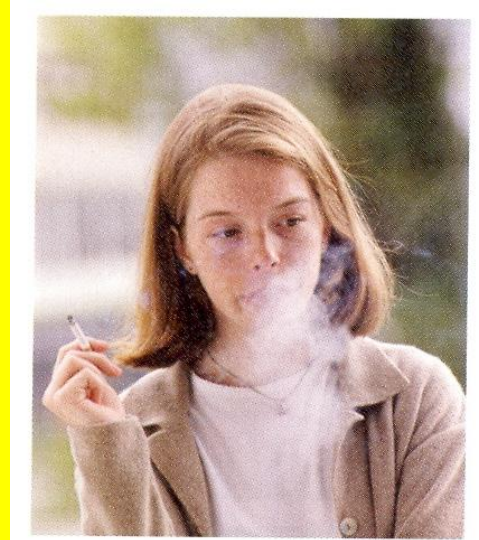
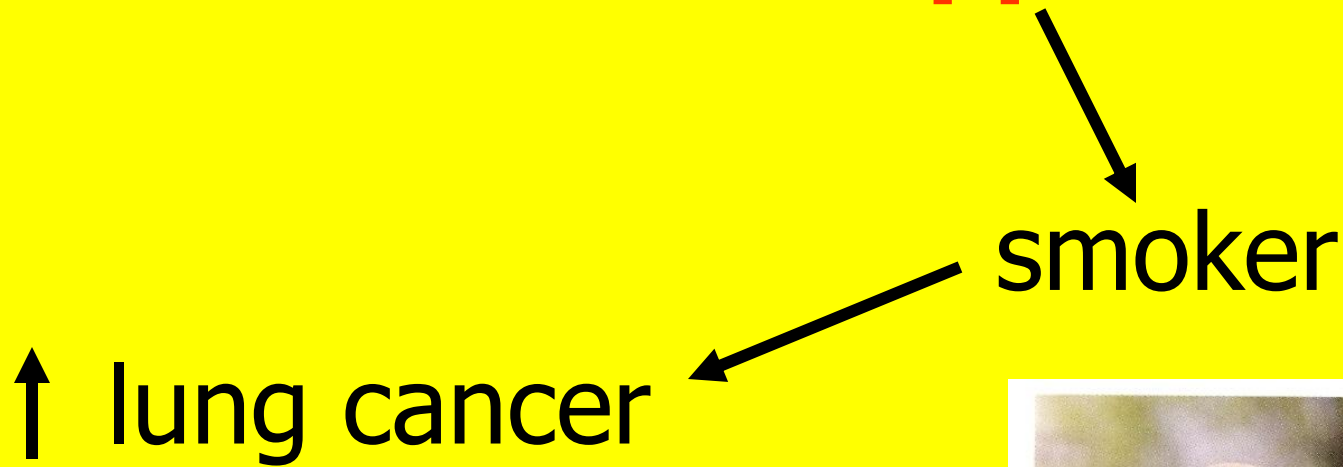
Cancer prevention foods: Eat these

- **Vitamin A, beta carotene** rich foods: ↓ stomach cancer
- ↑ **Calcium** maybe ↓ colorectal cancer



But: high calcium:
maybe
↑ prostate cancer risk

Caution: high **beta carotene supplements**

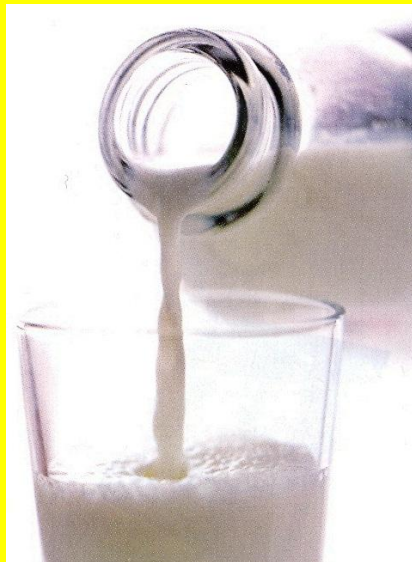


Cigarette smoking decreases bone density and is a risk factor for osteoporosis.

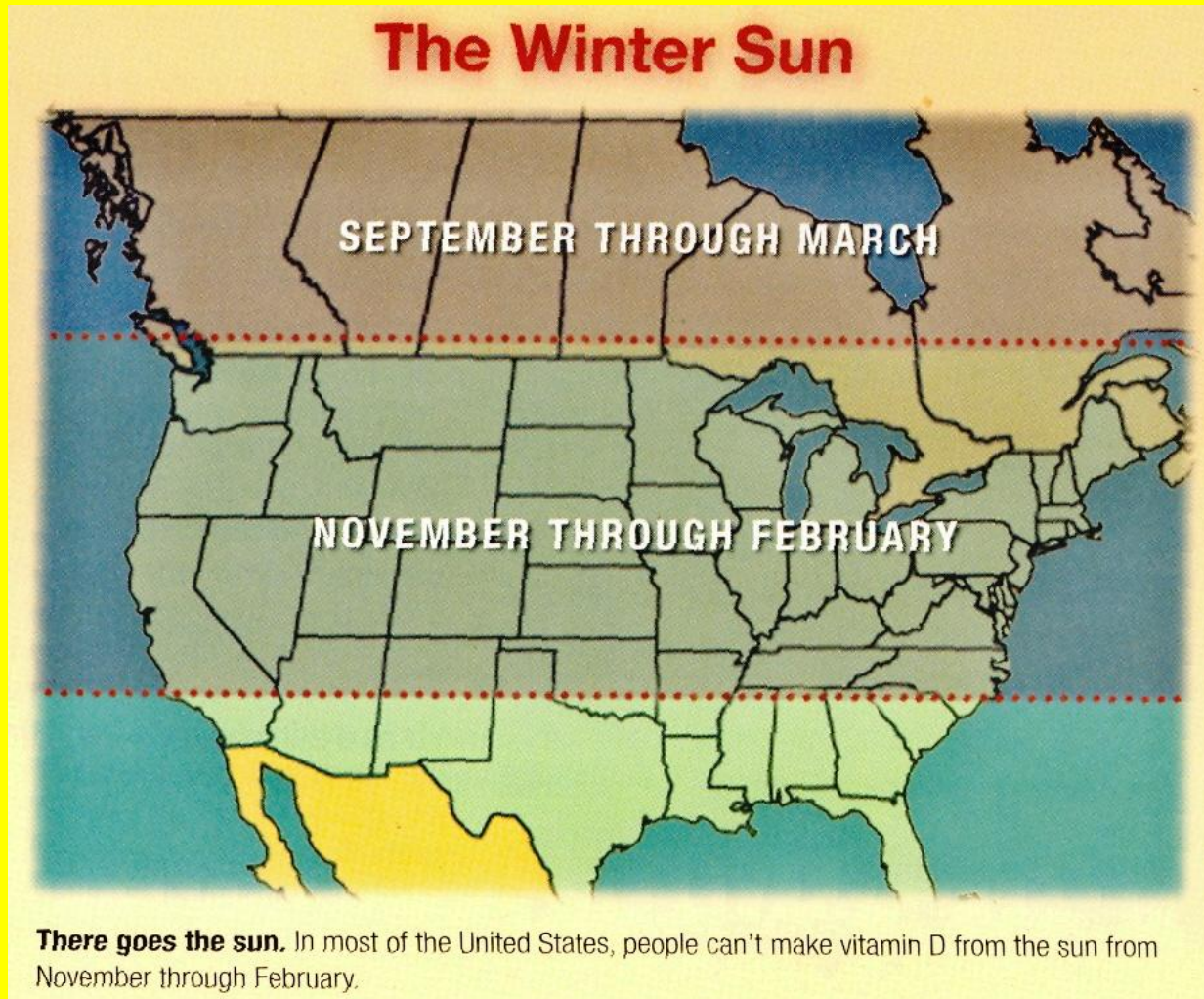
Cancer prevention foods: Eat these

- **Vitamin D**: women **200 IU/day** in diet

↓ 30% risk: breast cancer

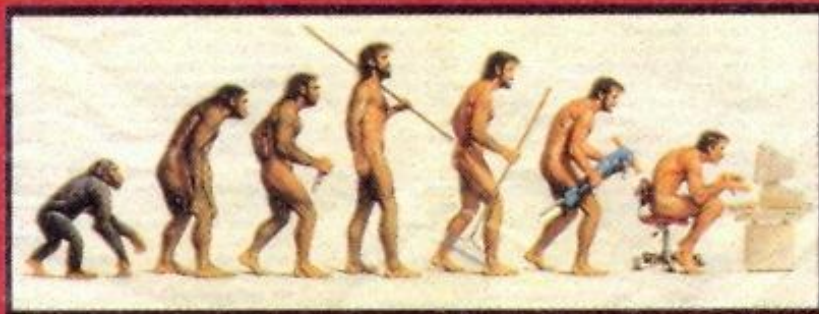


Vitamin D & sunlight- most of US:
November-February- Vitamin D: ↓ skin

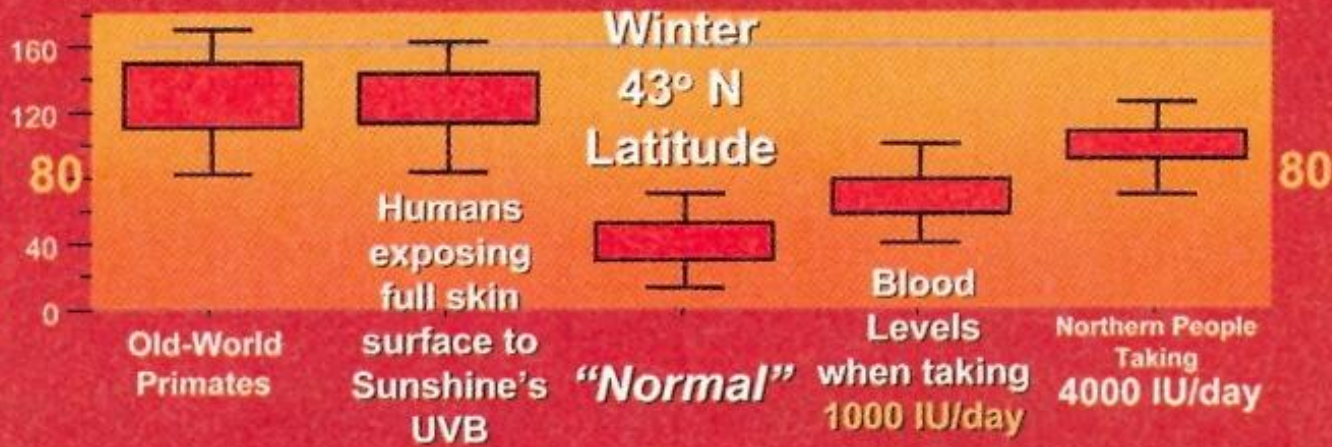


Vitamin D & supplements: optimal blood level

Vitamin D Status in Primates and Early Humans



Serum 25(OH)D nmol/L



Vitamin D and Cancer

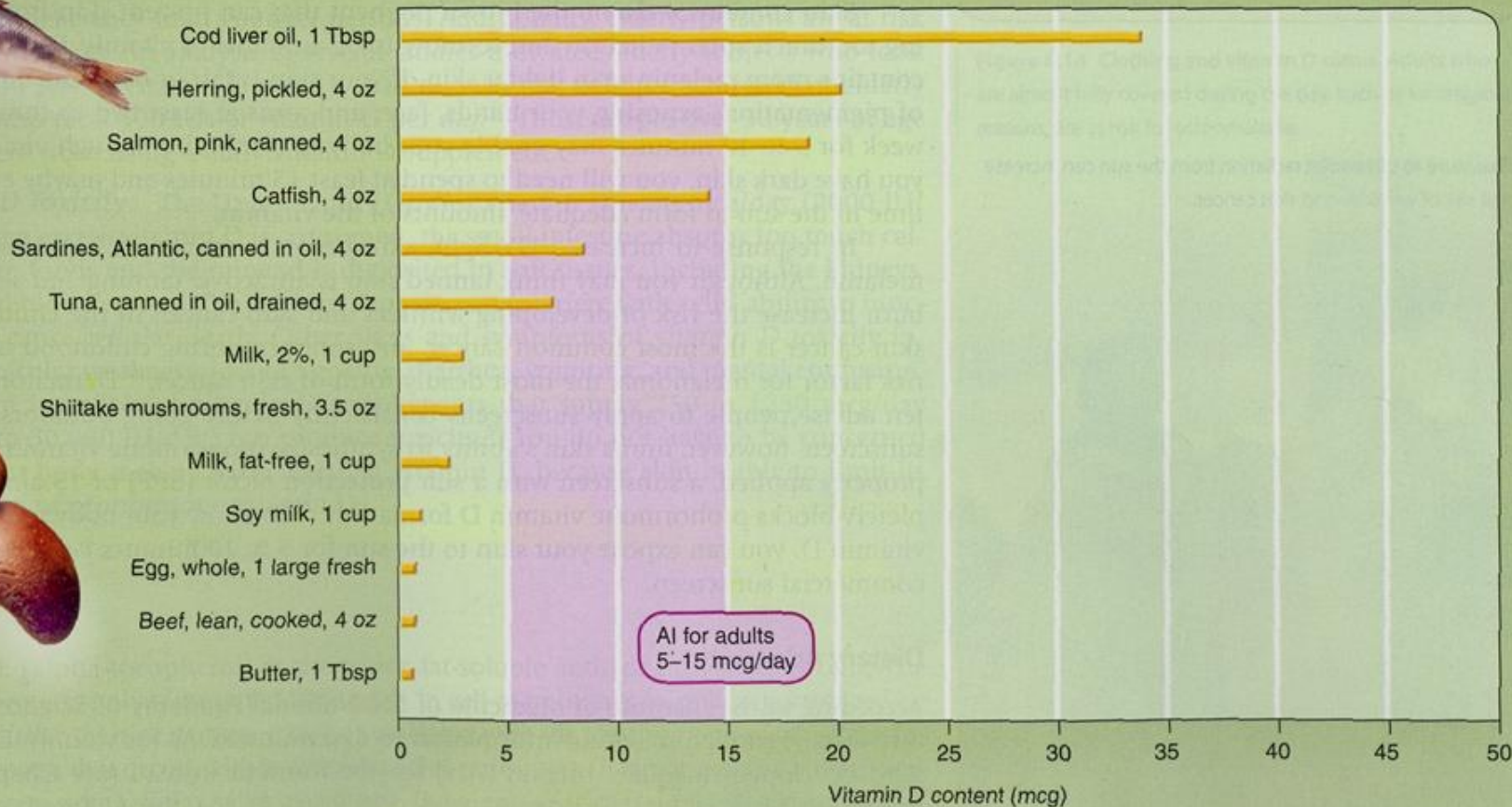
2007 Creighton University Study

- Women: supplement **1000** IU/day
Vitamin D3 (potent form) + **calcium**
(1400-1500 mg/day)
- ↓ **60%** all non-skin cancers
- Other studies: ↑ Blood vitamin D
↓ Colorectal cancer

Canadian Cancer Society Recommendation

- 1. 1000 IU/day** Vitamin D3
supplement: elderly/dark skin
people: Fall/Winter
 2. People little sun exposure: **1000**
IU/day: all year
- Diet sources:** fortified milk, OJ, yogurts,
margarine, cereals (read labels),
salmon, mackerel, sardines, shrimp,
egg yolks, liver

TABLE 8.4 *Vitamin D Content of Selected Foods*



How vitamin D may work?

- May inhibit cancer cell spread
- ↑ Immune function
- Block angiogenesis
- ↑ Death abnormal cells

2008 study: **Women's Health Initiative**

36,000 postmenopausal women

Vitamin D + calcium pills

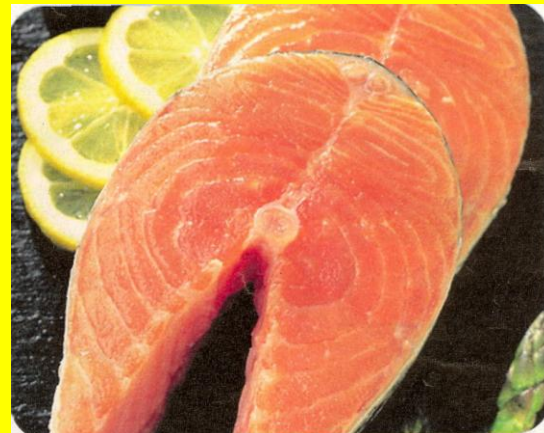
or placebo

After 7 years: no difference

Breast Cancer

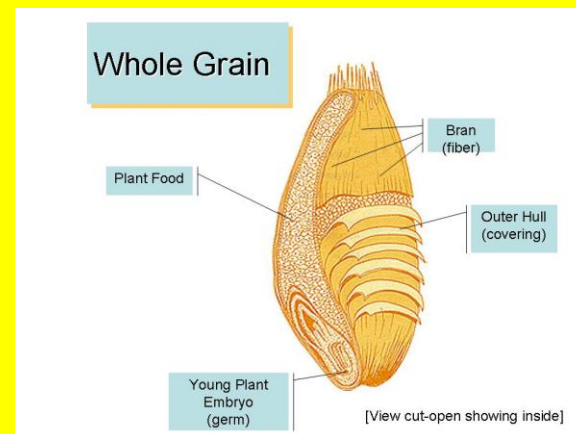
Cancer prevention foods: Eat these

- **Whole grains:** ↓ cancer GI tract
- **Fish** rich in **omega-3 fats**
 - ↓ colorectal, breast cancers,
non-Hodgkin lymphoma



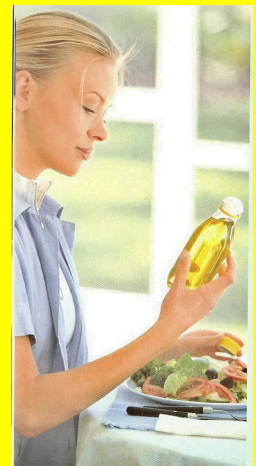
Cancer prevention foods: Eat these

- High **fiber** diets: ↓ colon cancer dilute carcinogens, ↓ transit time
- Some studies don't support this finding



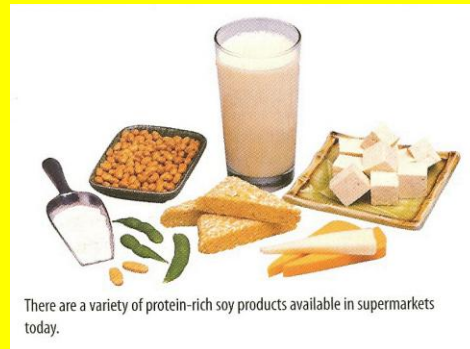
Cancer prevention foods: Eat these

- Olive oil- Mediterranean diet:
 - ↓ breast, colon, prostate, larynx, ovary, lungs cancers
- Protects DNA- oxidative damage
- Polyphenols- olive oil: stop leukemia cells from growing



Cancer prevention foods: Eat these

- **Phytoestrogens**: whole grains, veggies, **soy products**: may protect against- uterus, breast, prostate cancers
- Block activity of estrogen in body



There are a variety of protein-rich soy products available in supermarkets today.

2009 Shanghai Women's Health Study

73,323 Chinese Women

Strong Evidence:

↑ **Soy Food Intake**

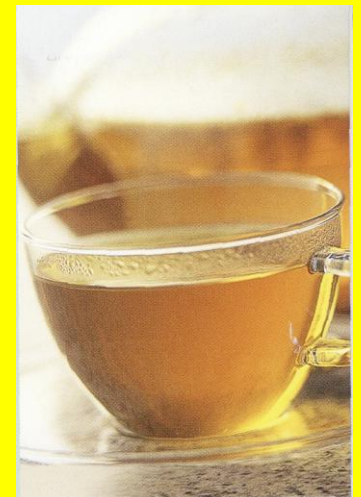
Protection against
Premenopausal Breast
Cancer

Other studies: **no** lower cancer risk
with **soy**



Cancer prevention foods: Drink these

- Tea- green & black have polyphenols
Kill breast, colon, prostate, liver cancer cells
- Also contain flavonoids (pigments):
protect against viruses
- Dartmouth Study 2007
1 cup tea/day ↓ skin cancer



Flavonoids

2007 German Study

↑ Onions, black tea, spinach,
cabbage

↓ Pancreatic cancer

Smokers: greatest risk
reduction

Cancer prevention: foods to limit

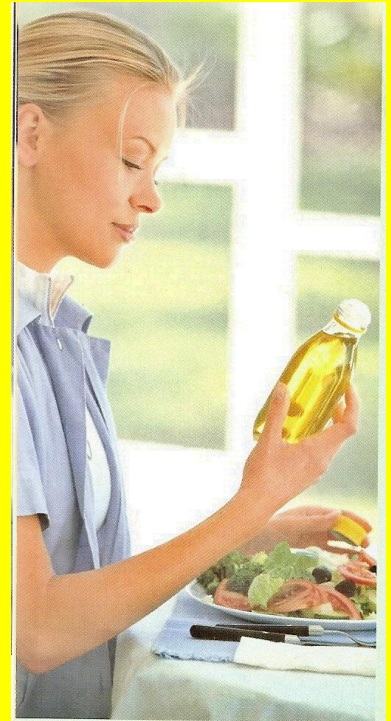
- Total fat: **fat** is tumor **“initiator”** & **“promoter”**
 - 1) Countries: low fat intake, low breast cancer
 - 2) Women: ↑ fat ↓ fiber
↑ breast cancer

Cancer prevention

Type of fat- important:

Women- Mediterranean
countries- olive oil
(monounsaturated)

↓ Breast cancer- even though total
fat calories similar to US



Cancer prevention: foods to limit

- **Trans fat:** ↑ breast cancer
- **Red meats** (high saturated fat)-
increase risk: colon & prostate
cancers

**Instead: white meat,
poultry, fish, shellfish**

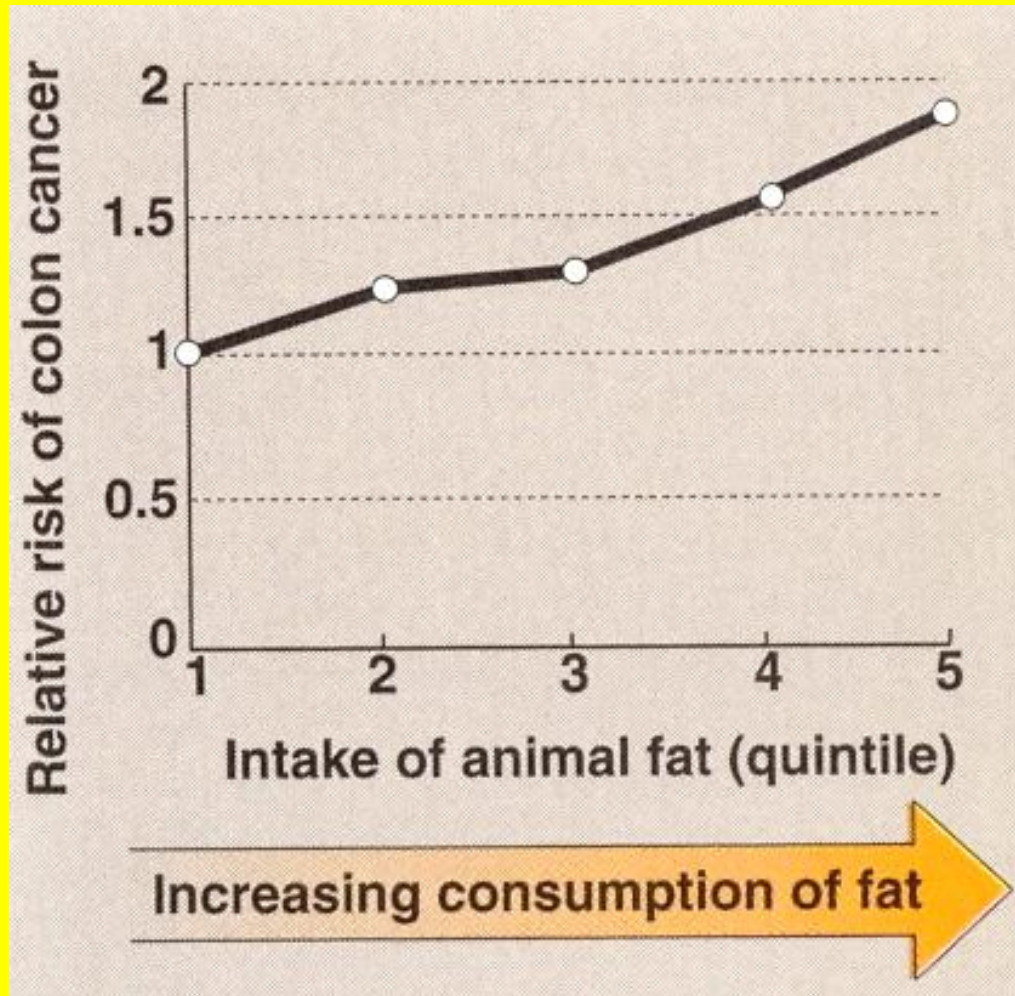
Cancer prevention: foods to limit

- Harvard Nurses' Health Study II
Women who ate **1.5 servings
red meat/day**

Almost **2X** risk: hormone-receptor positive **breast cancer**
(most common type)



Women: ↑ Animal (saturated) fat in diet
↑ Risk of colon cancer



Cancer prevention: foods to **limit**

- Total calories: ↑ obesity ↑ cancer



- Animal studies: lifelong calorie restriction

↓ spontaneous cancers

↓ aging

↑ life span

Calorie restriction- animals

Rhesus monkey:

Canto: 25

445 calories/day

- Nice coat
- Elastic skin
- Smooth walk
- Energetic
- Healthy blood chemistry
- Lived longer



CALORIE RESTRICTION DIET

Canto, 25

Although a senior citizen — the average rhesus monkey lifespan in captivity is 27 — Canto, above, is aging fairly well. Outwardly, he has a nice coat, elastic skin, a smooth gait, upright posture and an energetic demeanor. His bloodwork shows he is as healthy as he looks.

Human equivalent Meals prepared by Mike Linksvayer, 36



MONKEY MENU

Daily calories

445 885

Monkeys also receive an apple each day.



Breakfast fermented soybeans and garlic



Lunch tofu, konyakku and carrots



Dinner vegan sausage, kale, tomato sauce and salad

HUMAN MENU

Daily calories

2,000 3,000

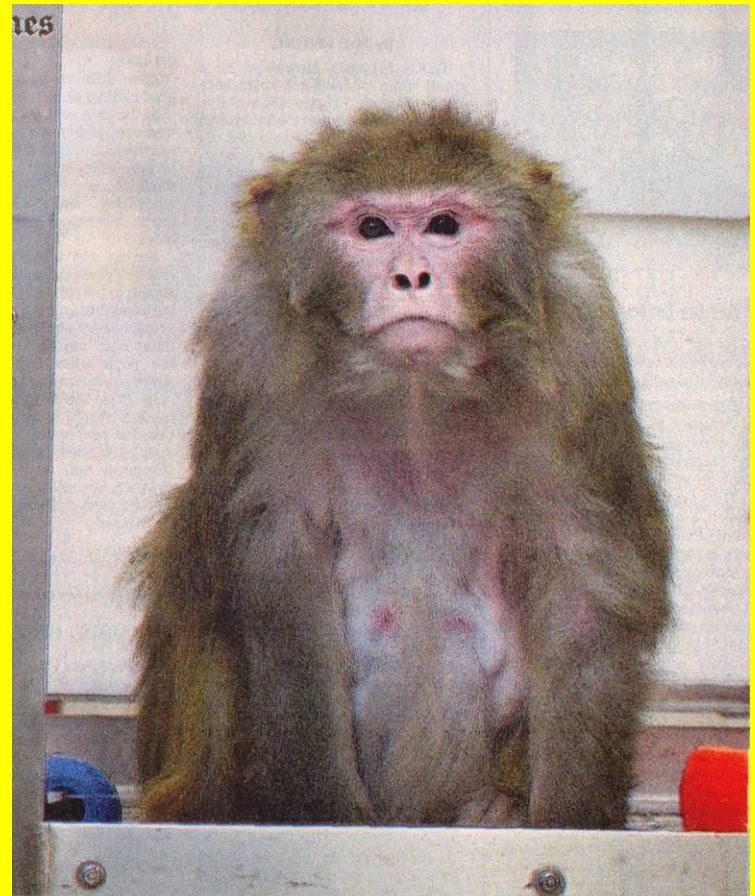
Beverages, snacks and desserts not shown. Diet varies according to body type, sex and activity level.

Rhesus monkey:

Owen: 26

885 calories/day

- Bad posture
- Arthritis
- Wrinkled skin
- Frail
- Moves slowly
- Blood: ↑ Glucose
↑ Triglyceride



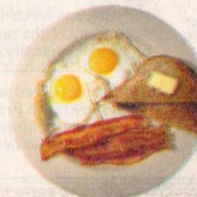
Jeff Miller/University of Wisconsin, Madison

NORMAL DIET

Owen, 26

He gets more food, but Owen, above, isn't aging as well. His posture has been affected by arthritis. His skin is wrinkled and his hair is falling out. Owen is frail and moves slowly. His bloodwork shows unhealthy levels of glucose and triglycerides.

Diet of an average, active human male of 36



Calorie restriction- humans

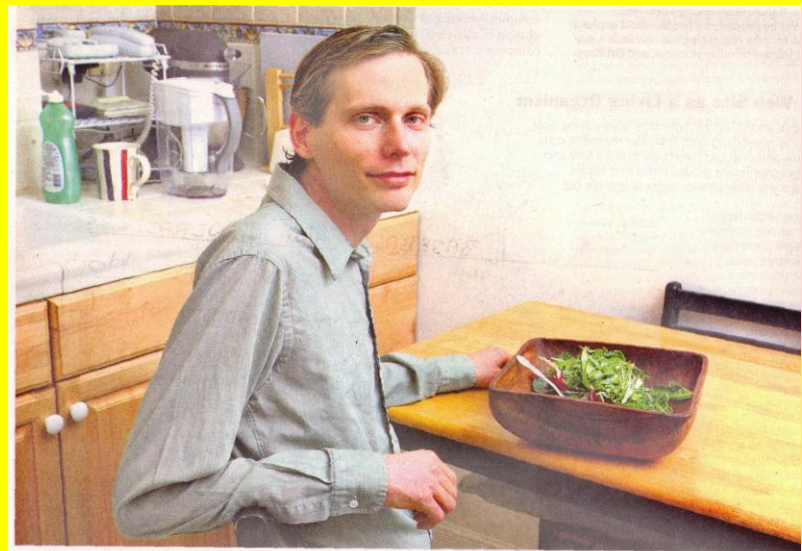
In general: people who restrict calories:

↓ LDL ↑ HDL Arteries: little blockage

Calorie Restriction Society:

goal- to live longer

- Mike Linksvayer: 36
- San Francisco, Chief Technology officer
- Low calorie diet: 6 years



THIN MAN Mike Linksvayer, 36, on a low-calorie diet for six years, is 6 feet and 135 pounds, and his blood pressure is 112 over 63. Jim Wilson/The New York Times

- **6' tall 135 pounds**
- **2000-2100 calories/day**
- Blood pressure: **112/63**
- **Breakfast:** apple or cereal
- **Lunch:** small vegetarian dish
- **Dinner:** no bread, rice, sugar
- Weekends: occasional **fasts**

Cancer prevention: foods to limit

- Cooking methods: Heterocyclic amines- carcinogens formed in meat cooked high temperatures/long time
(broiling/barbecuing/frying)
- Heterocyclic amines formed from: amino acids + sugar (meat)

Nutrition & Prevention

PLAYING WITH FIRE

**GRILLED CHICKEN CONTAINS
CANCER-CAUSING
COMPOUNDS**

By Jennifer Reilly, R.D.



2006: Physicians Committee for Responsible Medicine

Under California law sued:

McDonald's, Burger King,
Chili's, Applebee's, Outback
Steakhouse, Chick-Fil-A, TGI
Friday's (Still in courts-2010)

Heterocyclic amines: grilled chicken

Cancer-Causing Compound Found in Grilled Chicken at Chain Restaurants

Chain	Item	PhIP?
	<ul style="list-style-type: none"> Caesar Salad with Grilled Chicken 	PRESENT
	<ul style="list-style-type: none"> Grilled Italian Chicken Caesar Salad Honey-Grilled Chicken Entrée 	PRESENT
	<ul style="list-style-type: none"> Tendergrill Chicken Sandwich 	PRESENT
	<ul style="list-style-type: none"> Chargrilled Chicken Sandwich 	PRESENT
	<ul style="list-style-type: none"> Grilled Caribbean Chicken Salad Guiltless Chicken Platter Entrée 	PRESENT
	<ul style="list-style-type: none"> Chicken on the Barbie 	PRESENT
	<ul style="list-style-type: none"> Cobb Salad with Grilled Chicken Grilled Chicken Flavor Shots Entrée 	PRESENT

Source: Columbia Analytical Services tested 10 samples of each item, using a validated and published analytical method. Every sample from each restaurant tested positive for PhIP. PhIP is one of a group of carcinogenic compounds called heterocyclic amines (HCAs) that are found in grilled meats. In 2005, the federal government officially added HCAs to its list of carcinogens.

- Want **warnings** issued about **grilled chicken**
- California law: “consumers must be warned about products containing carcinogens”
- USDA: on side of defendants (**chickens** don't contain these carcinogens- **produced during cooking**)

Burger King settles lawsuit- California

Posts warnings: Grilled chicken contains heterocyclic amines

Prevention & Nutrition

Burger King Warns of Grilled Chicken Cancer Risk

Fast-Food Chain Settles PCRM Lawsuit

Burger King is the first of seven national restaurant chains to settle a lawsuit filed by PCRM over a dangerous carcinogen found in the companies' grilled chicken. As part of its agreement with PCRM, Burger King has posted warning signs in its California restaurants to alert customers that its grilled chicken products contain PhIP, a cancer-causing compound produced when meats are cooked at high temperatures.



Better grilling to reduce carcinogens

- Use well trimmed meat
- Remove chicken skin
- Marinate meats
- Pre-cook to reduce cooking time on grill
- Don't char meat
- Cover grill- aluminum foil with holes to reduce charring

Cancer prevention: foods to **limit**

- Open flame & smoking food:
produces hydrocarbons
(benzopyrene)- carcinogens
- ↑ **Stomach cancer**: Iceland,
Lithuania- smoked fish



Cancer prevention: foods to limit

- Careful: **Charred, burnt, browned meat**
- Women- who eat **very well done** beef/bacon 4 X greater risk: breast cancer
- Better: boiling, baking, poaching (in H₂O- near boiling point)

2007 Study in Epidemiology

- Heterocyclic amines & other carcinogens formed: **barbequing, smoking, frying meats-** high temps

- Women who ate grilled, barbequed, or smoked red meat **> once/week:**

↑ 47% risk breast cancer over lifetime



Carcinogens in Cooked Meat Increase Breast Cancer Risk

Cancer prevention: foods to **limit**

- Food Additives

- 1) **Nitrates & nitrites-** in sausage, ham, bacon, lunch meats

Preserve food (protects against food poisoning (bacteria))

Adds pink color/flavor

Problem: nitrites + amines (from amino acids) → **nitrosamines**
(carcinogen)

All cooked samples of bacon
contain nitrosamines



Food Additives

2) Food colors (dyes)

Carcinogens no longer allowed:

Green No. 1 (1966)

Violet No.1 (1973)

Red No. 2 (1976)

Orange B (1978)

Other artificial colors

- Synthetic- not natural
- Being studied- cancer risk
- Found: candy, soda, desserts
- Fenway Frank vs. Yankee hot dog: difference in color



Food Additives

- 3) **Flavorings**: outlawed
safrole (1960)- root beer
cyclamate (1970) artificial
sweetener

Saccharin: 1997 study causes
bladder cancer- rats

Politics

Industry/public prevented ban by
FDA

Instead: warning label "may
cause cancer"

2000: warning label dropped

Mycotoxins

- Metabolites produced by fungus (mold)
- May be present even if you can't see mold
- **Aflatoxin**- liver carcinogen
- Grains, nuts, peanuts (dry roasting)



If you or are someone you know
has cancer.....

- Major concern: cancer cachexia-
malnutrition/wasting away
- Cancer- a "parasite"- obtains
nutrients, person malnourished
- Similar: protein/calorie
malnutrition
- Good nutrition important: fight
cancer & withstand treatment

People with cancer

- Fatigue, ↓ energy, weak, loss appetite (anorexia), weight loss
- Due to: cancer and/or treatment
- Side effects:
chemotherapy/radiation: damage healthy & cancer cells

People with cancer

1. Malabsorption- food
2. Changes- food tastes/smells
3. Loss- appetite
4. Feeling full
5. Nausea
6. Vomiting
7. Diarrhea & constipation
8. Difficulty chewing/swallowing

People with cancer

Suggestions:

1. Eat **little** amounts/often
2. Small snacks- rich vitamins/minerals
3. Foods: **high protein, calorie-dense**
4. Breakfast & lunch main meals- **more energy early-day**

People with cancer

5. Avoid treatment-**empty stomach**
6. Avoid fried, greasy foods
7. Foods- **easy to digest**: oatmeal, noodles, boiled potatoes
8. Avoid foods- **strong odors**
9. During day: **sip juices, sports drinks, broths, peppermint teas**

People with cancer

10. Eat **bland foods**- mashed potatoes, rice, yogurt
11. Cut foods- **small pieces**
12. Choose **soft** foods
13. Add gravy, sauces, butter-
help swallowing
14. Avoid highly seasoned, spicy,
tart, acidic foods

People with cancer

15. Create
pleasant
eating
environment

People with breast or prostate cancer

- Drugs: may cause weight gain
- Overeating- stress

Suggestions:

1. Choose **lean** meat, chicken, turkey, fish, low fat dairy products

People with breast or prostate cancer

2. Eat more fruits & veggies
3. Avoid high fat/calorie snacks: chips/candies/cookies/ice cream
4. Get **regular exercise**

Dogs & Cancer

- Get cancers similar to humans

- Similar bone metastases



- Cancer: leading cause of death:
older dogs

Breeds at risk of cancer

BREEDS AT RISK

The breeds represented by the dogs shown here are particularly susceptible to cancers that also afflict humans. These malignancies look like the human forms under a microscope and act similarly as well. Such resemblances mean that canine responses to experimental drugs should offer a good indication of how the compounds will work in humans. In addition, research into the genes that increase susceptibility of specific breeds to particular cancers is expected to help pinpoint susceptibility genes in humans.

Rottweiler:
Bone cancer

Collie:
Nasal cancer

Chow Chow:
Stomach cancer

Golden Retriever:
Lymphoma

Boxer:
Brain cancer

Scottish Terrier:
Bladder cancer

SKELETAL DISTRIBUTION of metastases is another aspect of cancer similar in dogs and humans. In dogs, the lesions display the same "above the elbow, above the knee" pattern seen in people. Insights into why that pattern occurs in dogs could help explain the distribution in humans and perhaps suggest new ideas for intervening. (The numerals indicate the number of metastases found at each site in one study.)

ILLUSTRATION: BEATRIZ CORREIA (Chow Chow, Terrier, collie); DANIELA MARQUES/ISTOCK (Boxer); DAVID WILCOX (dog skeleton)

Dogs & Cancer

- Cancer research: helps dogs & people
- Enroll pets- drug/medical device trials
- Groundbreaking studies
- Pet owners- best treatments for pets

Dogs & Cancer: research

- Treatments may be applied-
humans
- Advantage: shorter studies 1 year
dog's life = 7 human's
- Quicker results
- New dog studies: collect DNA &
tumor samples: look for cancer
genes

Dogs & Cancer

- Basil- 6 year old Golden retriever-
“miracle dog”
- **“I’m a cancer survivor”**

In Trials for New Cancer Drugs,
Family Pets Are Benefiting, Too



Jessica Brandi Liffand for The New York Times

Basil, a golden retriever, with Kathy Wilber, his owner. The dog survived cancer after participating in tests of a treatment for the disease.

Basil

- Bone cancer: leg amputated
- 11 metastases
- Biotech company: Basil- drug study
- Free of cancer:
3 1/2 years

Dogs can detect cancer

- Dogs- good sense- smell (parts per billion)
- Can sniff cancer



Peter DaSilva for The New York Times

ON THE TRAIL OF CANCER Kobi, a golden retriever, achieved high marks in a cancer-detection experiment conducted at the Pine Street Clinic in San Anselmo, Calif.

Kobi
yellow lab

Dogs can detect cancer

- **Tumors**: release alkanes & benzene derivatives
- Northern California clinic
- Collect **breath samples** in tubes containing wool: cancer patients & healthy volunteers

Dogs can detect cancer

- If dog smelled cancer, trained to sit
- 3 yellow labs & 2 Portuguese water dogs
- 99% accuracy-lung cancers
- 80% accuracy- breast cancers

Dogs can detect cancer

- Other studies: dogs detect cancer-urine samples: people with bladder cancer

Health Benefits of Pets

2009 study underway
Eunice Kennedy Shriver
Center- Waltham

Human- animal interactions- anecdotal

1. Autism- service dogs calm children
2. Ill Children in hospitals:
anxiety/depression: bring dogs:
"brightens them up"
3. Patients (no speech, movement): talk
to dogs, reach out to pet

Cancer: The Good News

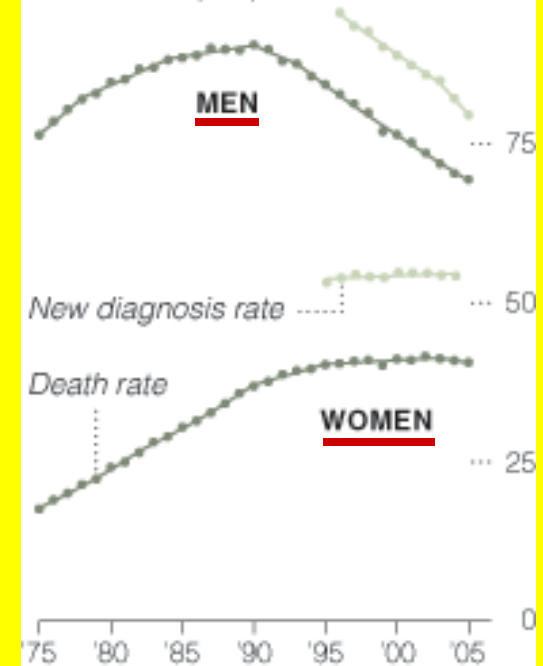
- Overall: 1999-2005
- ↓ Incidence new cases
- ↓ Cancer death rates
- Men: ↓ prostate, lung
- Women: ↓ breast cancer
- Both sexes: ↓ colorectal
- Result: ↓ risk factors,
↑ screening, newer treatments
- ↑ Some other cancer types
- Women: ↑ smoking 60's, 70's. Now slower increase in lung cancer

An Ongoing Trend

Rates of new cancer cases and deaths from cancer have been falling in recent years, due in part to a steady, 15-year decline in lung cancer rates among men.

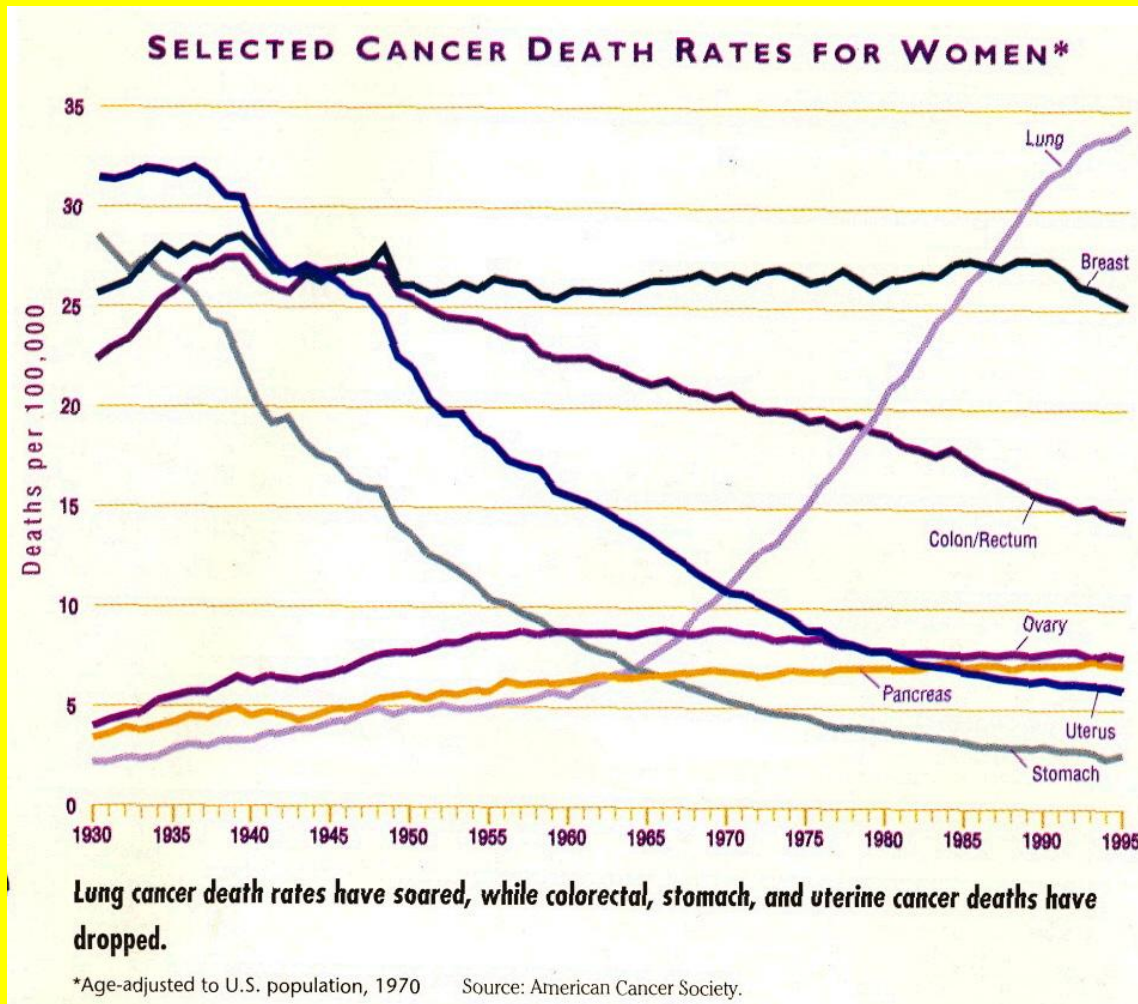
Lung cancer rates

Per 100,000 people



Source: Journal of the National Cancer Institute THE NEW YORK TIMES

Cancer Deaths: Women



Cancer Deaths: Men

