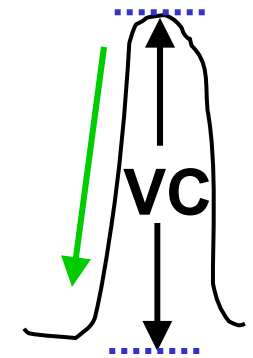
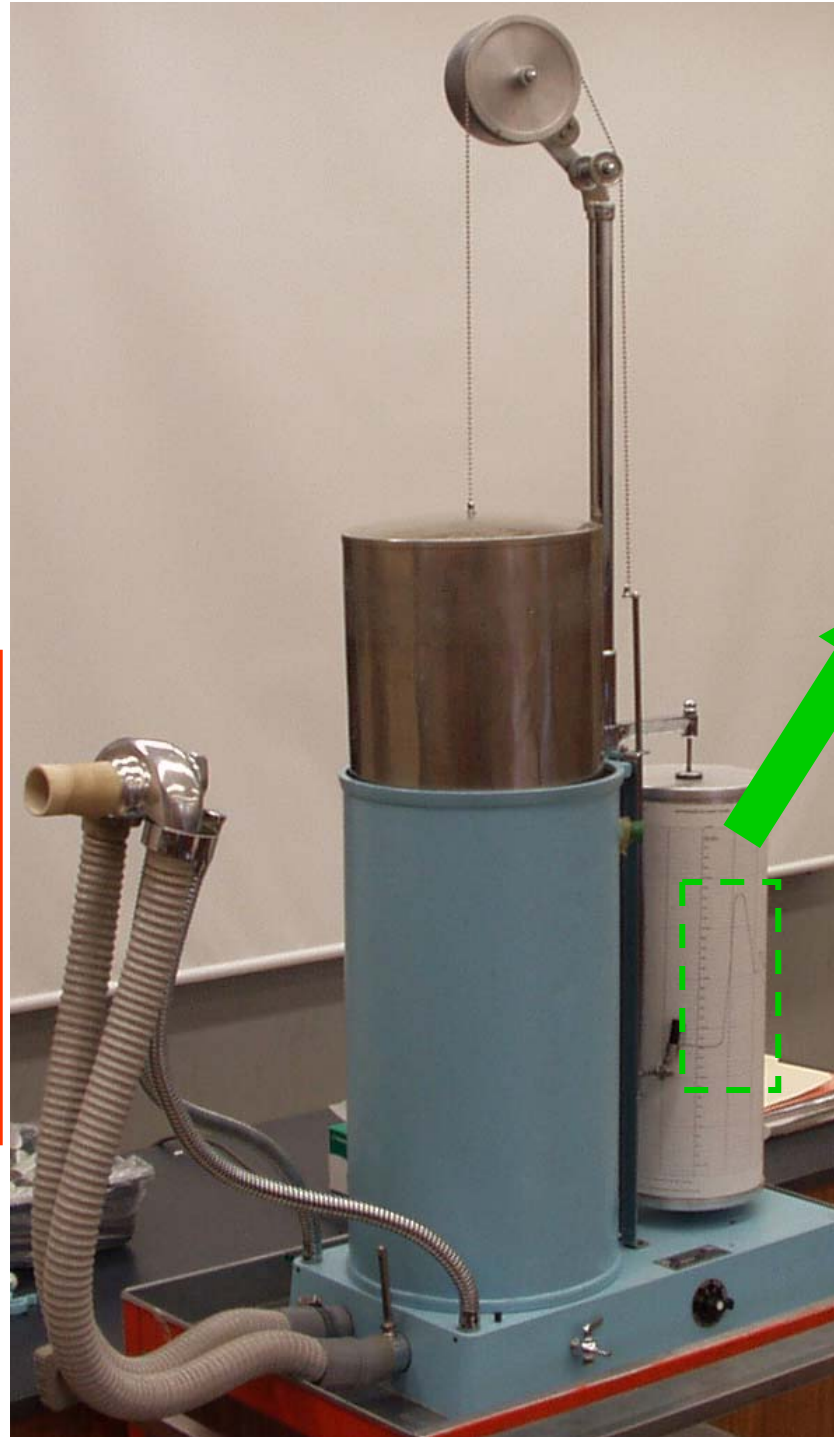


BI 121 Lecture 13

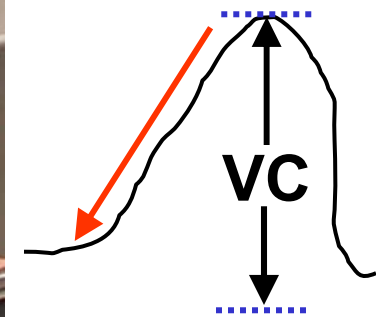
- I. Announcements Optional notebook check today. Discussion-Review followed by final exam tomorrow. Q?
- II. Introduction to PFT Lab 6 Pulmonary Function Testing
- III. Respiratory System LS ch 12, DC Module 7, SI Fox +...
 - A. Steps of respiration? External vs. cellular/internal?
LS fig 12-1 pp 345-7
 - B. Respiratory system anatomy LS fig 12-2 p347, DC, SI Fox +...
 - C. Histology LS fig 12-4 pp 347-9, DC
 - D. How do we breathe? LS fig12-12, fig12-25 pp 349-56, 373-8
 - E. Gas exchange LS fig 12-19 pp 362-5
 - F. Gas transport LS tab 12-3 pp 365-70
- IV. Physiology of Cigarette Smoking
 - A. ANS, autonomic nerves & nicotine? Route of chemicals,...
 - B. Emphysema? 2nd-hand smoke?... p 356, 365
 - C. UO Smoke-Free since Fall 2012! Help is available!

**Respirometer →
measures complete
Pulmonary Function
Test or PFT!**

**NB: Should be able to
blow out $\geq 75 - 85\%$ of
VC/FVC in 1 second!
That's $FEV_{1.0}/FVC \geq$
 $0.75 - 0.85$. If less,
may indicate asthma
or other lung disease.**

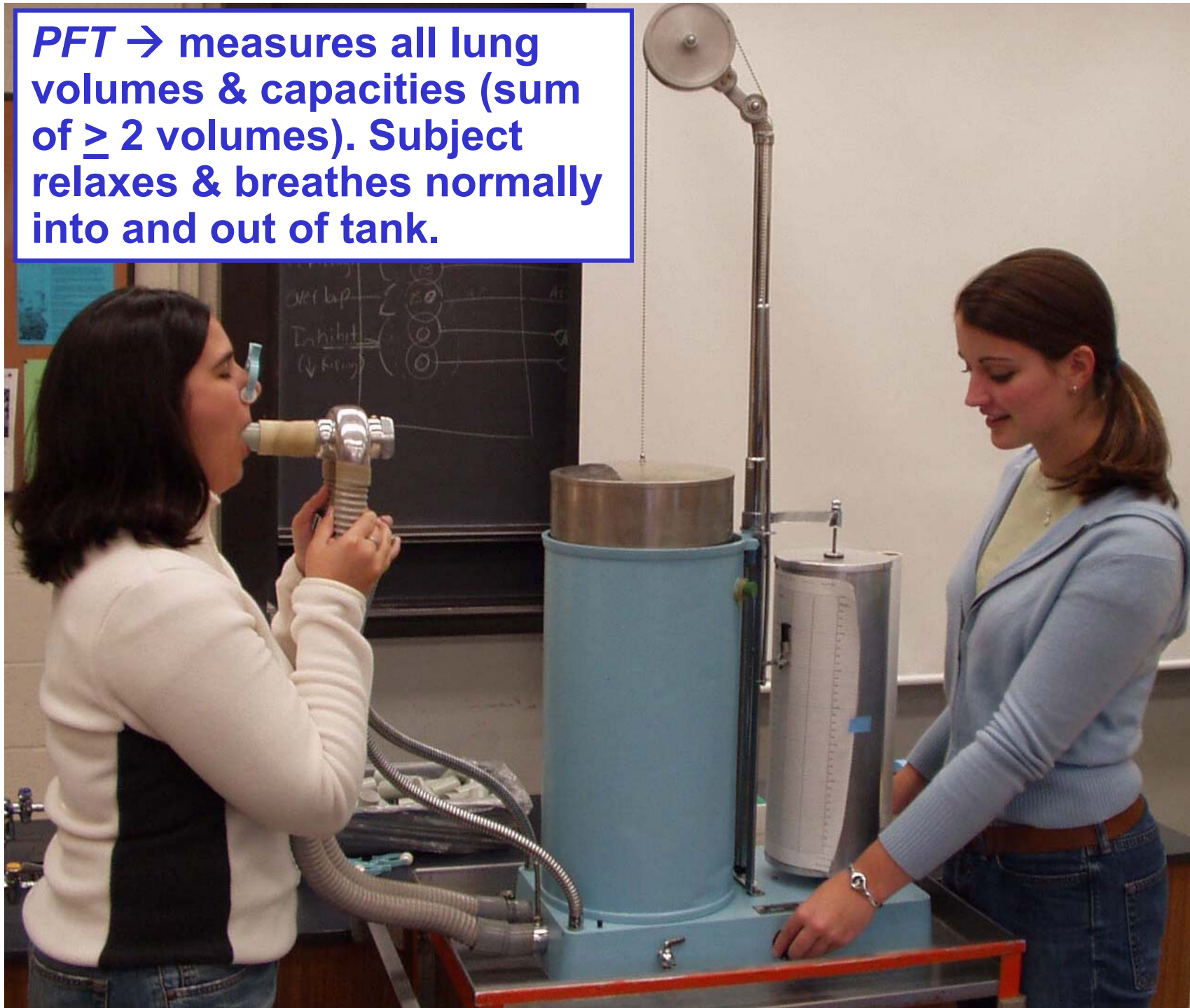


**Normal =
Steep**

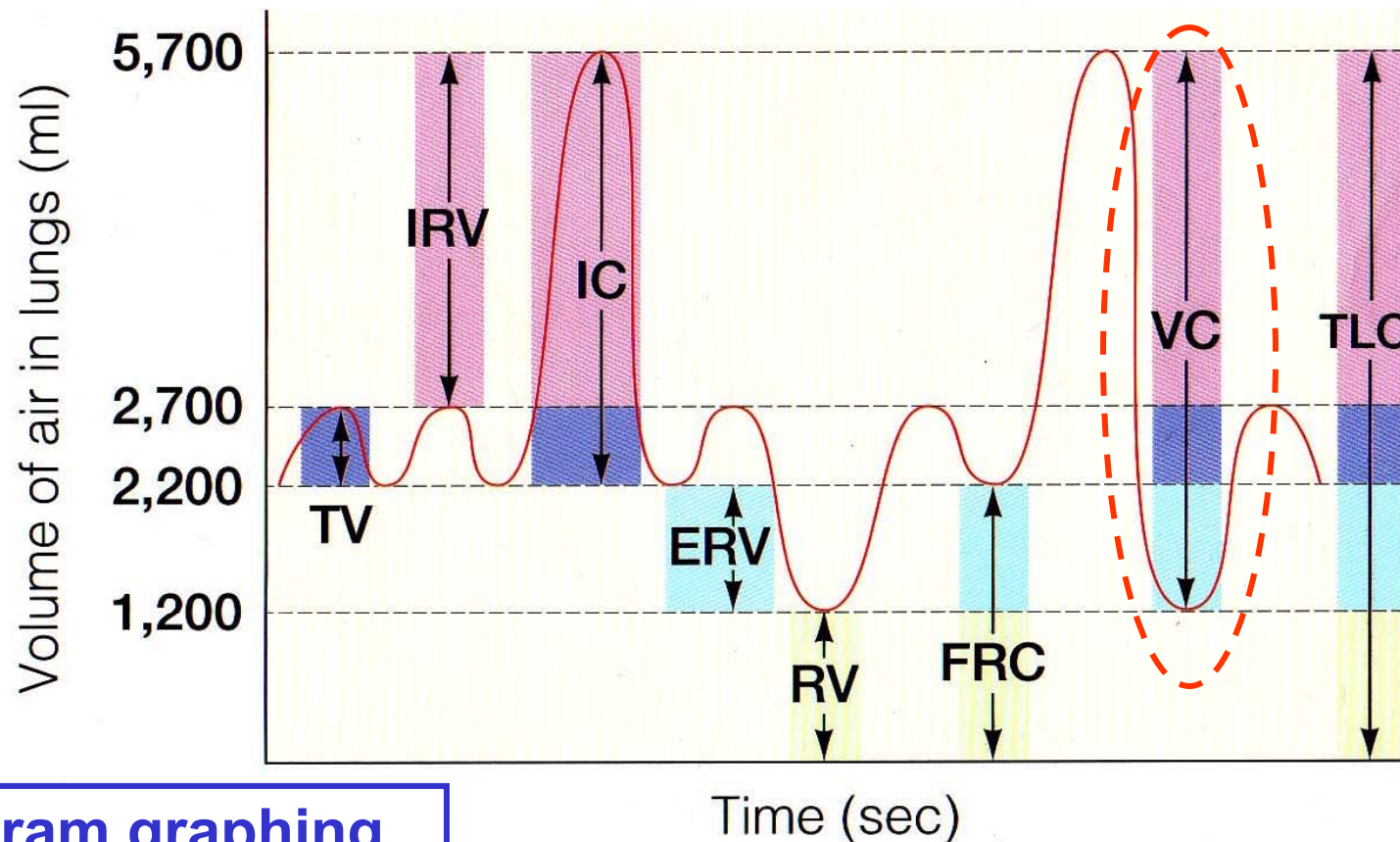


**Abnormal =
Flatter
Downslope
(eg, Asthma)**

PFT → measures all lung volumes & capacities (sum of ≥ 2 volumes). Subject relaxes & breathes normally into and out of tank.



Normal Spirogram of Healthy Young Adult Male



**Spirogram graphing
complete *PFT* from
computer simulation.**

- TV = Tidal volume (500 ml)
- IRV = Inspiratory reserve volume (3,000 ml)
- IC = Inspiratory capacity (3,500 ml)
- ERV = Expiratory reserve volume (1,000 ml)
- RV = Residual volume (1,200 ml)
- FRC = Functional residual capacity (2,200 ml)
- VC = Vital capacity (4,500 ml)
- TLC = Total lung capacity (5,700 ml)

***Vitalometer* → Can only measure Vital Capacity (VC). No graph paper, so no time component.**



Inhale air in room maximally!

NB: noseclip & mouthpiece!



Exhale into tube maximally!



More modern-day computerized Pulmonary Function Testing



*Complete with HH!
Happy Helpers!*

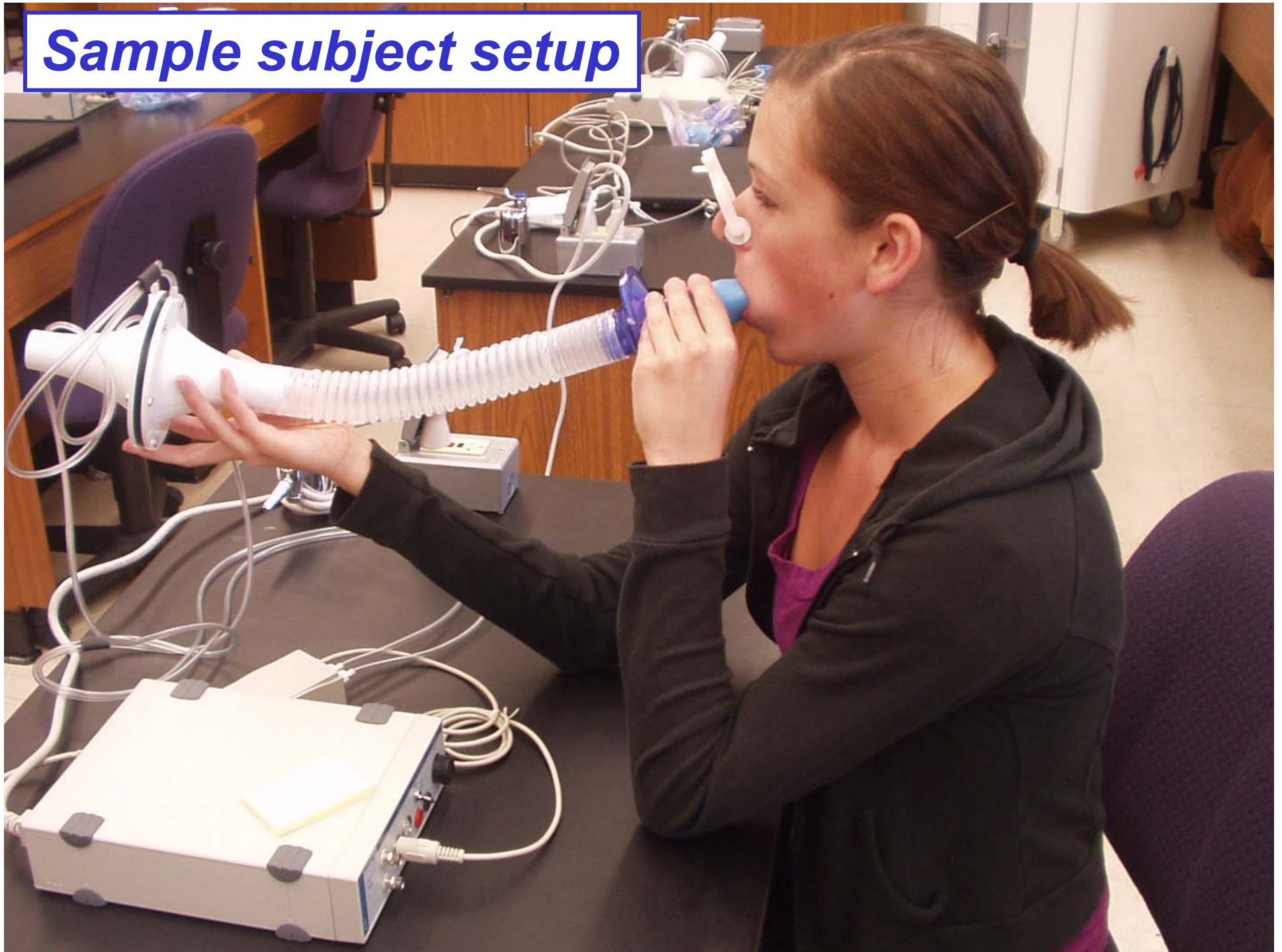


**How to put
together?**

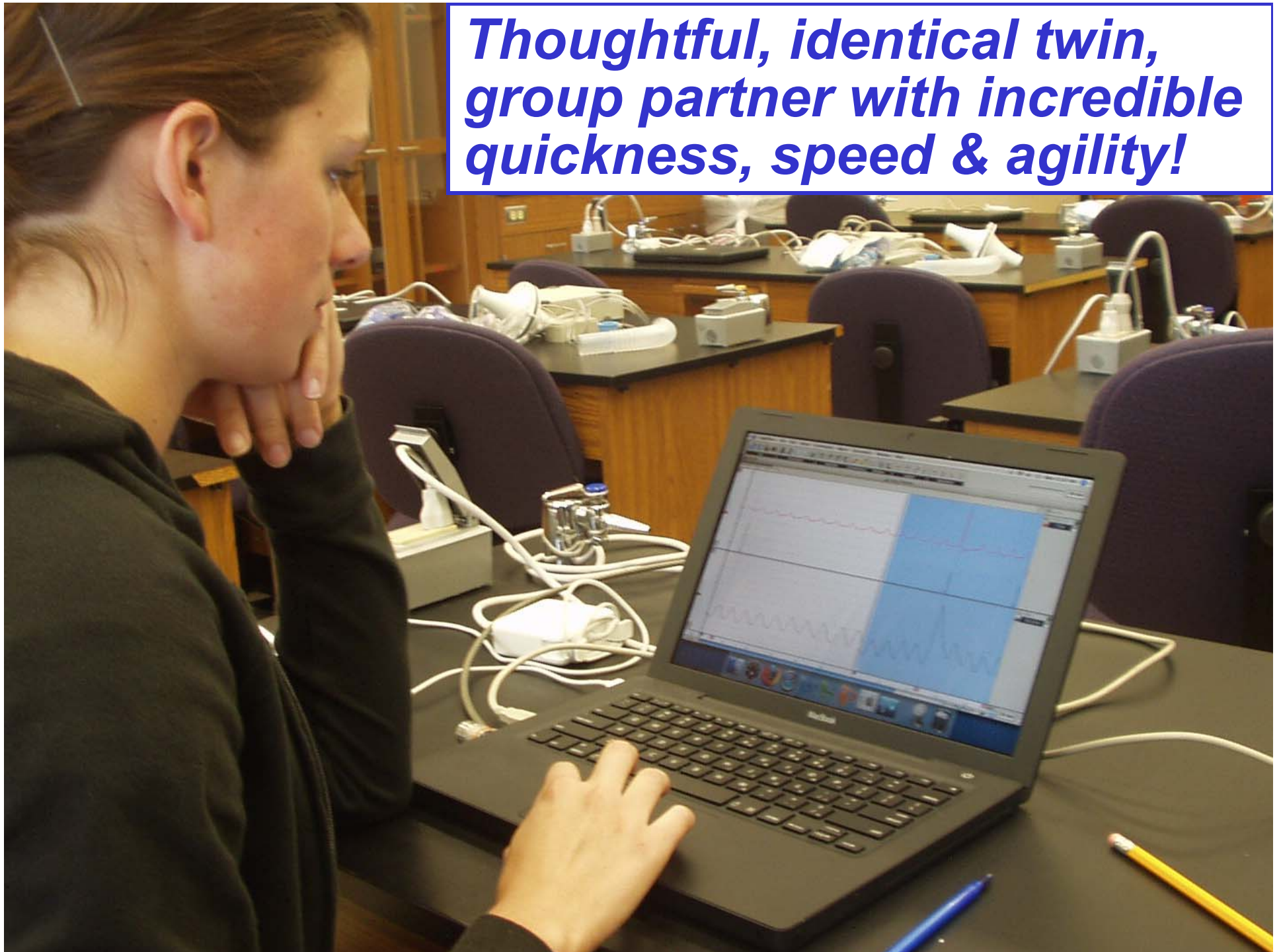
Viola!!



Sample subject setup

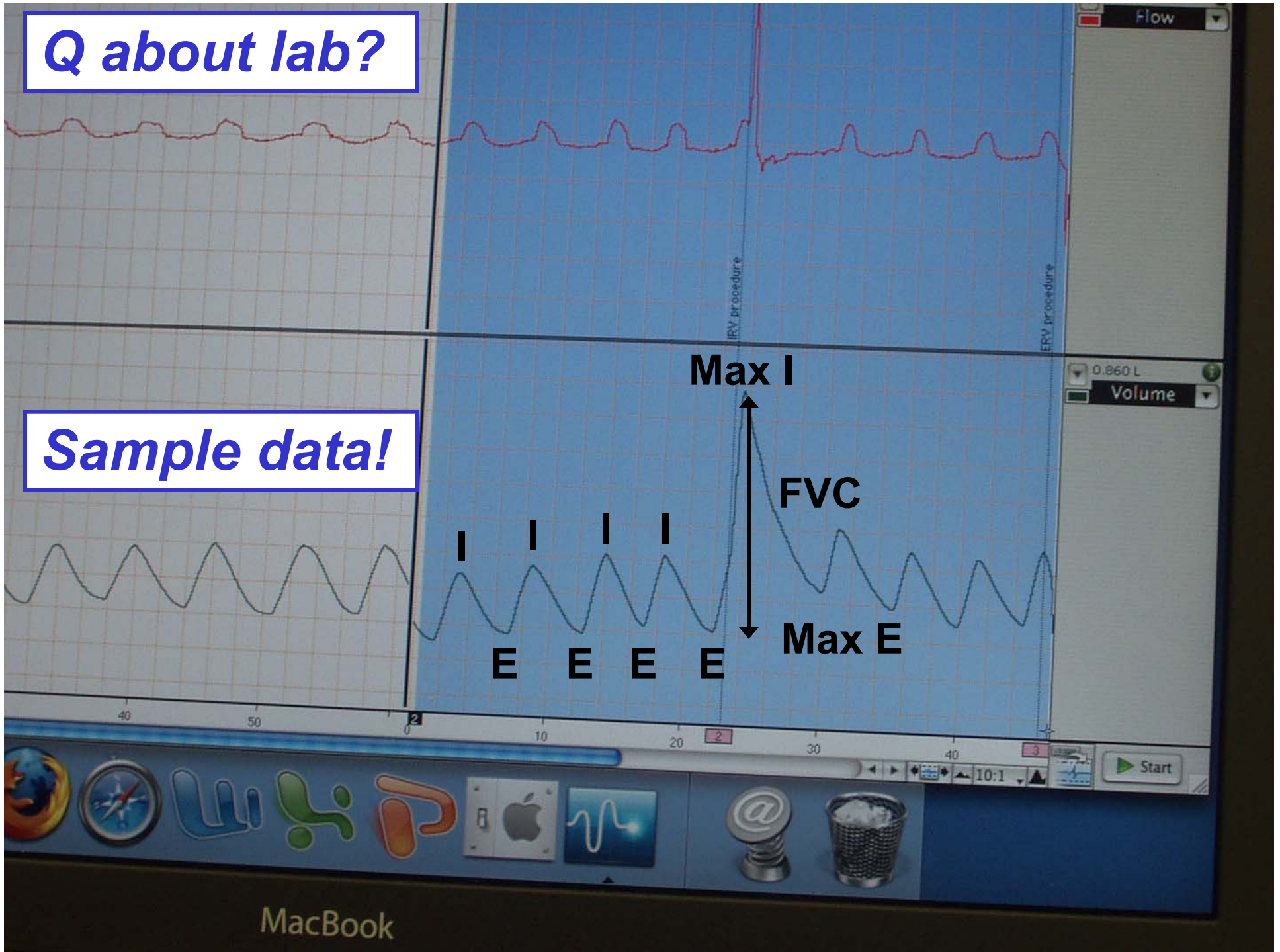


***Thoughtful, identical twin,
group partner with incredible
quickness, speed & agility!***



Q about lab?

Sample data!



Lombo's simplified steps!

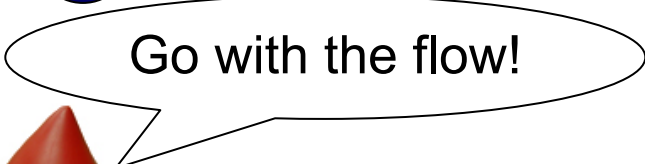
1 Breathe in & out!



2 Cross membranes!



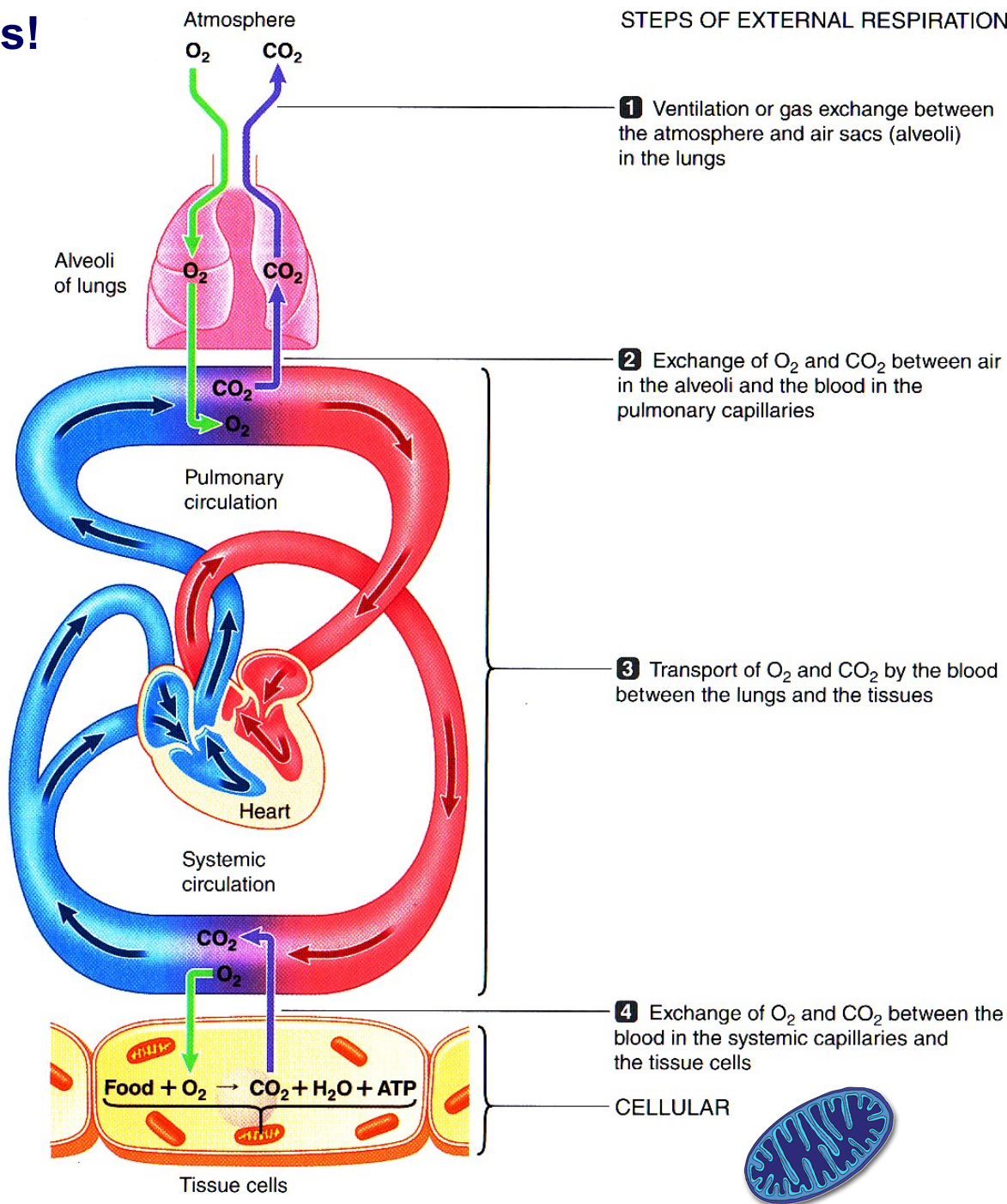
3 Move with blood!



4 Cross membranes!



STEPS OF EXTERNAL RESPIRATION



Respiratory System Anatomy

NB: In vivo, Cupola or peak of each lung goes into neck > clavicle line!

Nasal passages

Mouth

Pharynx

Larynx

Trachea

Cartilaginous ring

Right bronchus

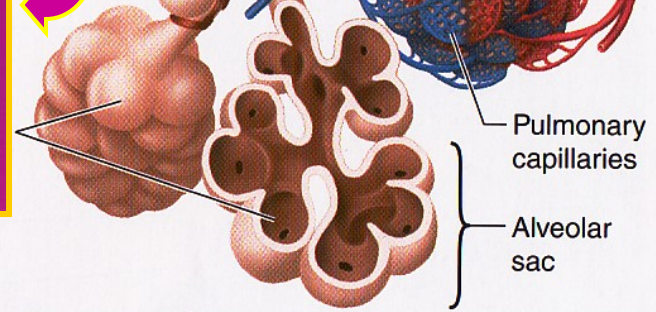
Bronchiole

Terminal bronchiole

Branch of pulmonary artery

Smooth muscle

Branch of pulmonary vein



Pulmonary capillaries

Alveolar sac

(b) Enlargement of alveoli (air sacs) at terminal ends of airways

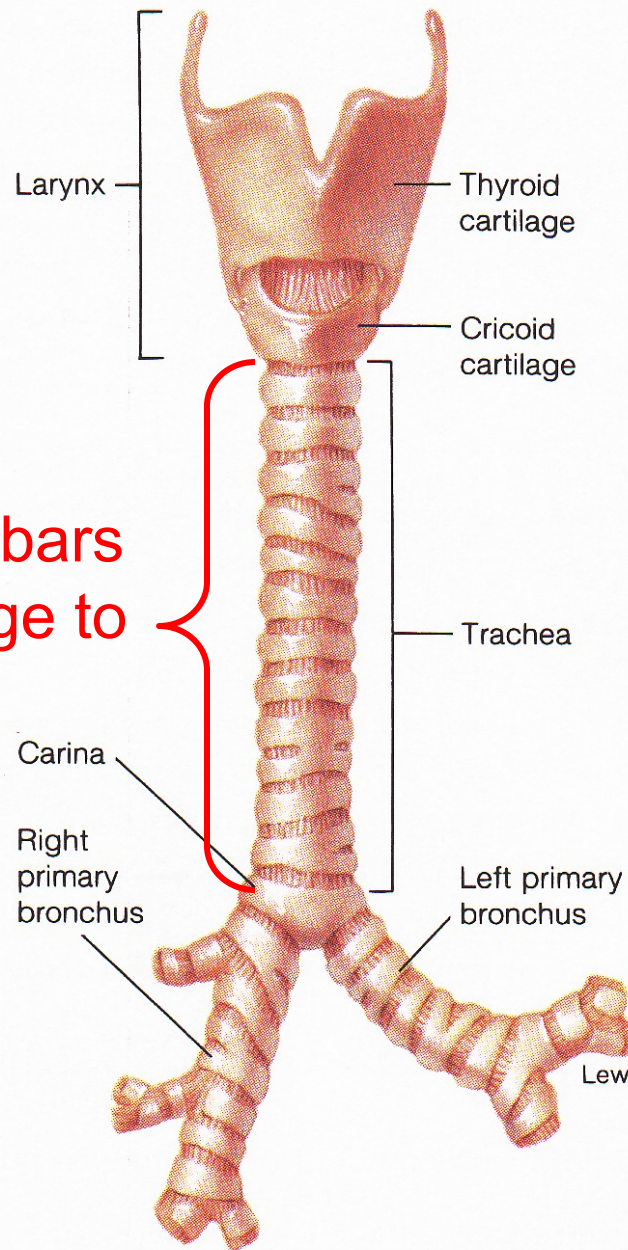
Left bronchus

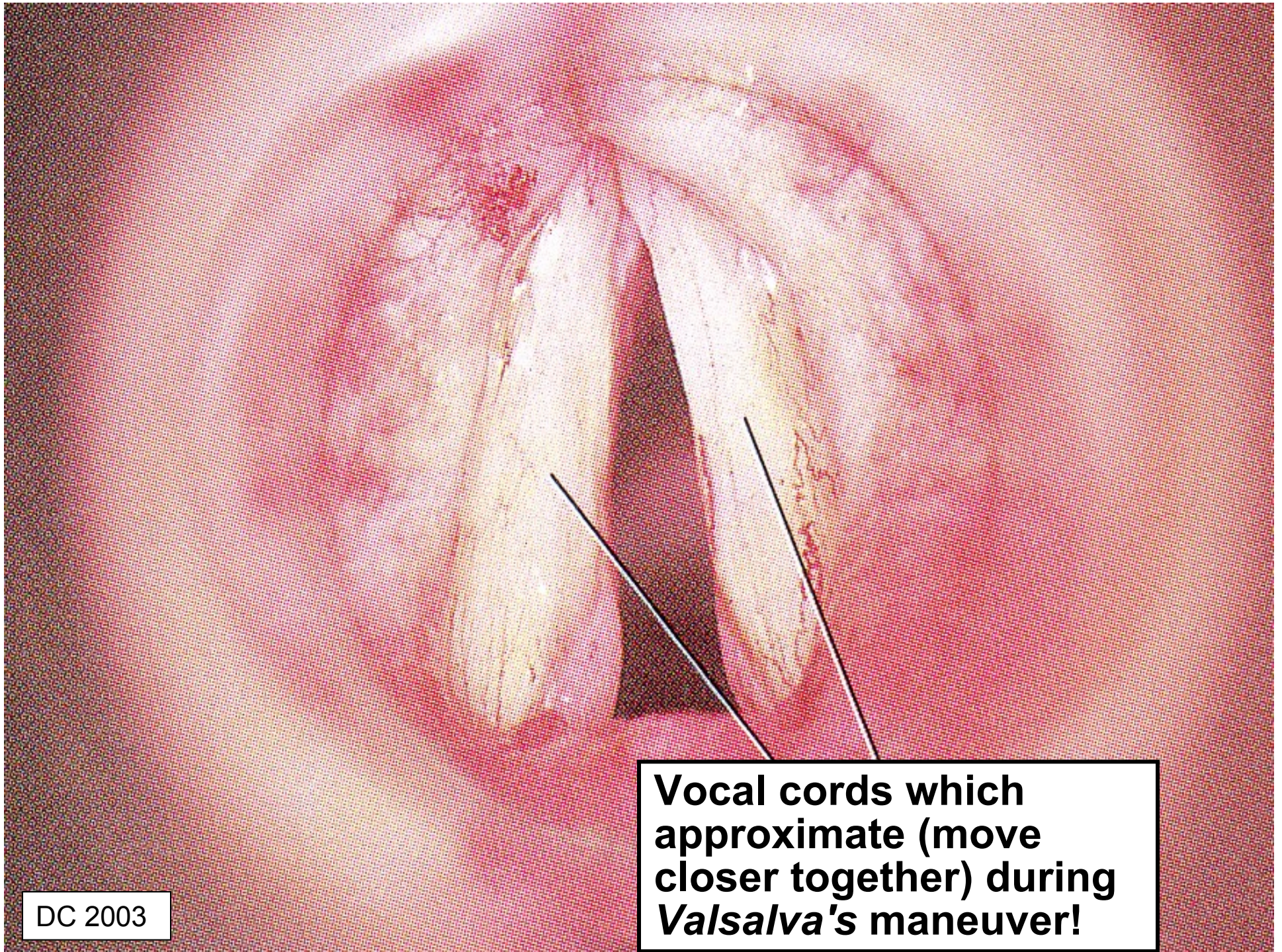
Terminal bronchiole

Alveolar sac

Terminal bronchiole

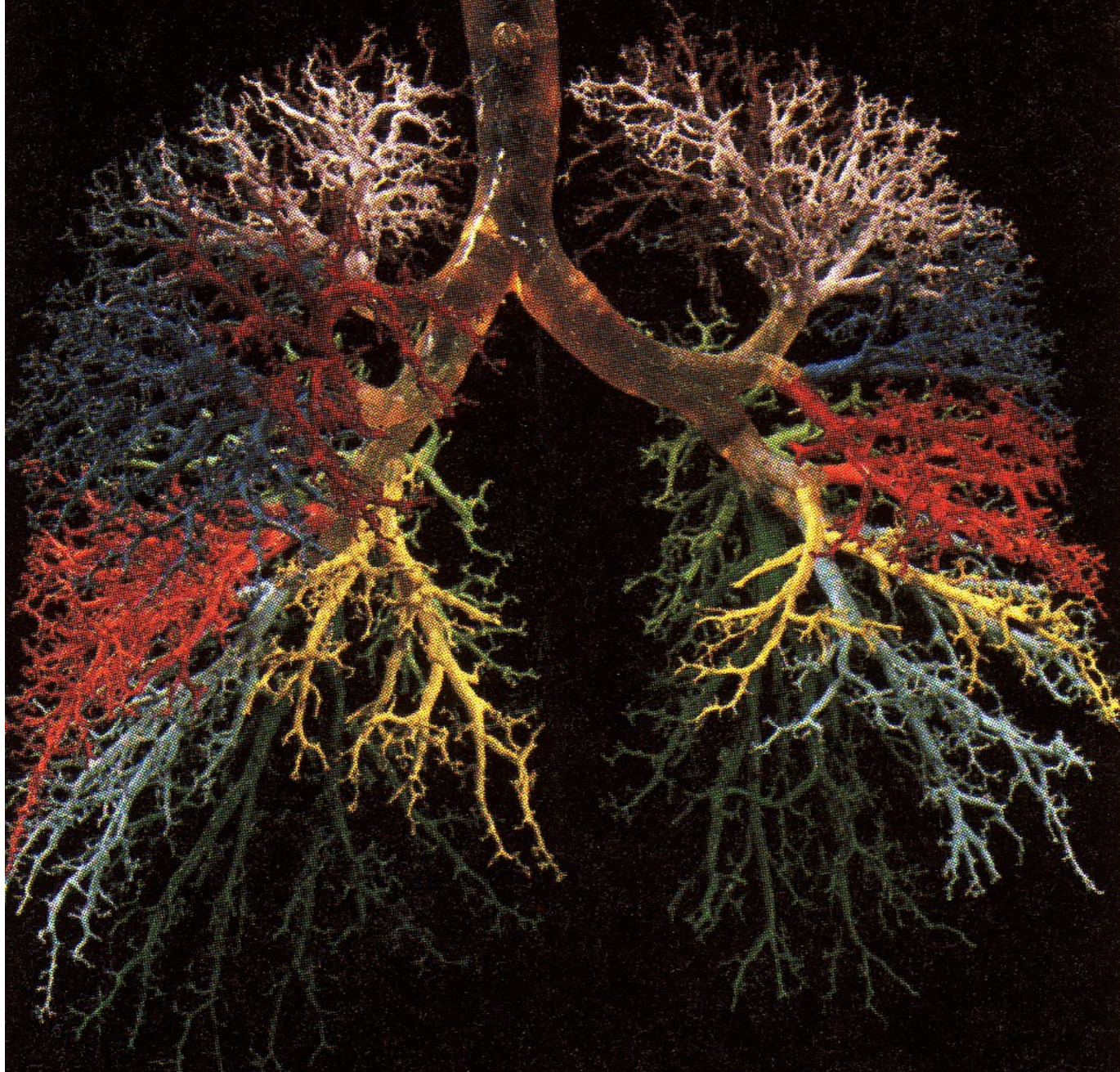
16-20 C-shaped bars
of hyaline cartilage to
prevent collapse



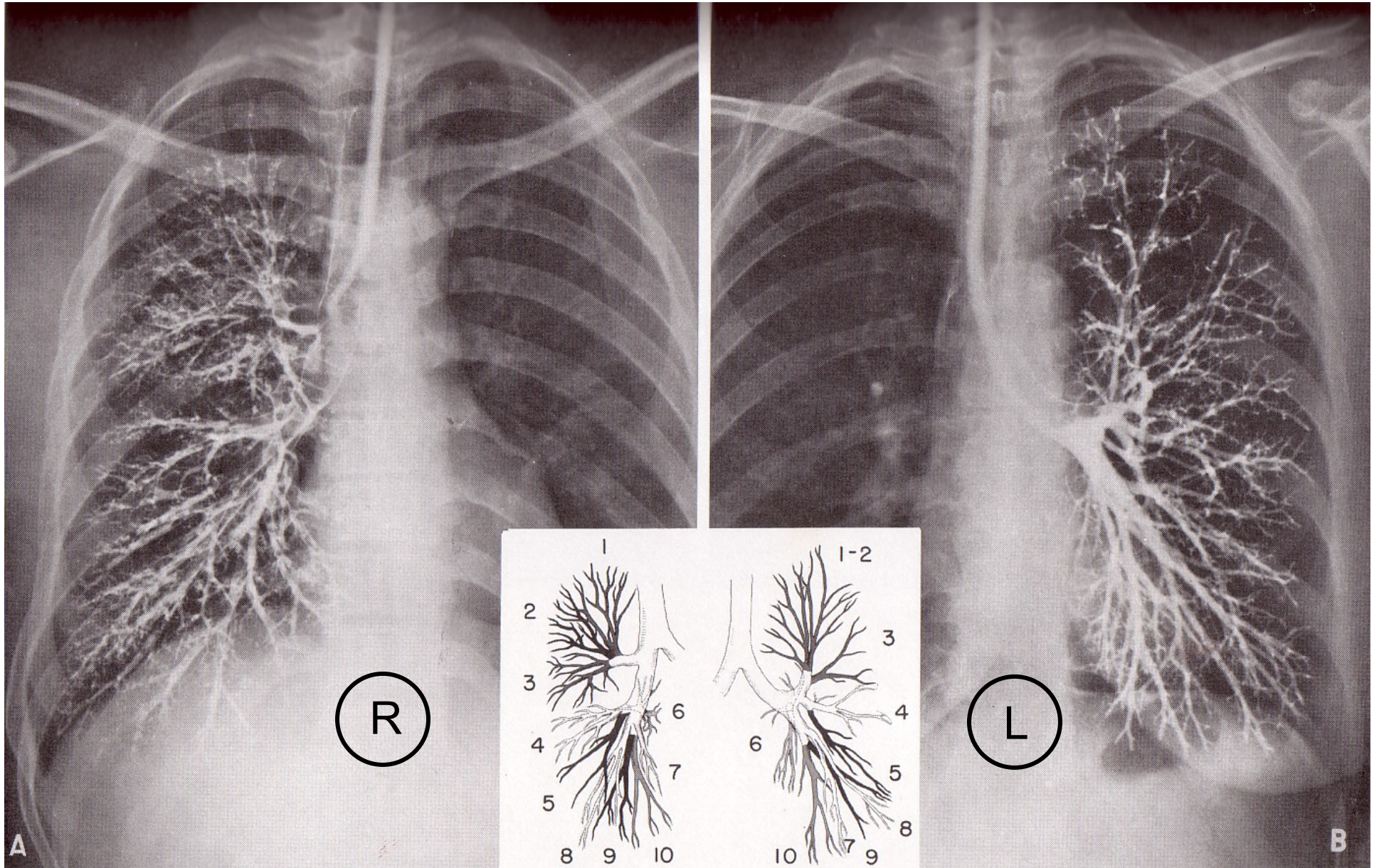


Vocal cords which approximate (move closer together) during *Valsalva's* maneuver!

Pulmonary Latex Cast with Colored Segmentation

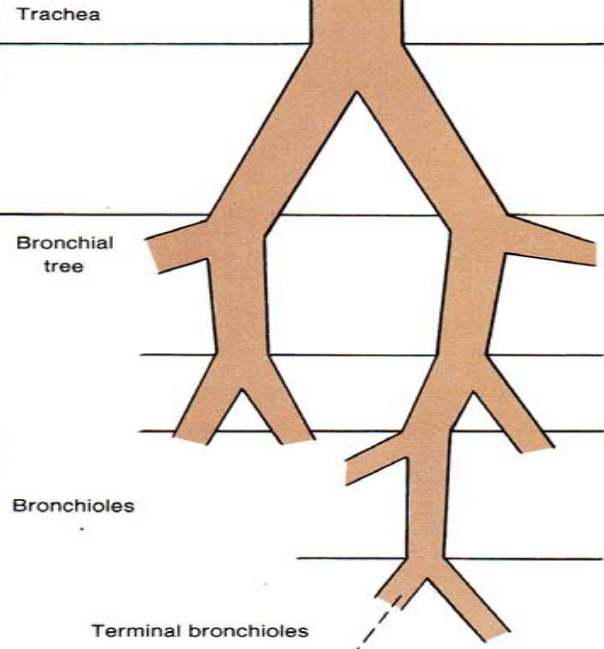


Bronchograms (posteroanterior)



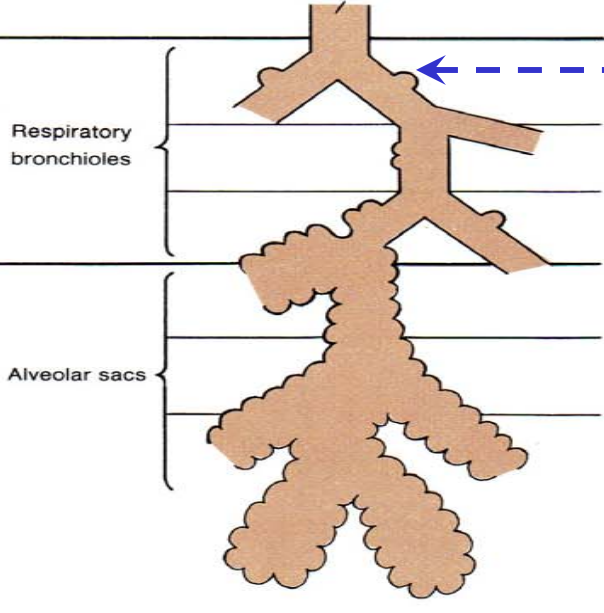
Source: Gardner, Gray, O'Rahilly, *Anatomy*, fig 29-11, p 295.

Conductive Zone



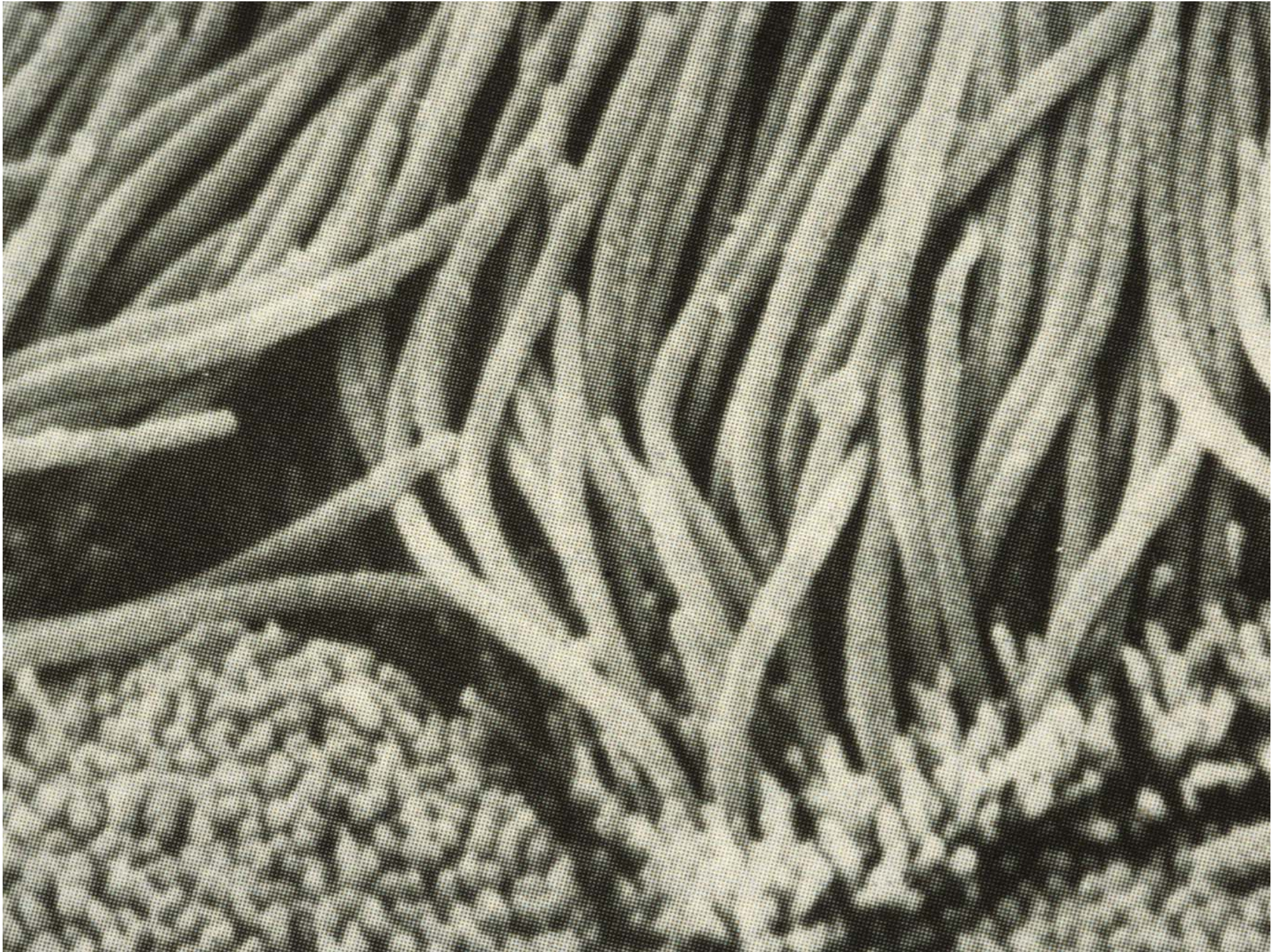
No Gas Exchange

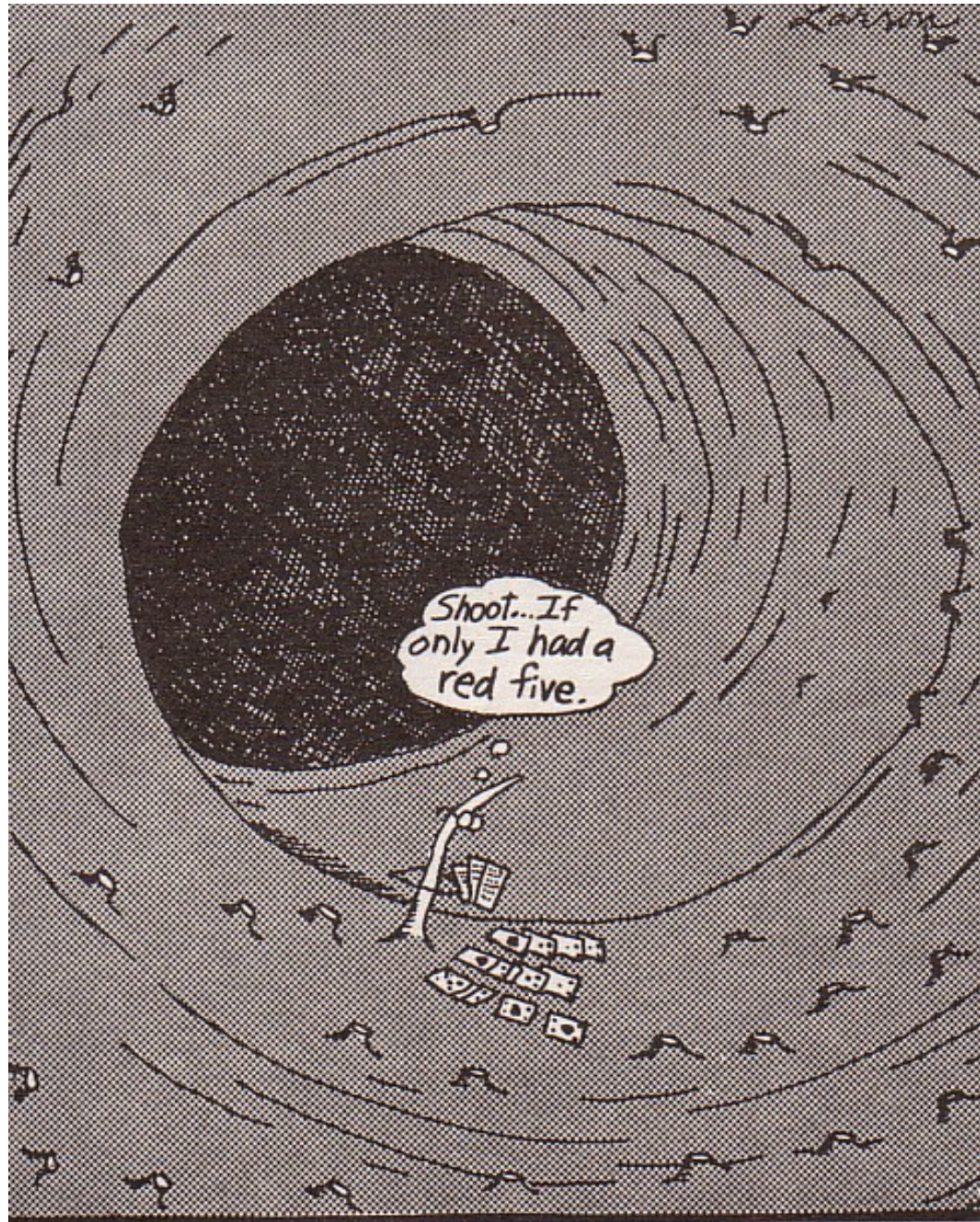
Respiratory Zone



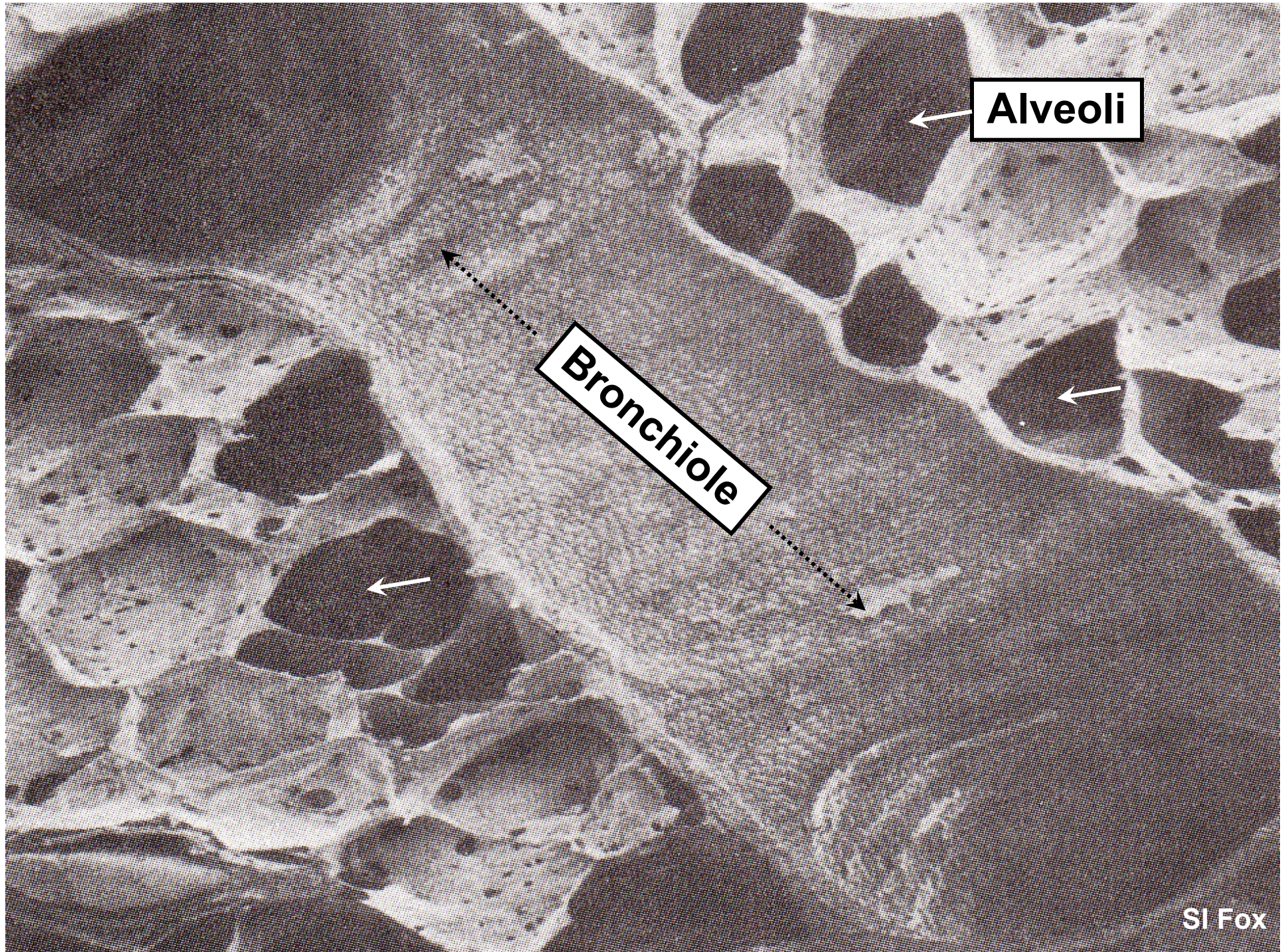
1st alveolar outpouching!

Gas Exchange



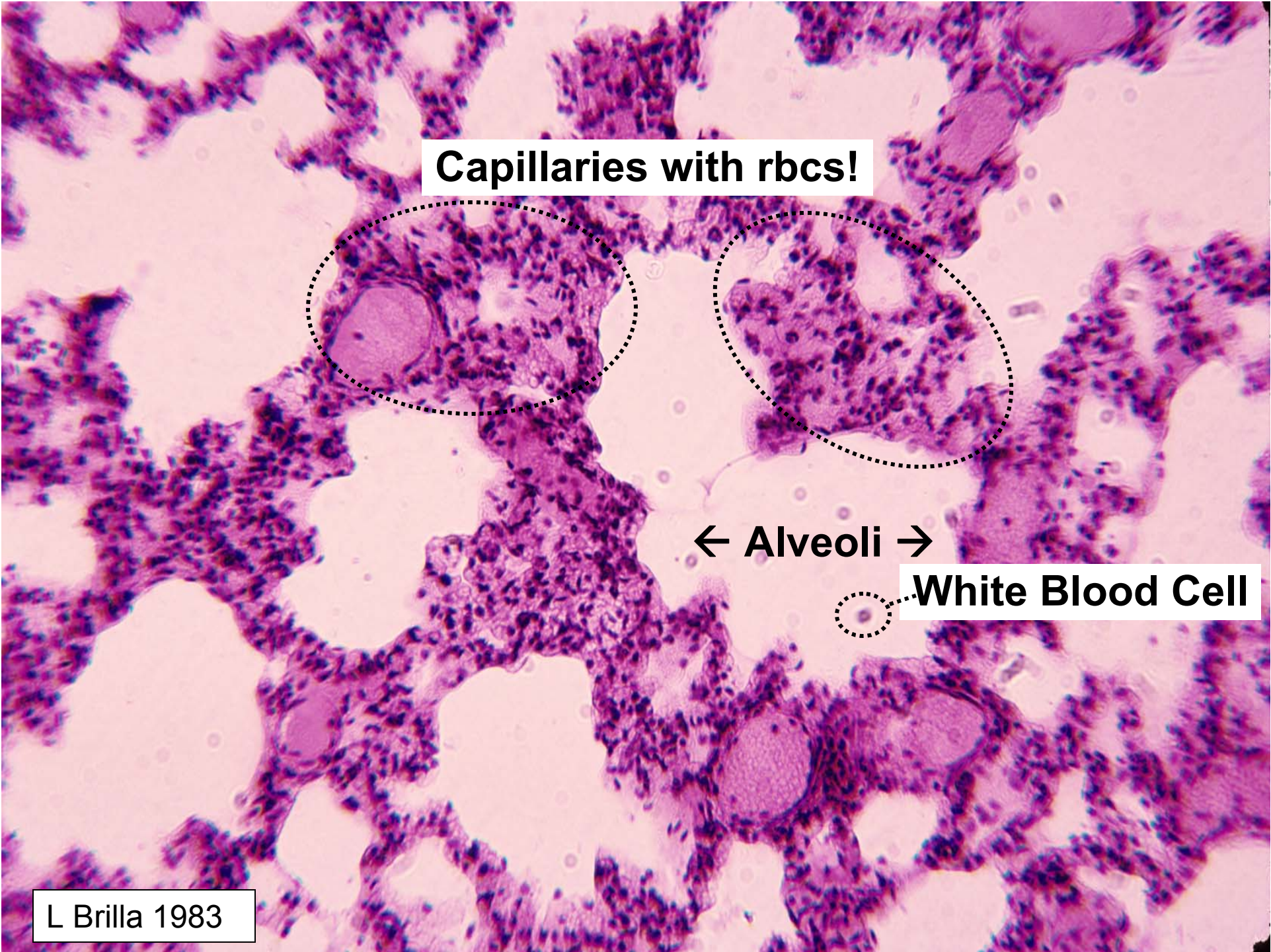


The last cilium on a smoker's lung



Alveoli

Bronchiole



Capillaries with rbcs!

← Alveoli →

White Blood Cell

L Brilla 1983

Muscles of Ventilation

Accessory muscles of inspiration
(contract only during forceful inspiration)

Sternocleidomastoid

Scalenus

Internal intercostal muscles

Sternum

Ribs

External intercostal muscles

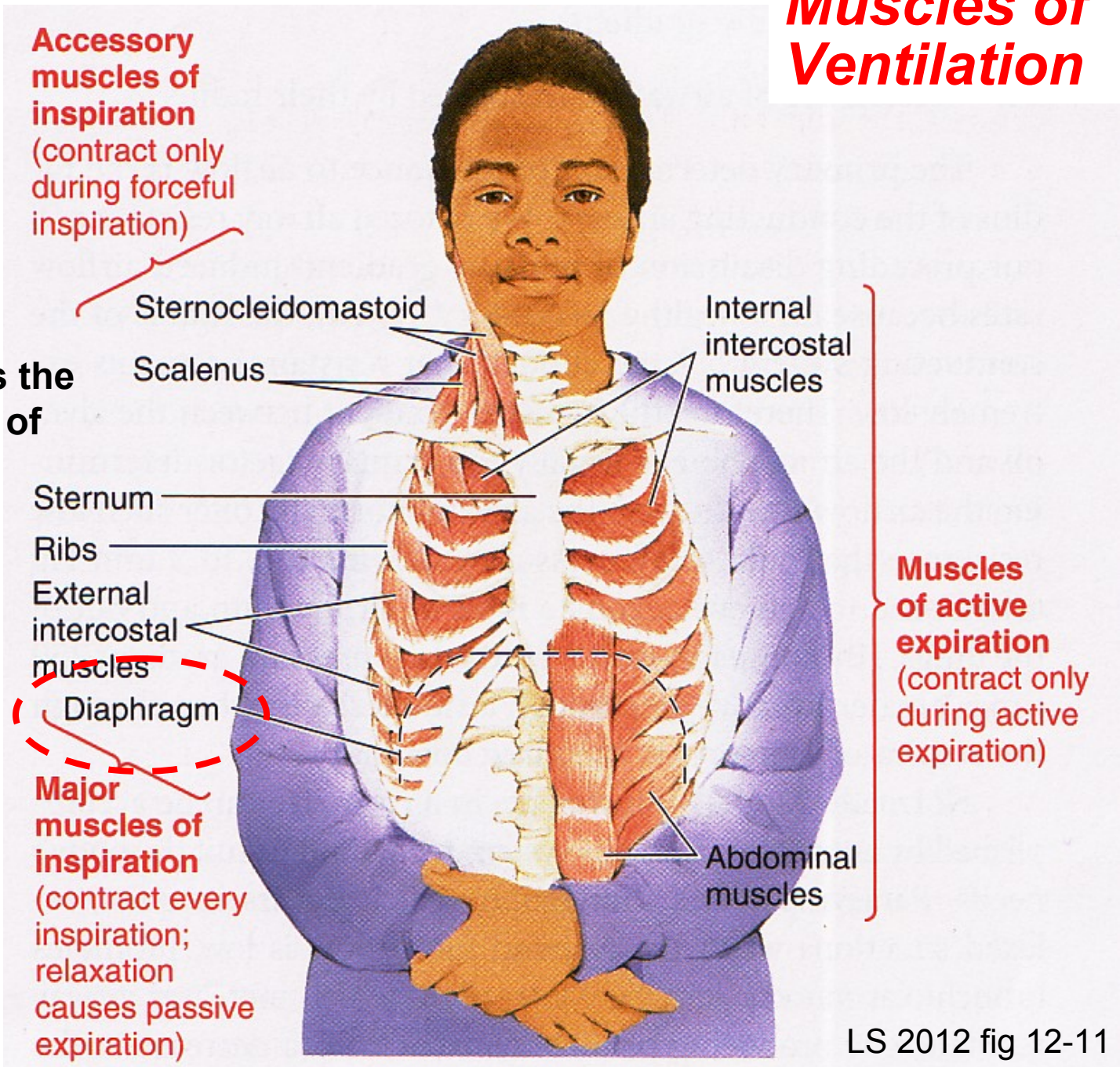
Diaphragm

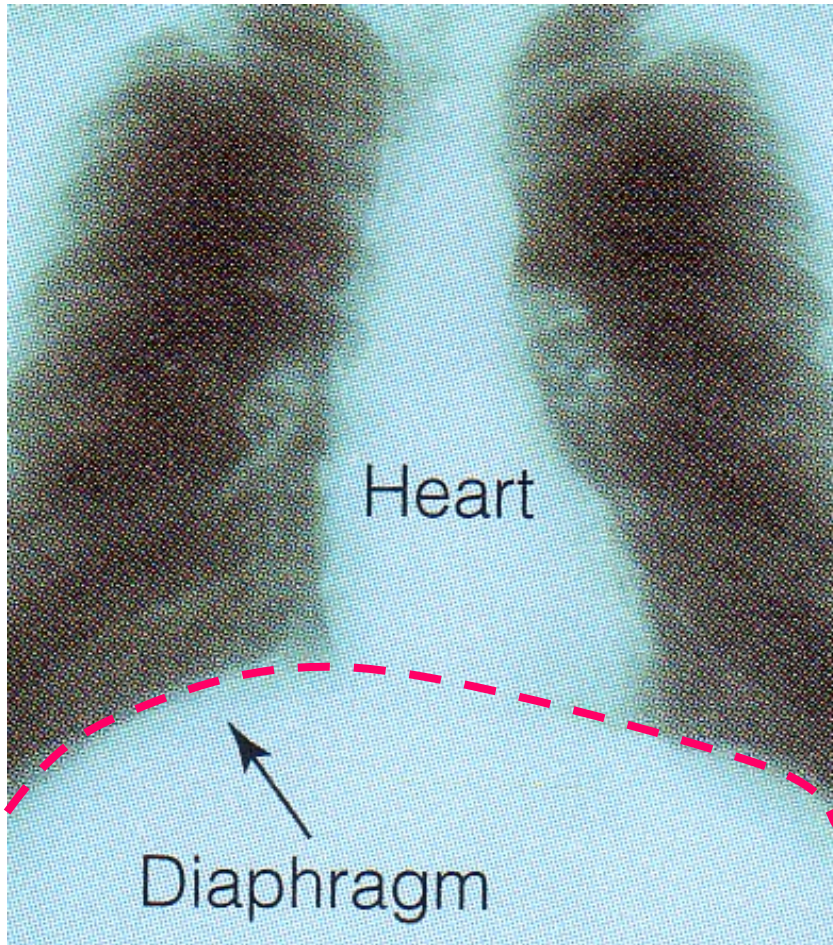
Major muscles of inspiration
(contract every inspiration; relaxation causes passive expiration)

Abdominal muscles

Muscles of active expiration
(contract only during active expiration)

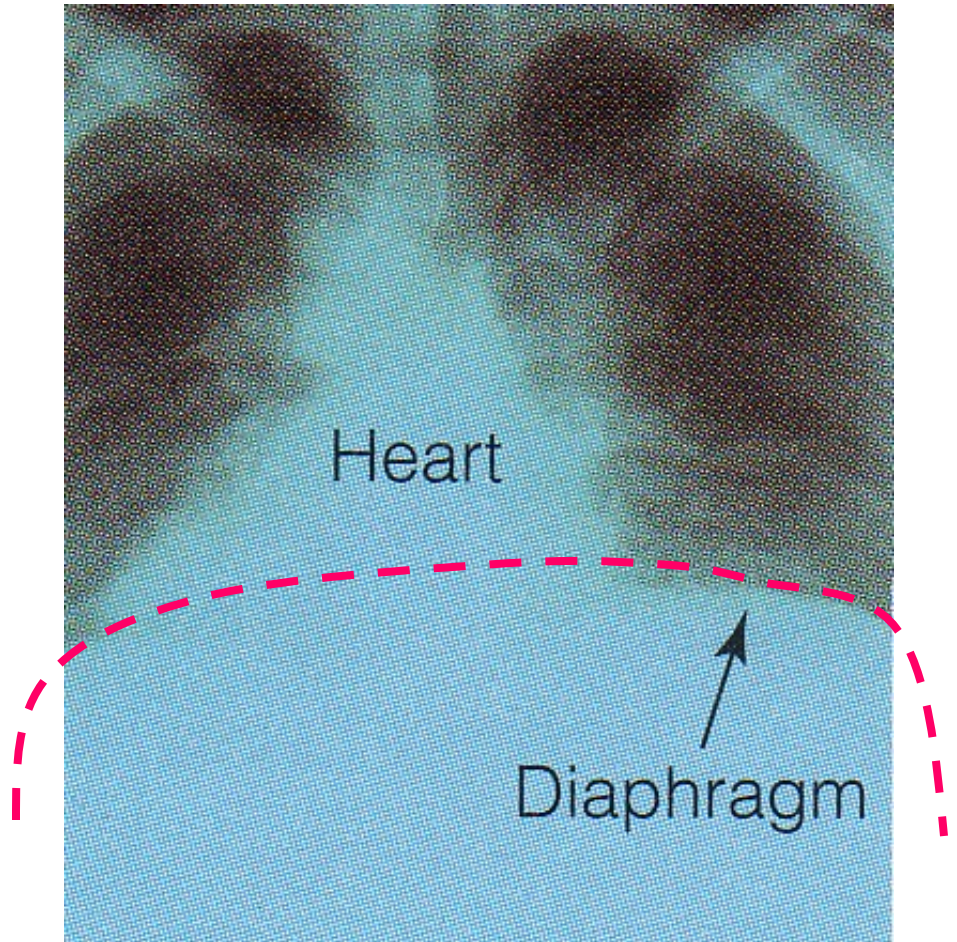
NB: Diaphragm is the chief muscle of ventilation!





Inhale (active)

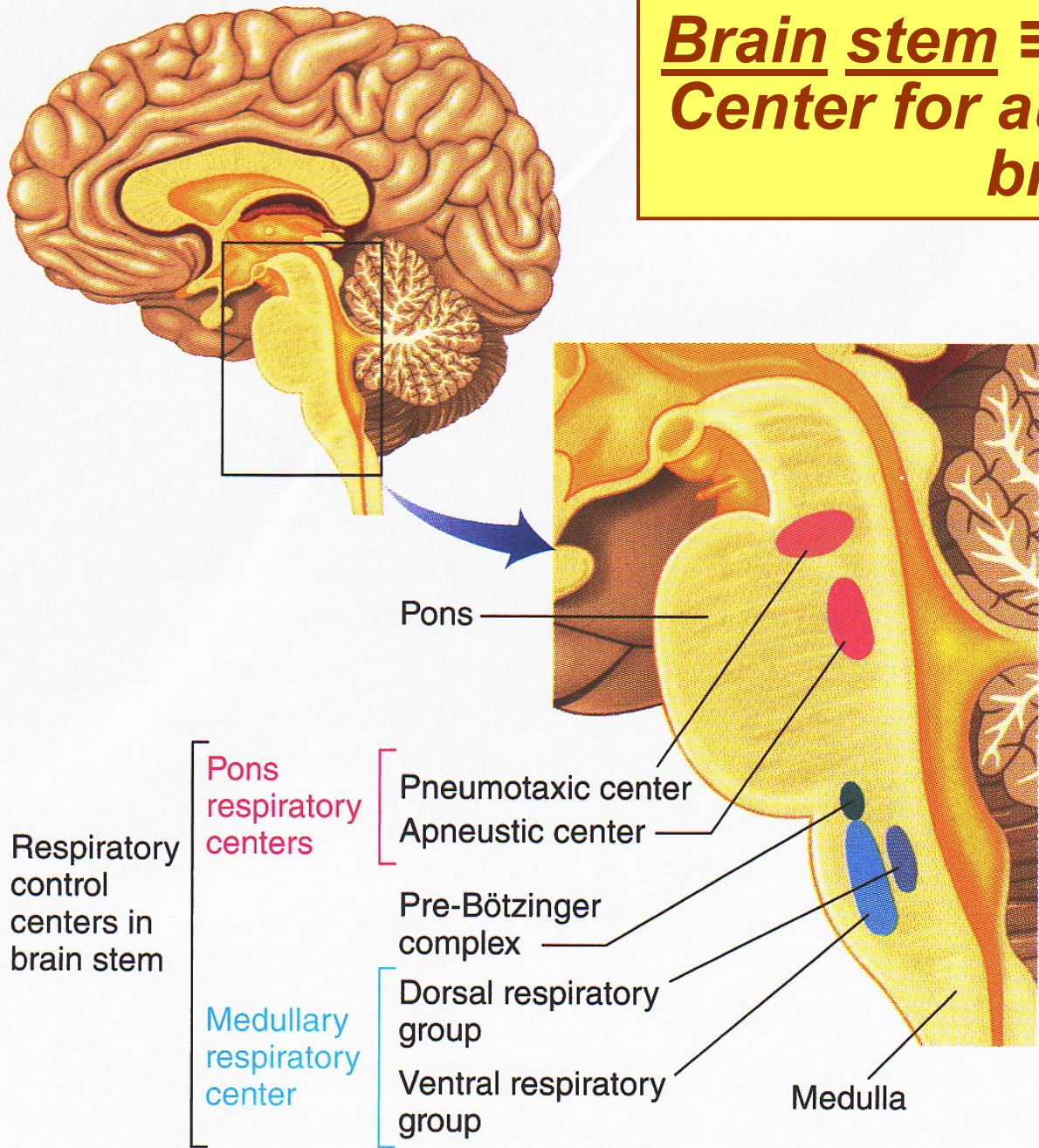
Contract & flatten diaphragm



Exhale (passive @ rest)

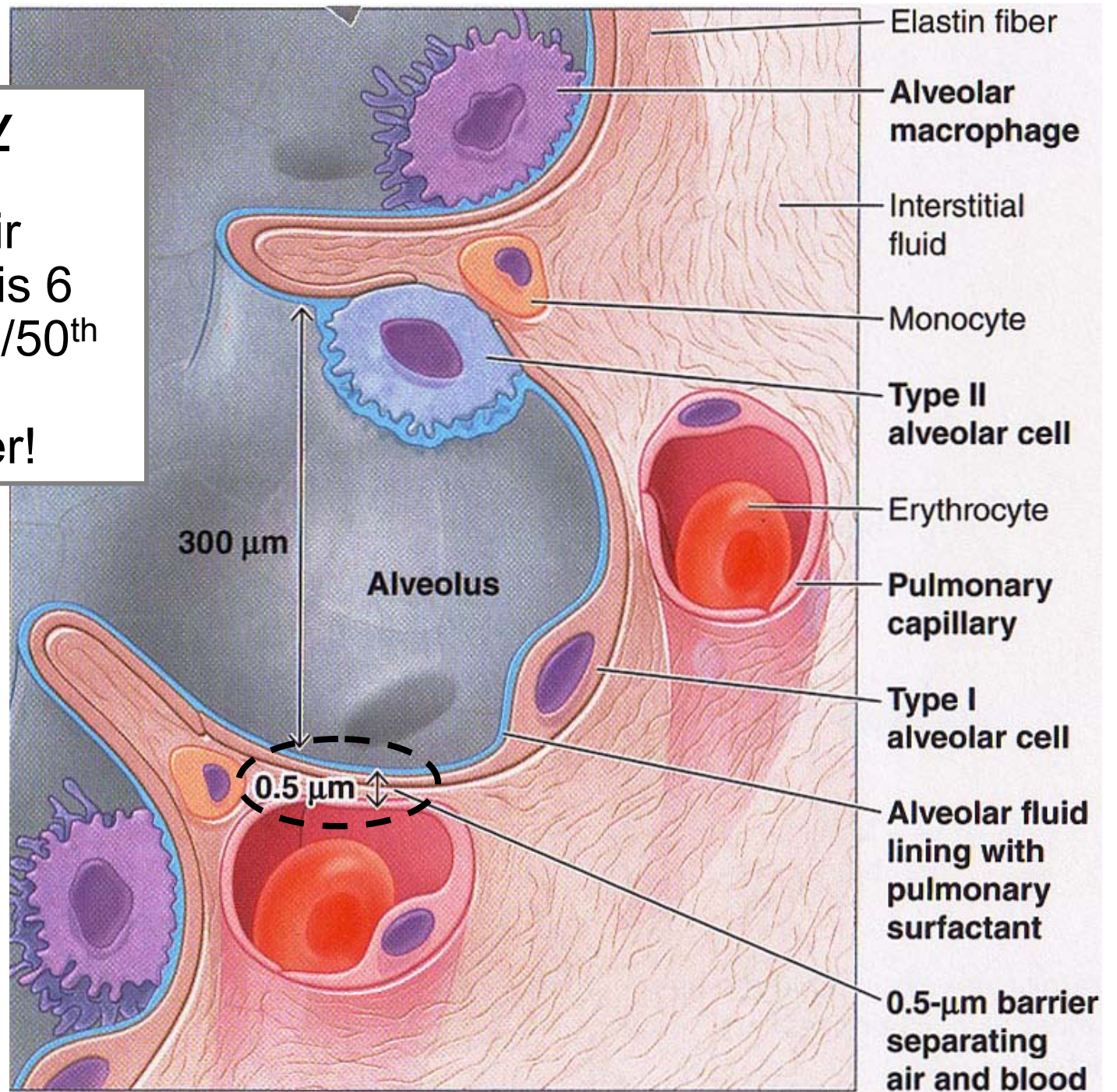
Relax & pouch up diaphragm!

Brain stem ≡ Control Center for automatic breathing!

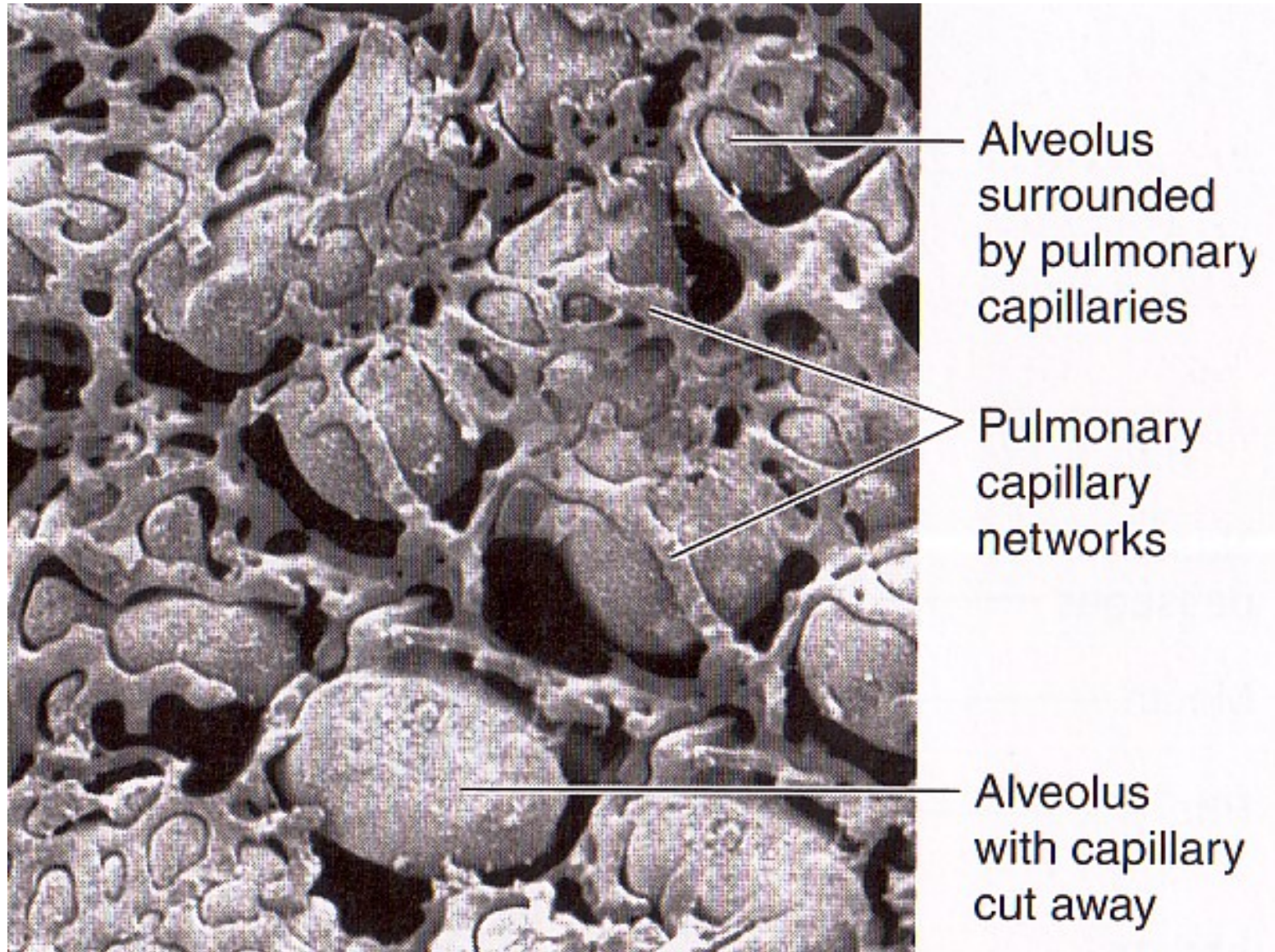


Respiratory membrane

separates air from blood, is 6 layers, yet 1/50th thickness of tracing paper!



Alveoli are surrounded by jackets of capillaries!



Gas Exchange

CO₂ LOW

O₂ HIGH

Across pulmonary capillaries:

O₂ partial pressure gradient from alveoli to blood = 60 mm Hg (100 → 40)

CO₂ partial pressure gradient from blood to alveoli = 6 mm Hg (46 → 40)

Across systemic capillaries:

O₂ partial pressure gradient from blood to tissue cell = 60 mm Hg (100 → 40)

CO₂ partial pressure gradient from tissue cell to blood = 6 mm Hg (46 → 40)

Numbers are mm Hg pressure.

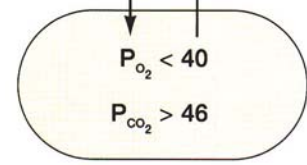
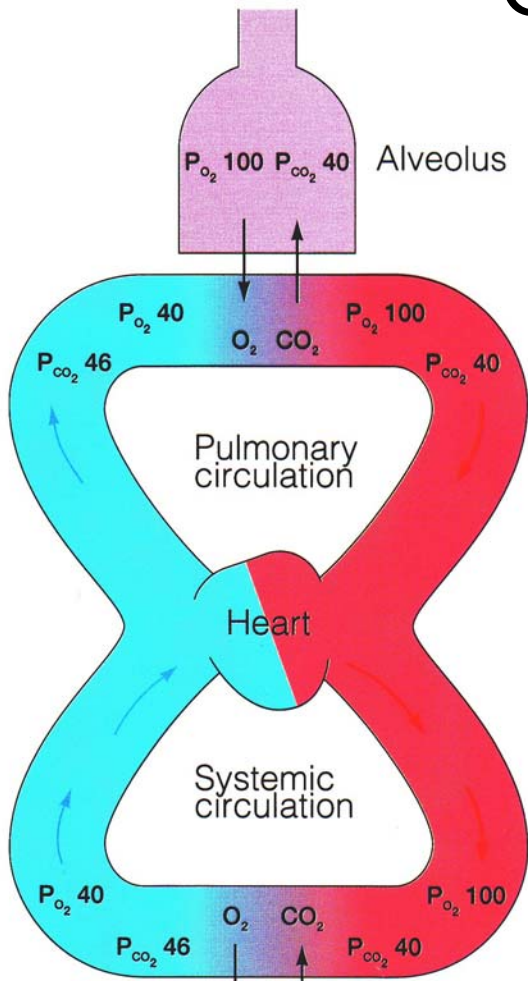
Inspired air

P_{O₂} 160

P_{CO₂} 0.3

P_{O₂} 100 P_{CO₂} 40

Alveolus



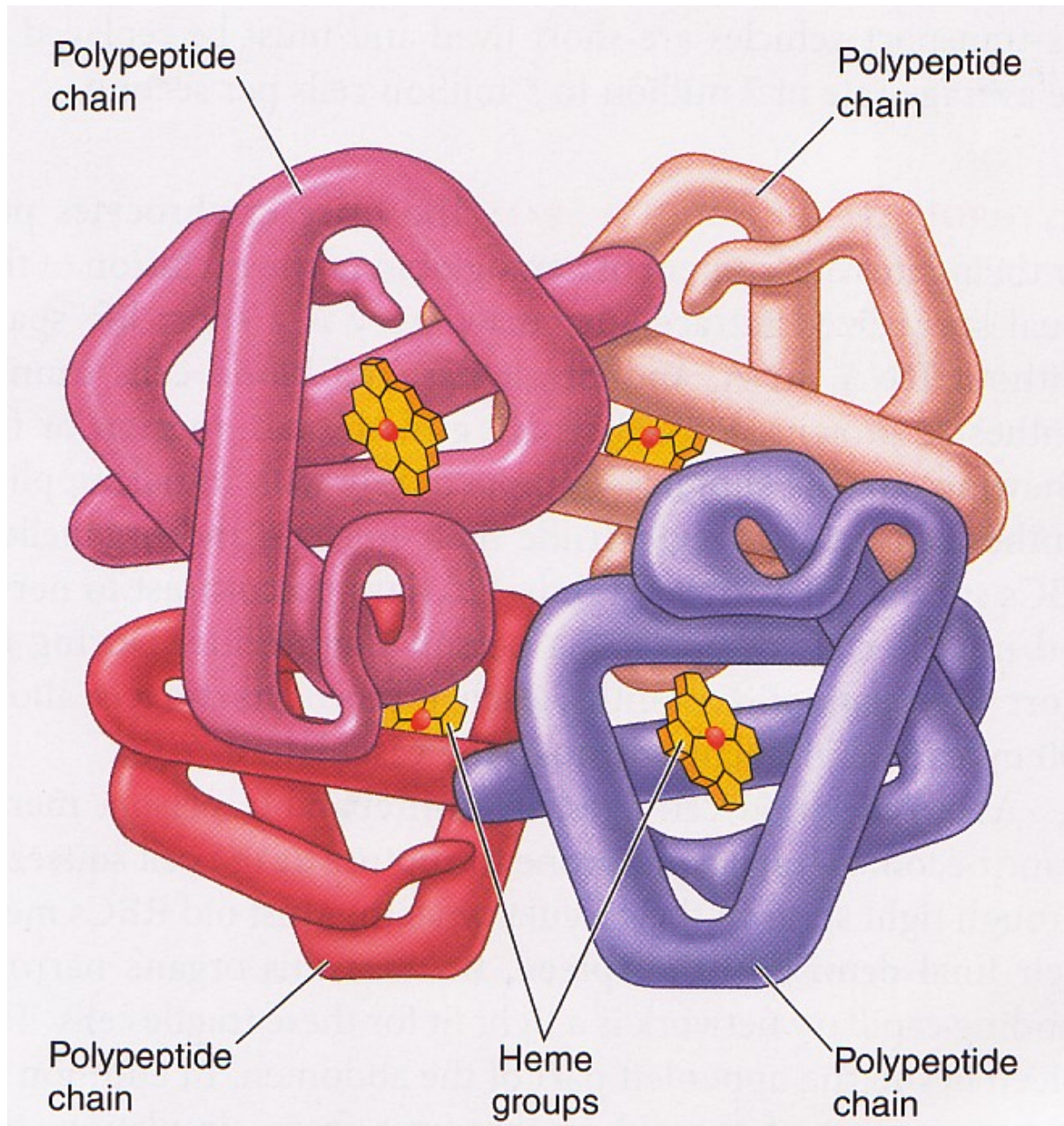
Tissue cell

CO₂ HIGH

O₂ LOW

cf. LS 2012 fig 12-19

O₂ is carried mainly by red blood cell hemoglobin!



▲ **TABLE 12-3**

Methods of Gas Transport in the Blood

GAS	METHOD OF TRANSPORT IN BLOOD	PERCENTAGE CARRIED IN THIS FORM
O₂	Physically dissolved	1.5
	Bound to hemoglobin	98.5
CO₂	Physically dissolved	10
	Bound to hemoglobin	30
	As bicarbonate (HCO ₃ ⁻)	60

American Cancer Society Great American Smoke Out!



Help create a
world with less
cancer and
more birthdays.

CELEBRATE WITH US! TOBACCO-FREE FALL 2012!

Official Announcement Today

9:45 A.M. - 10:15 A.M.

EMU Taylor Lounge

The Health Center invites you to join:

Jim Bean, Senior Vice President & Provost

Amelie Rousseau, ASUO President

Renée Klein, President and CEO of the American Lung
Association, Mountain Pacific Region

Dana Mills, Health Center Director



Health Center

M - F, 9 A.M. - 5 P.M.; Sat, 10 A.M. - 2 P.M.

Located on the corner of 13th & Agate

Appointment or After-Hours Nurse Advice Line, call (541) 346-2770.

Flu information line, call (541) 346-4444.

Please see <http://healthcenter.uoregon.edu> for After-Hours Care Options

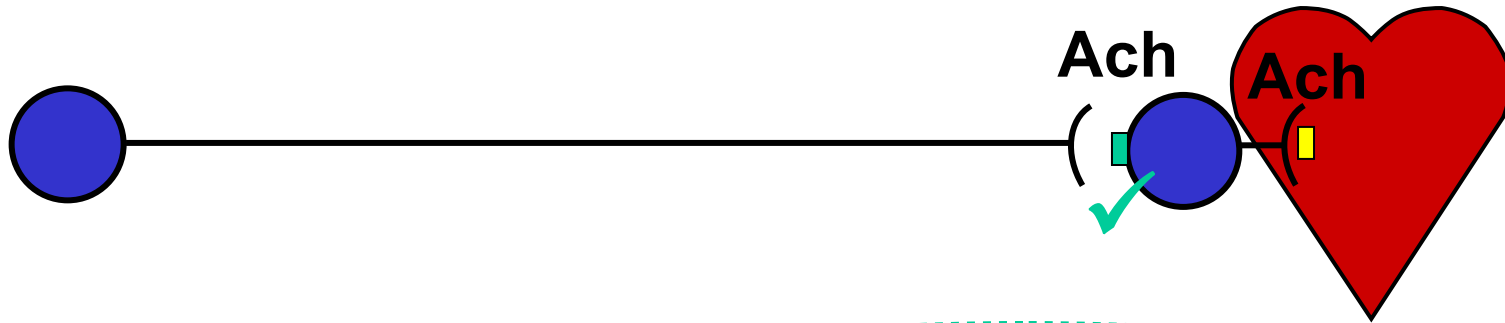
<http://kezi.com/page/195295>

<http://kezi.com/healthwatch/231034>



UNIVERSITY OF OREGON

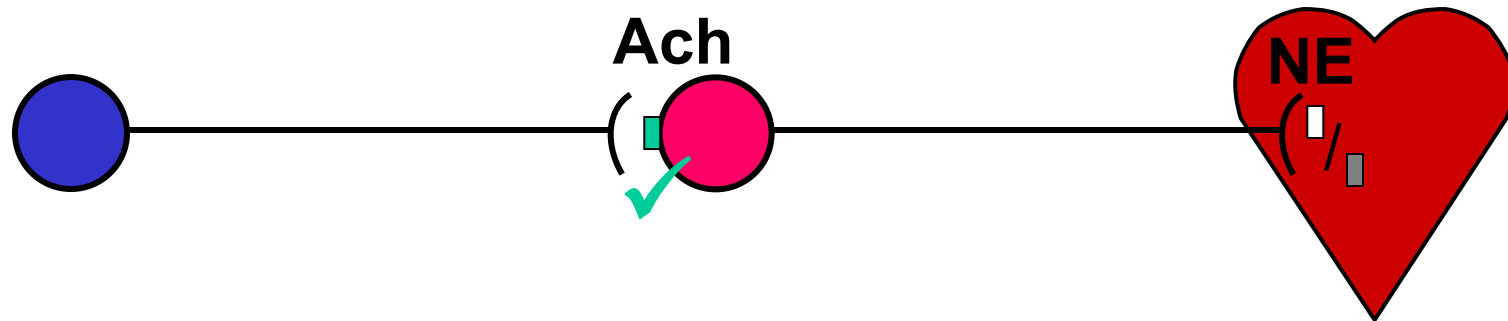
Parasympathetic



Ach = Acetylcholine

- = Nicotinic Receptor
- = Muscarinic Receptor

Sympathetic



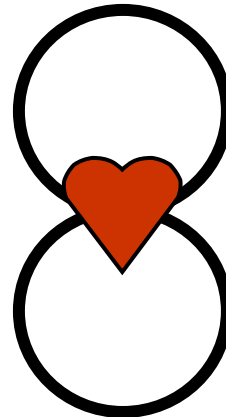
NE = Norepinephrine

- = α Receptor (α_1 , α_2)
- = β Receptor (β_1 , β_2)

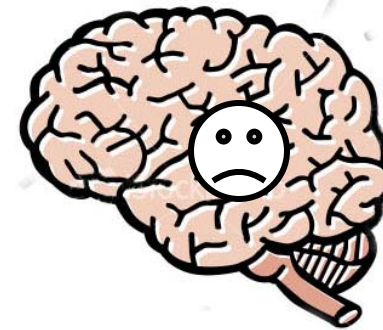
***Cigarettes ≡ Patient-Assisted Drug-Delivery System
Inhaling Bypasses the Systemic Circulation
& Is Powerfully Reinforcing!***



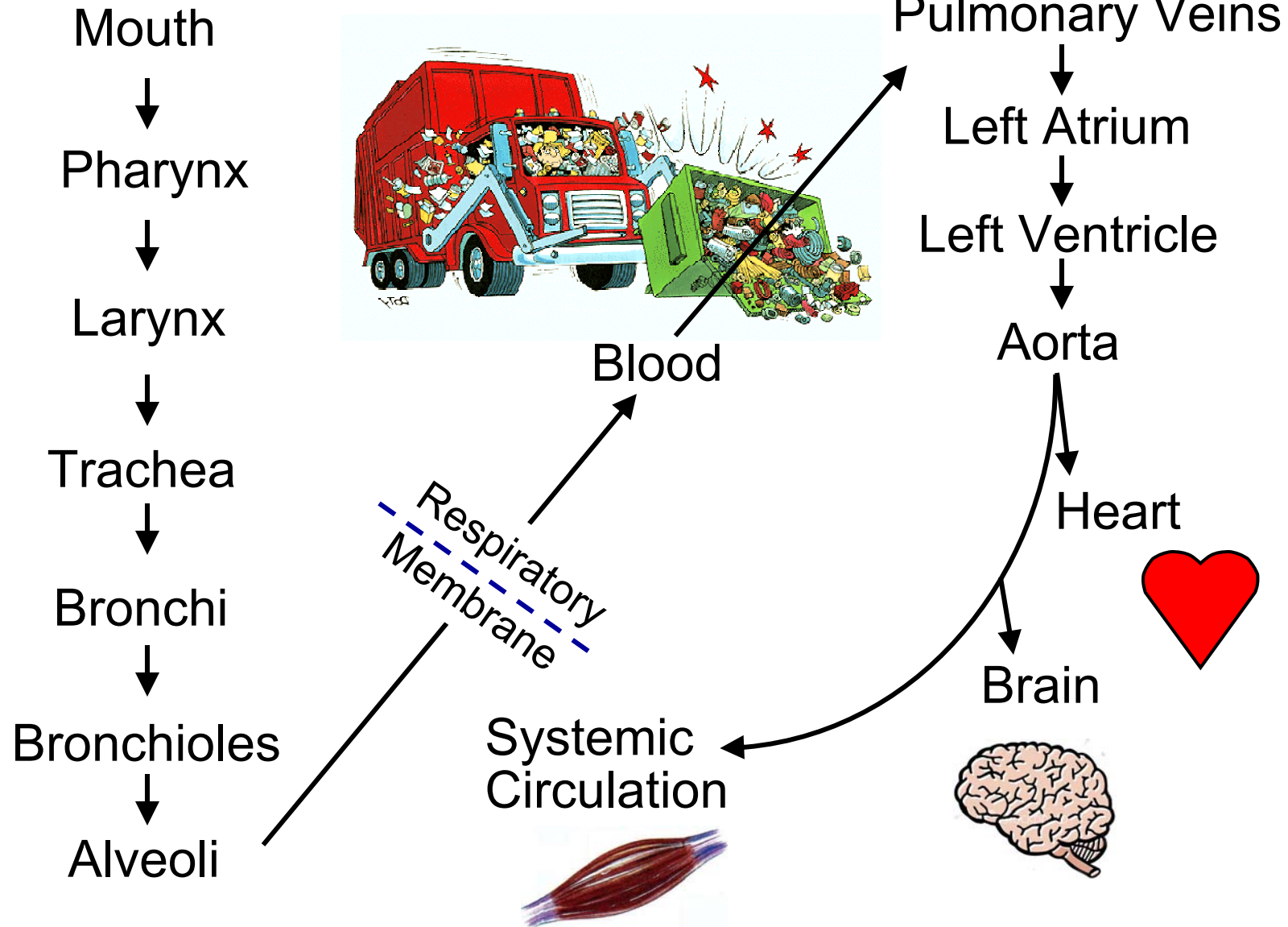
Pulmonary



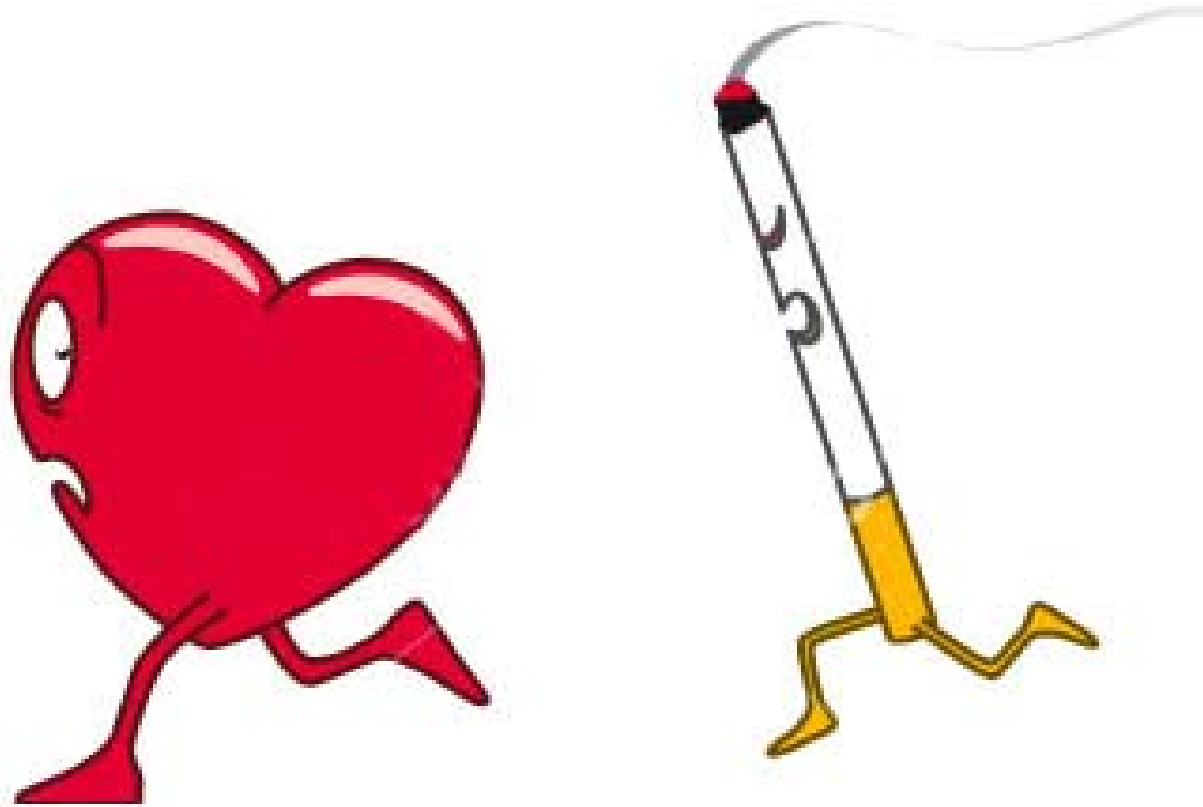
Systemic



Tracing the Route of Cigarette Smoke Puff to Brain Time 5 to 8 seconds!!



***Not only the Lungs, but the Heart, Brain & 100s
of Other Tissues & Organs Adversely Affected!***



Tobacco smoke = Deadly mix of > 7000 chemicals!

**[http://www.cdc.gov/tobacco/data_statistics/sgr/
2010/consumer_booklet/chemicals_smoke/](http://www.cdc.gov/tobacco/data_statistics/sgr/2010/consumer_booklet/chemicals_smoke/)**

Keep it Basic?

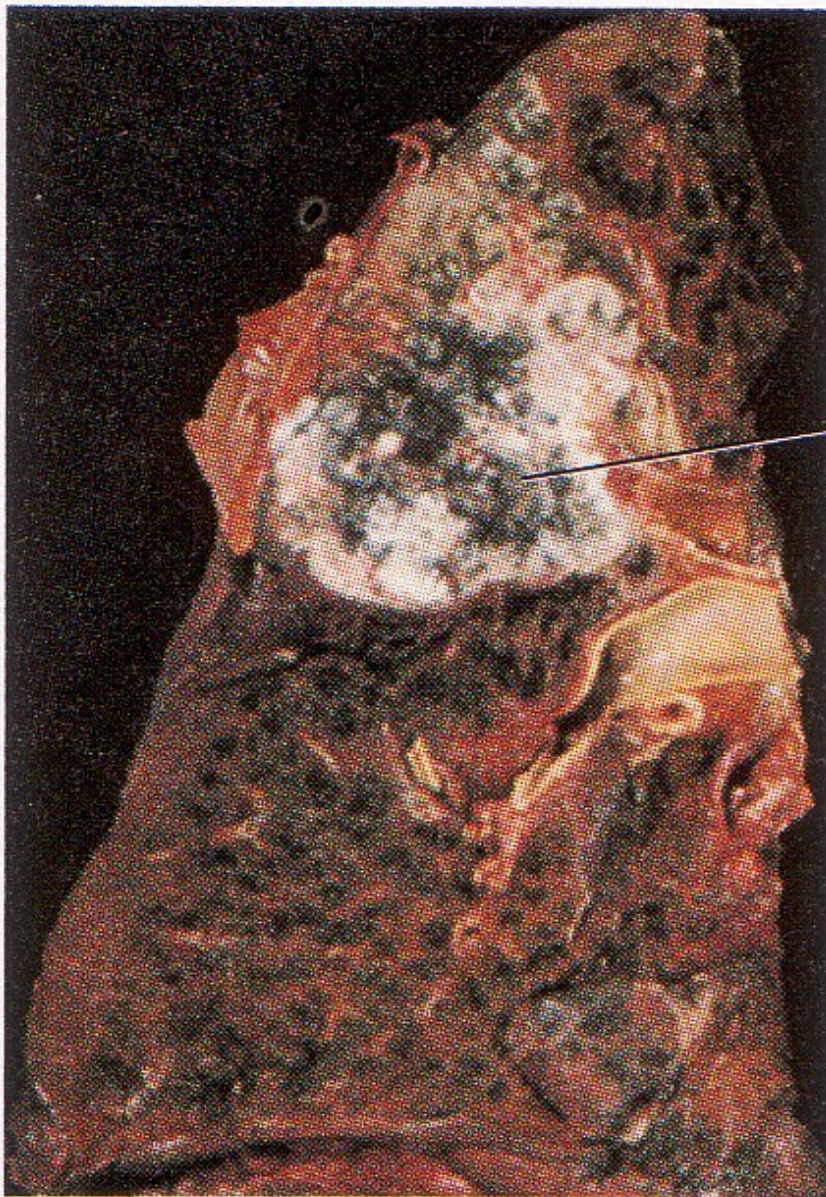
Cigarette smoking is the most important preventable cause of premature death in the U.S. accounting for 443,000 annual deaths.

http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/tobacco_related_mortality/#cigs

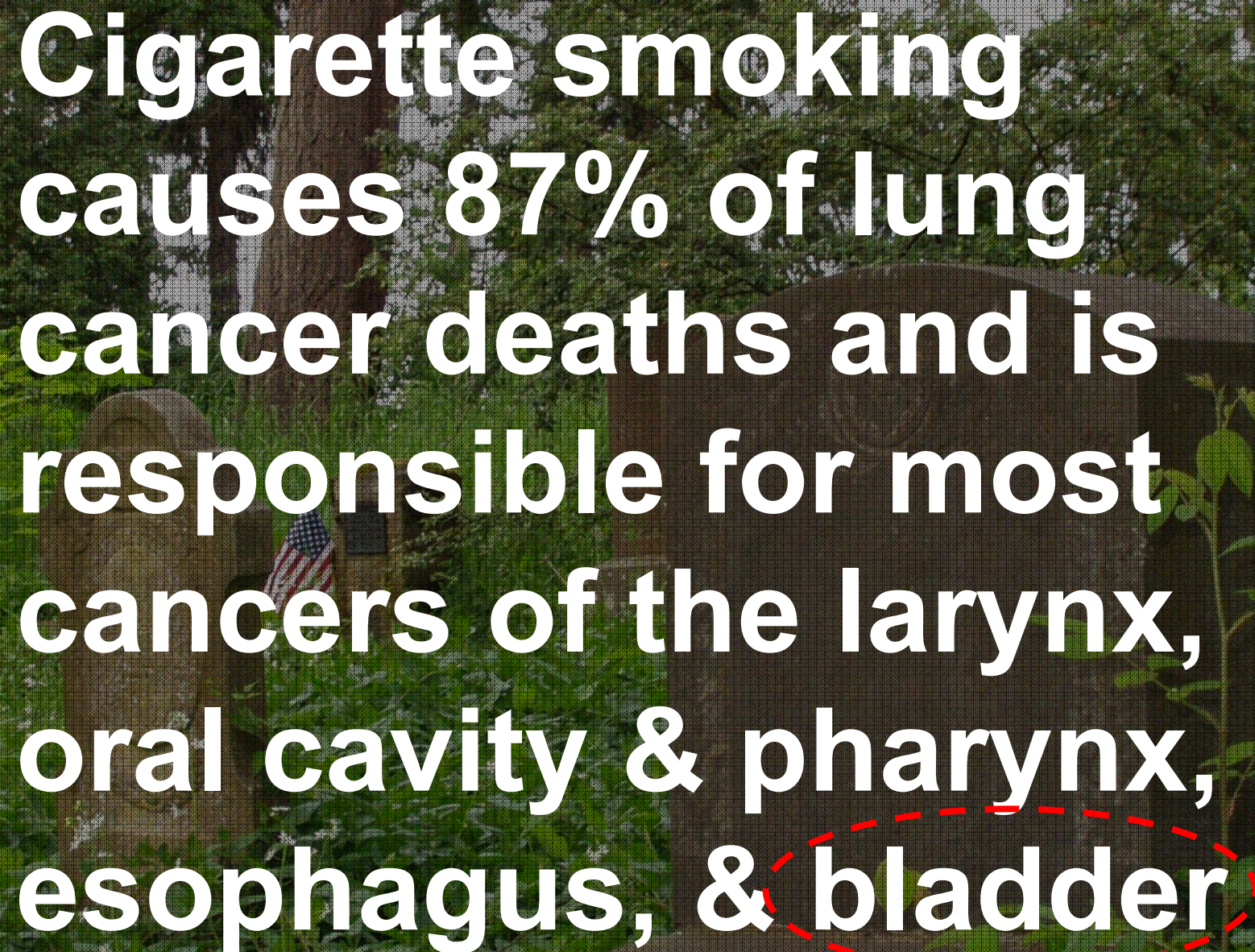
We know about lung cancer, but what about...?



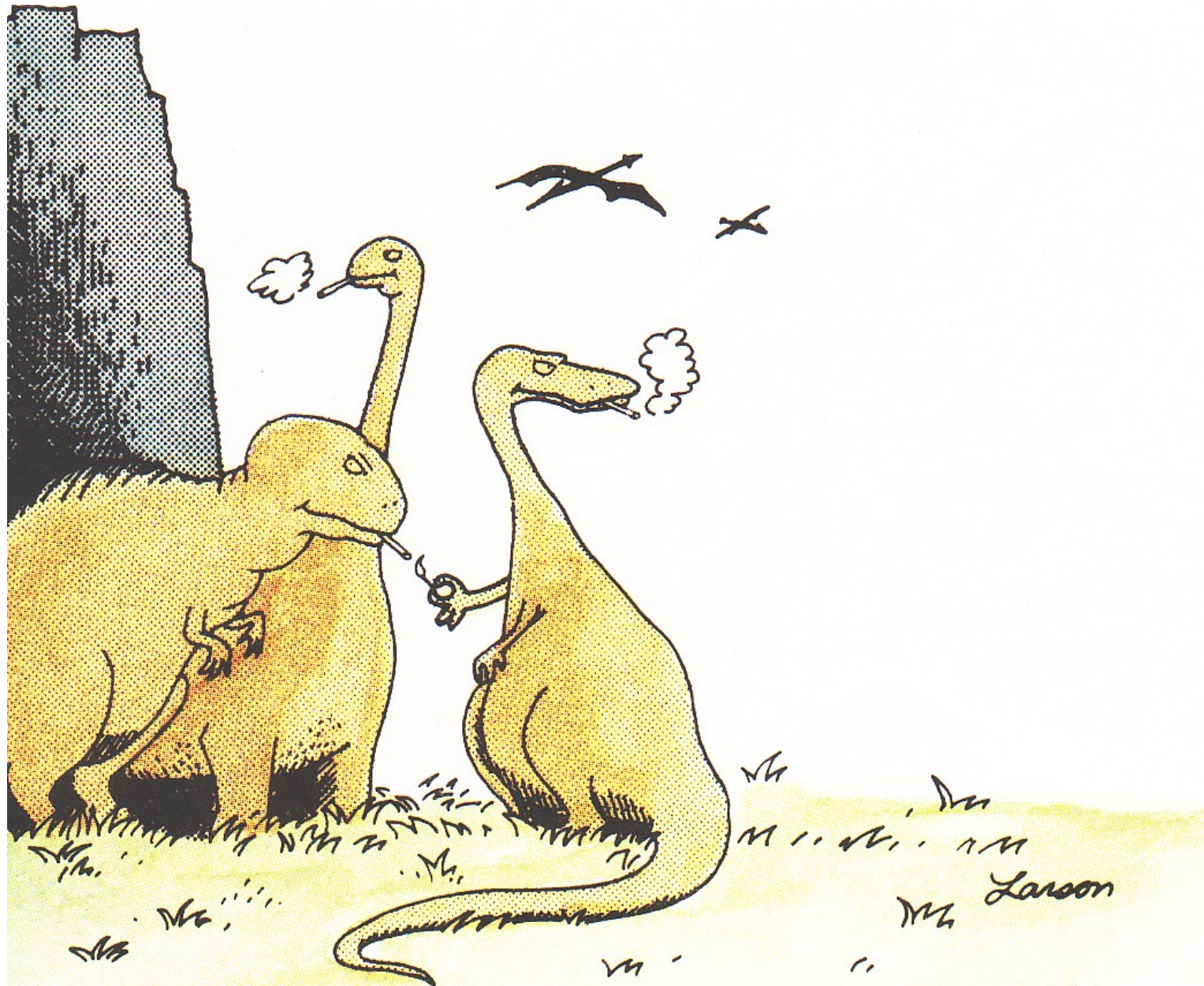
(a)



(b)

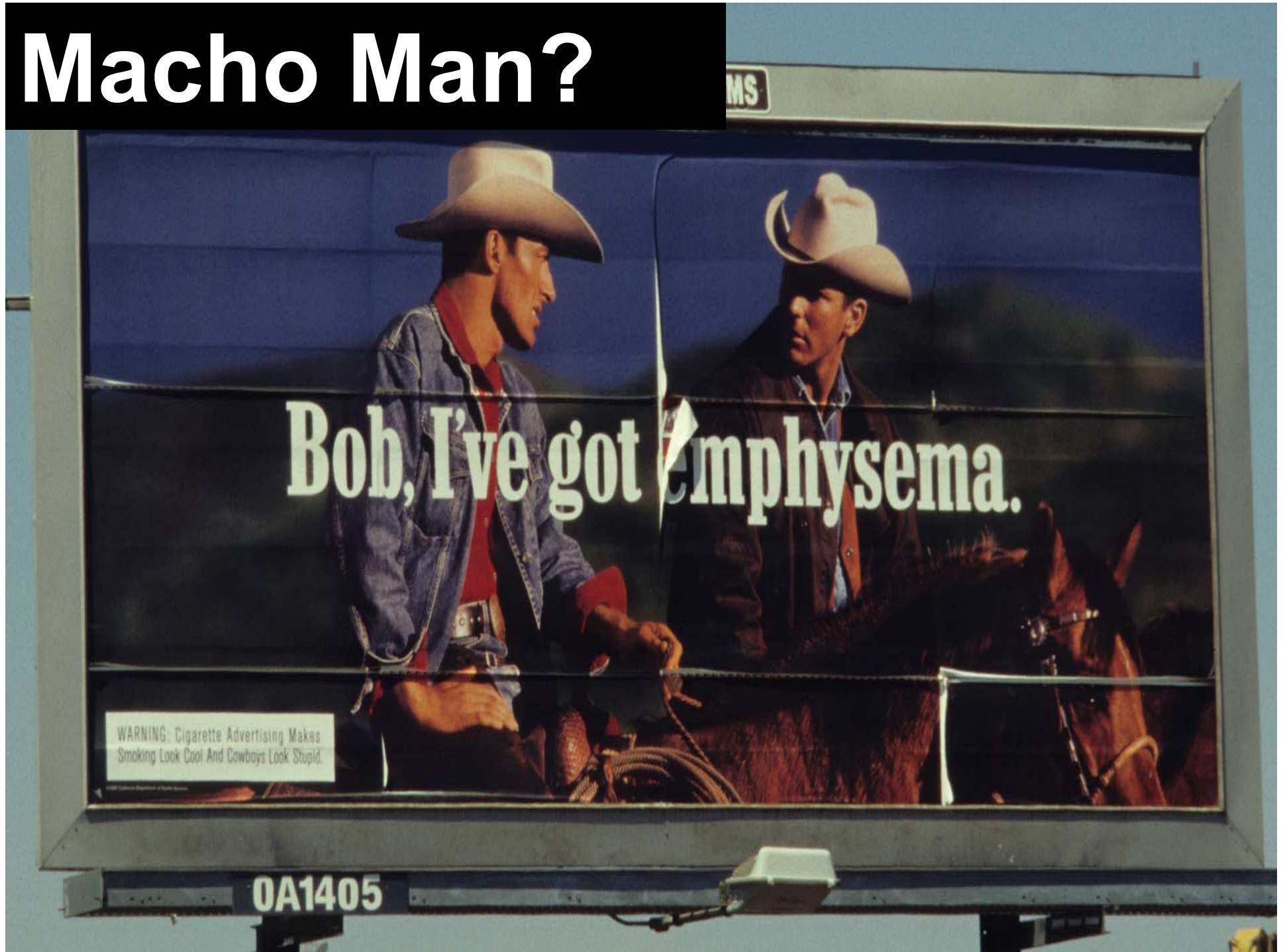


**Cigarette smoking
causes 87% of lung
cancer deaths and is
responsible for most
cancers of the larynx,
oral cavity & pharynx,
esophagus, & bladder**

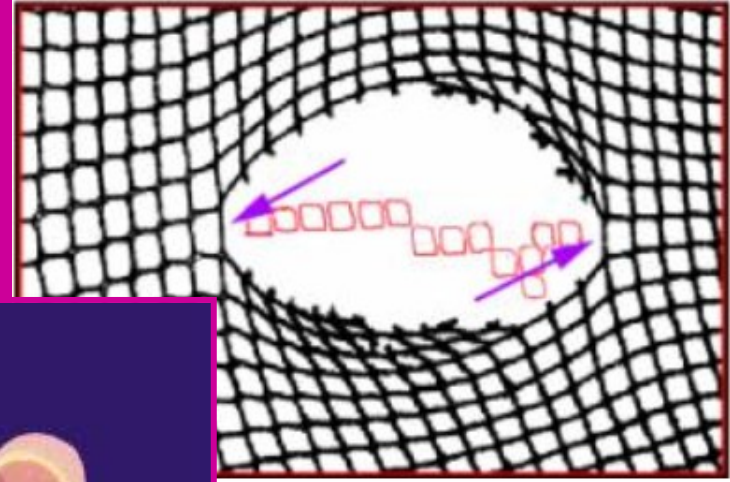
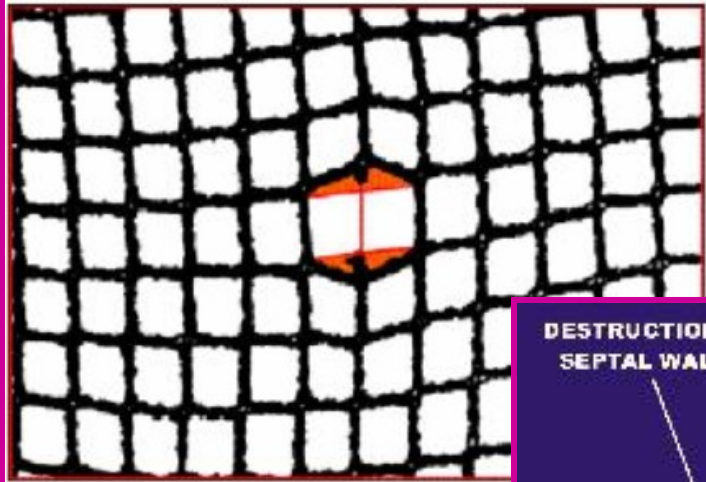


The real reason dinosaurs became extinct

Macho Man?



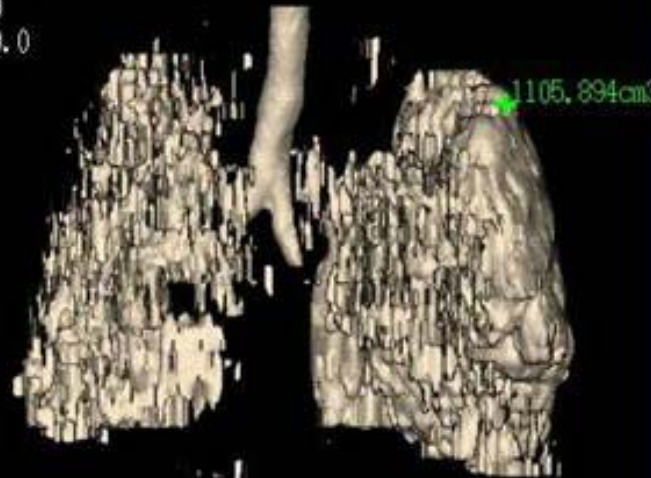
Emphysema ≡ Corrosion of Alveolar Walls with ↓ SA & Labored Breathing



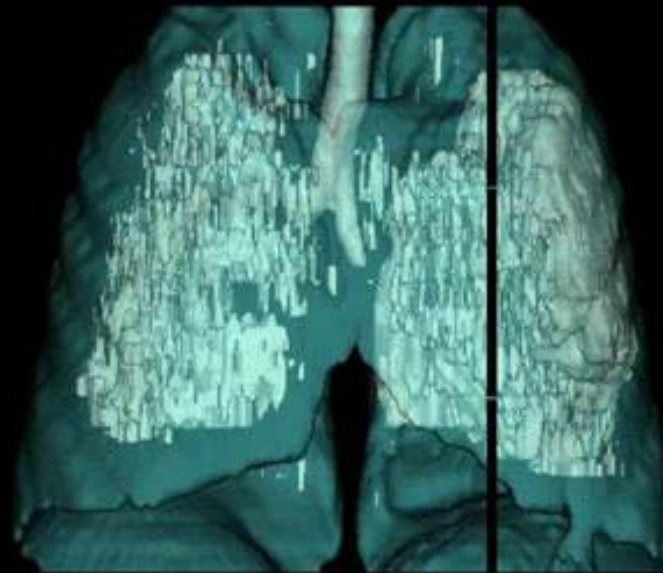
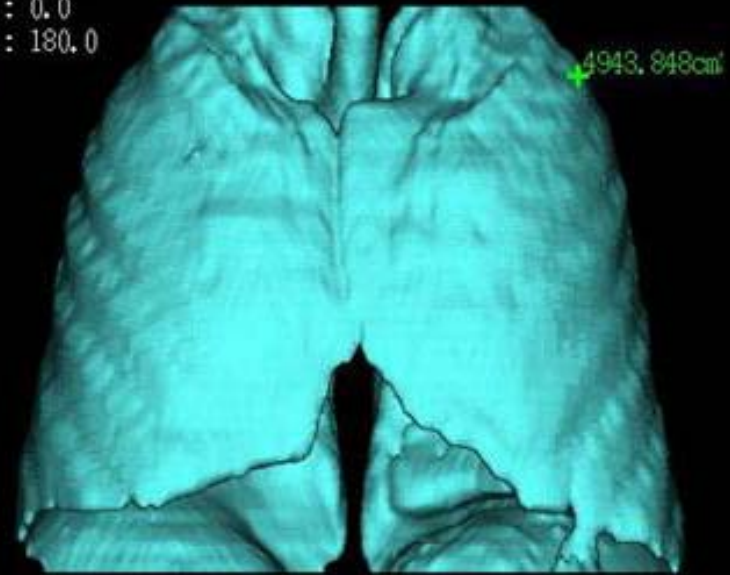
*Internet Journal of Pathology
Mayo Clinic Health*

CT Densitovolumetry in Heavy Smoker with Emphysema Indicating ~ 22% Compromise of Lung Parenchyma

Y : 0.0
Z : 180.0



Y : 0.0
Z : 180.0



SOURCE: Corrêa da Silva, 2001, from *Emphysema Imaging* Ali Nawaz Khan

<http://www.realityunfiltered.com/>



Terrie Hall, who has appeared in television commercials for Tobacco.Reality.Unfiltered., started smoking when she was 18. She smoked two packs a day for twenty-two years before she was diagnosed with throat cancer. She had a permanent tracheotomy and has fought cancer seven times. The photo to the right is of Terrie as a teenager. Photos: Tobacco.Reality.Unfiltered.



**Why you have to tell
your gynecologist you smoke.
Even if it's only at parties.**

You figure an occasional cigarette can't hurt, and you really don't want to listen to the "stop smoking" lecture from your doctor. But if you want any type of hormonal birth control, smoking is a vitally important issue.

Hormonal birth control is a prescription drug, and while the risks are rare, they can be serious, and smoking, even a little, increases the risks, especially if you're over 35.

Risks include blood clots, stroke, and heart attack. If you have a history of these conditions or certain cancers, you shouldn't use hormonal birth control.

Of course, you should tell your healthcare professional if you could be pregnant, and because hormonal birth control doesn't protect against HIV or sexually transmitted diseases, learn how to stay safe and healthy.

Hormonal birth control has been used safely by millions of women for 45 years, and is 99% effective when used correctly.

It could be a good choice for you. To find out, talk to your healthcare professional. And to help you get started, there's a list of questions to ask at: www.orthowomenshealth.com



Be smart about your body.
Be smart about your birth control.

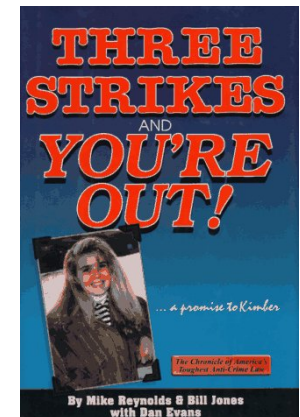
On the Pill & Smoke?

Increased Risk of:

1. Blood Clots

2. Heart Attack

3. Strokes!



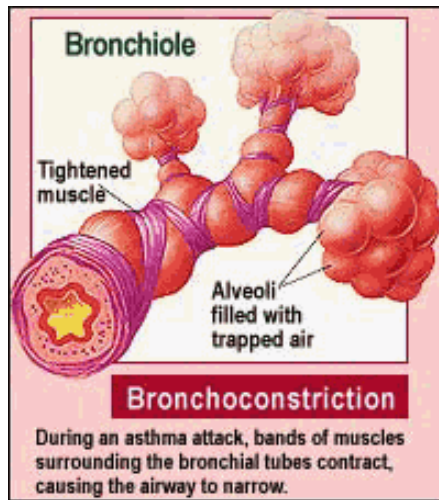
**Breathing 2nd-hand
smoke for as little as
1/2 hr activates
platelets almost as
much as if you were a
pack-a-day smoker**

2nd-hand smoke is the 3rd leading preventable cause of death in the US!

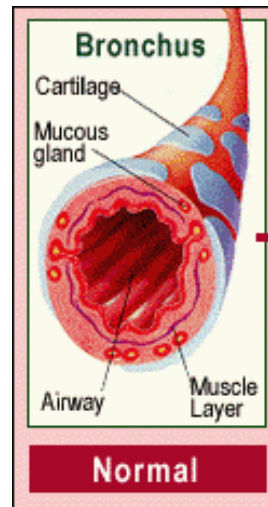


Each year 53,000 Americans die due to 2nd-hand smoke exposure!

SMOKING \equiv ASTHMA?



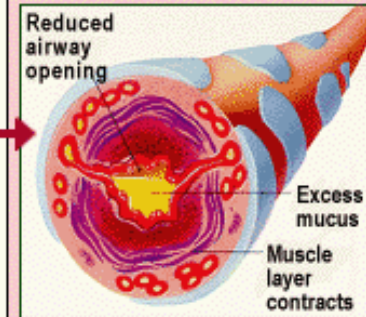
+



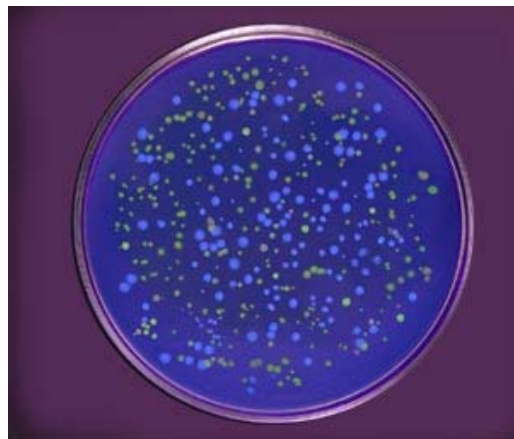
Asthma Triggers

- Allergens
- Drugs
- Exercise
- Occupational stimuli
- Infections
- Environmental changes
- Air pollutants
- Chemical irritants
- Emotions
- Weather/Temp.
- Food additives

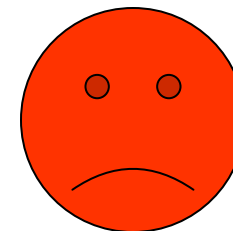
Inflammation



=



Petri-dish Effect



Ugh!!
Cough!
Cough!!

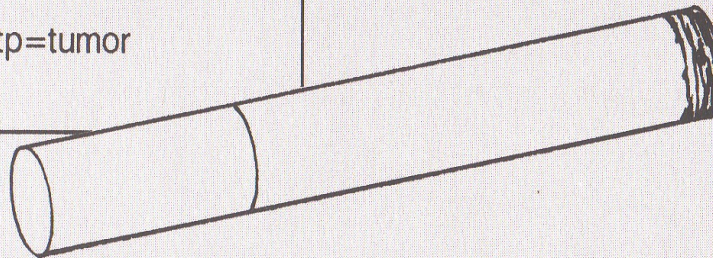
Source: *Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General, 1989*

(per cigarette)

4-aminobiphenyl	c	140 ng
benz(a)anthracene	c	40-200 ng
benzene	c	400 µg
benz(o)pyrene	c	40-70 ng
carbon monoxide	t	26.8-61 mg
formaldehyde	c	1,500 µg
hydrazine	c	90 ng
hydrogen cyanide	t	14-110 µg
2-naphtylamine	c	70 ng
nitrogen oxides	t	500-2,000 µg
N-nitrosodimethylamine	c	200-1,040 ng
N-nitrosodiethanolamine	c	43 ng
N-nitrosopyrrolidine	c	30-390 ng
phenol	tp	70-250 µg
polonium 210	c	.5 - 1.6 pCi
quinoline	c	15-20 µg
o-toluidine	c	3 µg

Note: c=carcinogenic; t=toxic; tp=tumor promoter

TOLUIDINE
AMINOBIIPHENYL
BENZENE
BENZ(A)ANTHRACENE
NITROSODIMETHYLAMINE
QUINOLINE
HYDRAZINE
PHENOL
CARBON MONOXIDE



**Some Toxic and Cancer-Causing Agents
You Breathe When You Are Exposed To Other People's Tobacco Smoke**

...propyl, ...benzoate, ...benzylpropyl, ...cinnamate, ... (2-(4-hydroxypropyl) ...
phoric Acid, Pimenta Leaf Oil, Pine Needle Oil, Pine Oil, Scotch, Pineapple
ntrate, alpha-Pinene, beta-Pinene, D-Piperitone, Piperonal, Pipsissewa L
Potassium Sorbate, 1-Proline, Propenylguaethol, Propionic Acid, Propyl
hydroxybenzoate, Propylene Glycol, 3-Propylideneephthalide, Prune Juice
re, Pyroligneous Acid And Extract, Pyrrole, Pyruvic Acid, Raisin Juice Co
nol, Rose Absolute and Oil, Rosemary Oil, Rum, Rum Ether, Rye Extract,
age Oleoresin, Salicylaldehyde, Sandalwood Oil, Yellow, Sclareolide, Ska
; Snakeroot Oil, Sodium Acetate, Sodium Benzoate, Sodium Bicarbonate
nate, Sodium Chloride, Sodium Citrate, Sodium Hydroxide, Solanone, Spe
t, Gum and Oil, Sucrose Octaacetate, Sugar Alcohols, Sugars, Tagetes
ic Acid, Tea Leaf and Absolute, alpha-Terpineol, Terpinolene, Terpinyl Ac
3-Tetrahydroquinoxaline, 1,5,5,9-Tetramethyl-13-Oxatricyclo(8.3.0.0(4,9))
5, and 3,4,5,6-Tetramethylethyl-Cyclohexanone, 2,3,5,6-Tetramethylpyraz
chloride, Thiazole, 1-Threonine, Thyme Oil, White and Red, Thymol, Tob
pherols (mixed). Tolu Balsam Gum and Extract Tolu aldehydes para-Tol

TOBACCO ADDITIVES

The tobacco industry has acknowledged that nearly 600 chemicals are added to cigarettes. It is not clear, however, how much of the various additives are used or which combinations appear together. Some of the chemicals among cigarette additives most questioned by tobacco opponents include:

■ **Megastigmatrienone:** A flavoring that tobacco companies contend is found naturally in grapefruit juice.

■ **Dehydromenthofuro lactone:** A flavoring that tobacco companies say is found in peppermint.

■ **Ethyl furoate:** Found naturally in coffee, kiwi and peanuts.

■ **Maltitol:** A sweetener used in chewing gum and diabetic candy.

■ **Sclareolide:** A synthetic form of a naturally occurring tobacco element.

■ **Ammonia:** A processing aid.

■ **Methoprene:** An insecticide that toxicologists say is biodegradable.


■ **Other additives:** Yeast, wine, caffeine, beeswax, beta carotene, chocolate, coconut oil.



freebase nicotine!!

Ammonia converts nicotine, the addictive agent in tobacco, into a more volatile form, Pan-kow said. "Ammonia is the thing that helps tobacco companies hook the smoker by providing a means of delivering the nicotine."


Last October a former tobacco industry employee revealed that secret industry documents indicated that ammonia was added to tobacco to double the impact of nicotine. The Oregon Graduate Institute study confirms the contention that

A black calculator with a green background on the right side. The display shows '0.0000' and '0.10 20'. The chemical symbol 'As' is overlaid on the right side of the calculator.

As

Arsenic 33

- o Shotgun pellets
- + Metal for mirrors
- v Glass, lasers
- v **Light emitting diodes=LED**
- x 74.9216

A black and white photograph of an astronaut in a space suit walking on the moon. The chemical symbol 'Po' is overlaid on the right side of the image.

Po

Polonium 84

- o **Nuclear batteries**
- o Neutron source
- o Antistatic agents
- o Film cleaner
- x (209)

Sunflowers are planted along with our organic tobacco to attract beneficial insects to protect our organic crops...



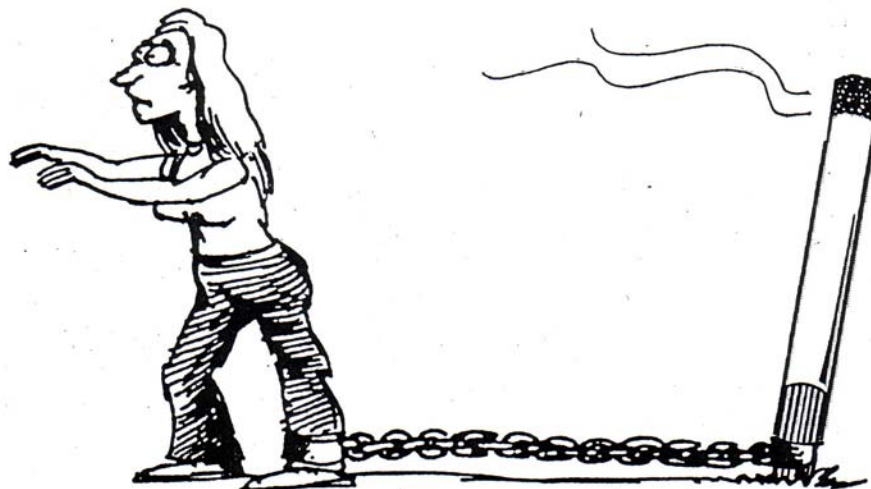
To be buried
with sunflowers?
Compost?



Cigarettes & 2nd-hand smoke!!

...and to avoid the use of chemical pesticides.

Cigarettes got you on a tight leash?



Free Yourself

Smoking Cessation Workshop

Wednesdays, 3:30-4:30 p.m.
January 22 to March 5, 1997

Student Health Center, Medical Library
Free to UO students

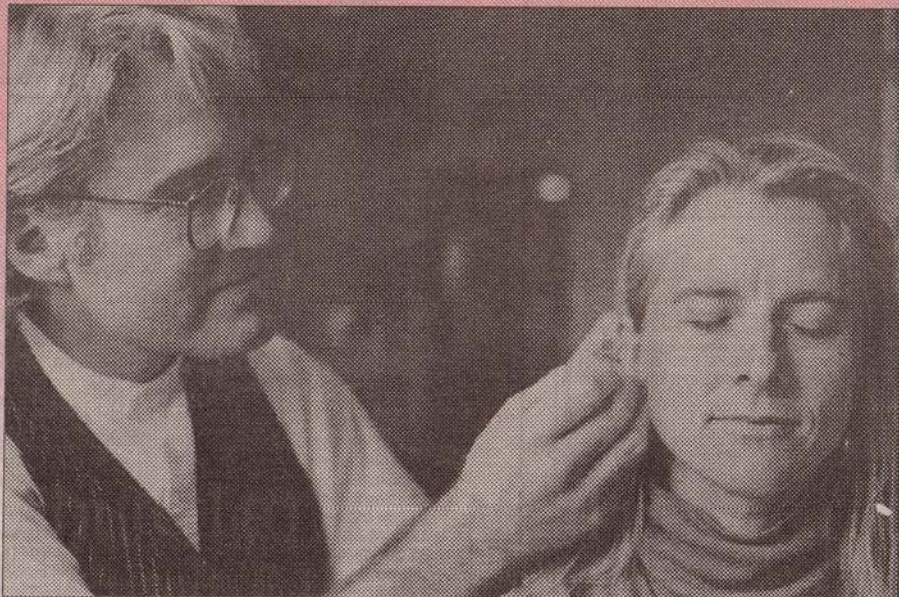
Call 346-4456 to register



***...Thanks for helping us
for well over 15 yr!!***

Stop Smoking Through Acupuncture

If you're serious about quitting the smoking habit, now's your chance.
In honor of the great American Smoke Out



Tom Williams, a licensed acupuncturist in Eugene, provides stop-smoking treatments to relieve cravings and irritability at the four-session stop smoking workshop that begins at the Health Center November 18th in conjunction with the Great American Smokeout on November 19th. Call 346-4456 to sign up.

Educational Session*

Wednesday, November 18, 4-5 pm

*You must attend this session in order to receive acupuncture treatment.

Acupuncture Sessions

Thursday, November 19, 4-6 pm

Friday, November 20, 4:30-6 pm

Monday, November 23, from 4:30-6 pm

All sessions meet in the medical library in the basement of the University Health Center.

**Space is limited, so sign up now
by calling the Health Education
office at 346-4456.**

\$30 fee that will be donated to the American Lung Association is requested.

UNIVERSITY

HEALTH CENTER

We're a matter of degrees ◆

Open daily 8 a.m. to 6 p.m., except Tuesdays (9 a.m.) and Sundays (10 a.m.).
Appointments and after hours: 346-2770 • Web: darkwing.uoregon.edu/~uoshc

Nicotine Addiction & Help Quitting Smoking

[http://www.cancer.org/healthy/stayawayfromtobacco/guide
toquittingsmoking/guide-to- quitting-smoking-help-phys-nrt](http://www.cancer.org/healthy/stayawayfromtobacco/guide-toquittingsmoking/guide-to- quitting-smoking-help-phys-nrt)

2nd-Hand Smoke or ETS & 3rd-Hand Smoke?

[http://www.cancer.org/cancer/cancercauses/tobaccocancer
/secondhand-smoke](http://www.cancer.org/cancer/cancercauses/tobaccocancer/secondhand-smoke)

2nd-Hand Smoke Addictive?

[http://www.ncbi.nlm.nih.gov/pubmed?term=2nd%20hand
%20smoke%20addictive](http://www.ncbi.nlm.nih.gov/pubmed?term=2nd%20hand%20smoke%20addictive)

<http://www.ncbi.nlm.nih.gov/pubmed/20211642>

<http://www.ncbi.nlm.nih.gov/pubmed/19936715>

<http://www.ncbi.nlm.nih.gov/pubmed/21840504>

Comments + Questions + Discussion!

