Cancer 1

- **iClicker 30A**
- **Cancer**
  - Mechanisms (intro)
  - Cell Division I
- **iClicker 30B**

- **Due in Lab this week**
  - Lab report #9
  - Pre-lab #10

- **Register your iClicker!**

Cancer

for Bio 111, cancer is uncontrolled cell division (mitosis)

in medical field: malignant tumors = cancer
benign tumors ≠ cancer

cell growth is controlled by growth factors (GF)
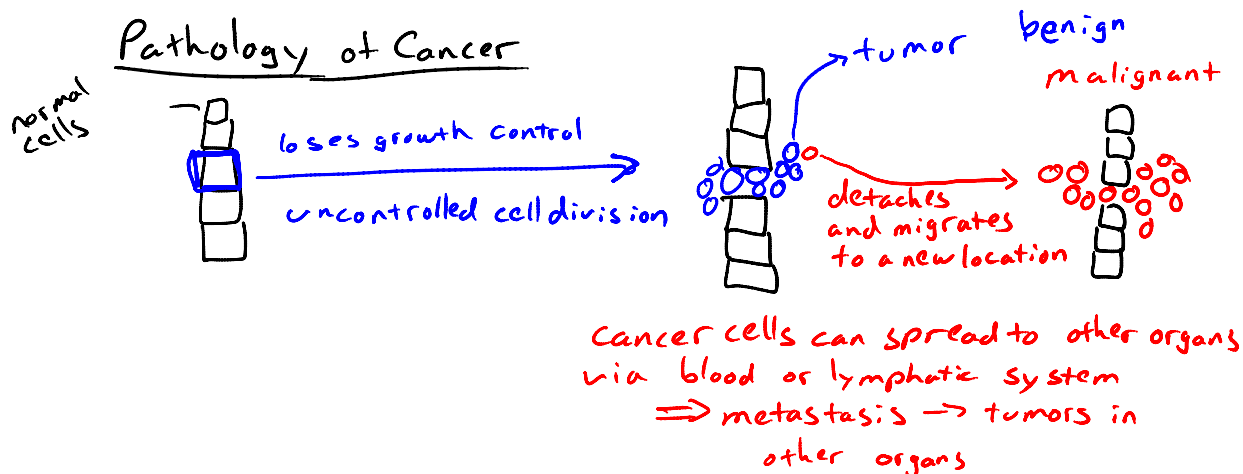
GF: produced by other cells and stimulate target

cells to divide
(ex. healing, growth, etc.)

− cells do not divide unless told to

ex. erythropoetin ("epo") = small protein growth factor

produced by kidneys when the # of red blood cells
is too low
− epo stimulates red blood cell producing cells
to divide rapidly and create more
red blood cells

Pathology of Cancer

normal cells

loses growth control

uncontrolled cell division

→tumor   benign
           malignant

detaches
and migrates
to a new location

Cancer cells can spread to other organs
via blood or lymphatic system
⇒ metastasis → tumors in
other organs

How does Cancer kill?

as a tumor grows and spreads, it squezes or destroys
blood vessels, nerves, vital organs, etc.   until
the organ can no longer do it's job ⟶ death

cancer accounts for ~ 28% of all US deaths

ex. lung cancer ⟶ a cell in your lungs loses growth
control and produces a tumor
~ 19% of all US cancers
~ 34% of US cancer deaths

Bio 111 Lung Cancer Statistics

Major types: (distinguished by where they form & what the tumor cells look like)
• Epidermoid carcinoma
• Adeno-carcinoma
• Large Cell Carcinoma
• Small Cell Carcinoma

The following data are from *Cancer: Principles & Practice of Oncology* DeVita, &al.
• they are from 1985, but little has changed since then (the 2001 average 5-year survival is only 15%!)

	Epidermoid Carcinoma	Adeno-carcinoma	Large Cell Carcinoma	Small Cell Carcinoma

Incidence

	Epidermoid Carcinoma	Adeno-carcinoma	Large Cell Carcinoma	Small Cell Carcinoma
% of cases in **Smokers**	36	23	16	23

[handwritten: lung cancer is 10X higher in smokers]

5-year survival with treatment*

	Epidermoid Carcinoma	Adeno-carcinoma	Large Cell Carcinoma	Small Cell Carcinoma
% of all cases surviving	25	12	13	1
% survival after surgery	37	27	27	0

[handwritten: 90% of people with lung cancer smoke]

Top 5 metastatic sites

	Epidermoid	Adeno	Large Cell	Small Cell
	lymph nodes	lymph nodes	lymph nodes	lymph nodes
	thorax	pleura	pleura	liver
	pleura	other lung	adrenals	adrenals
	liver	adrenals	liver	pancreas
	adrenals	CNS	other lung	bone

pleura - the membrane lining the lungs
adrenals - glands that secrete adrenaline (among other hormones)
CNS - central nervous system (brain & spinal cord)
pancreas - gland that secretes digestive enzymes & insulin

* Why so poor a prognosis?
• lung cancer is vigorous & highly metastatic
• By the time it's detected, the tumor has been growing for a long time:
> Typical symptoms that brought people to a doctor who then found out that they had lung cancer:
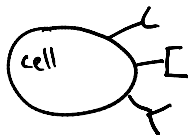
Cancer 1-3

– persistent cough
– hemoptysis = coughing or spitting blood
– dyspnea = difficuty breathing, shortness of breath
these would not appear until the tumor is well-developed
- making successful treatment less likely

Cancer 1-4

<u>Growth Control in Cells</u> — normal cells only divide when told to

growth factors made by other cells ——> • ▲ ▬

cell

receptors (proteins) for different GF
— different on different cell types
receptors bind GF through specific interactions,
H-bond, ionic bonds, phobic interactions

① if right combination of GF are present —> bind to receptors

② receptors send chemical messages to genes in nucleus

③ in nucleus, specific genes are activated → transcription, translation → protein is made

④ these new proteins are the machinery for cell division

⑤ cell divides

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2 types of chemical "messages"

① oncogenes — "gas pedal", when active they stimulate cell division, when inactive they do nothing

② anti-oncogenes/ — "brakes", when active they inhibit tumor-suppressor genes   cell division, when inactive they do nothing

how do cells lose growth control?

- Somatic mutations in genes encoding proteins that control growth and cell division

these mutations are not inherited, they occur during development and life

you can inherit faulty genes for DNA replication → can lead to mistakes during replication