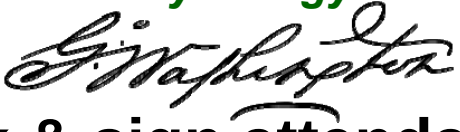
...Welcome to Human Physiology – what makes us tick!

Bl 121 Lecture 1



I. *Announcements*: Please check & sign attendance roster. Not on list? See Pat during a break or after class. *Lab 1 Histology* tomorrow in 130 HUE: 12 n & 1 pm sections.

II. *Introduction*: Staff, office hr, required sources, course overview, grading, expectations & success. Q?

III. *Human Physiology* LS ch 1, DC Module 1,

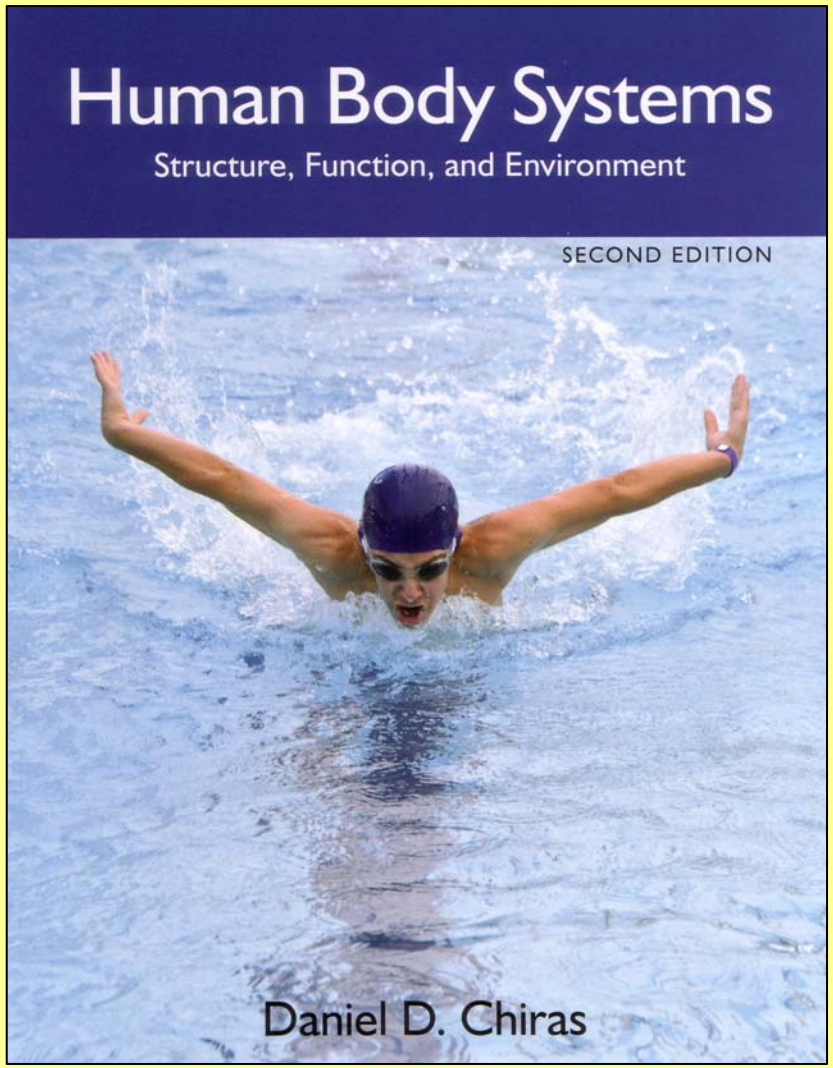
- **A. What? cf: Anatomy LS p 1**
- **B. Where?Body Levels of Organization LS pp1-6, DC pp1-5**
- **C. How? Different Study Approaches LS p 1**
- **D. Why? Security+Decision-Making Power LS p xxi, DC p v**

IV. *Homeostasis* LS ch 1, DC Module 1

- **A. What? Maintenance of ECF LS p 8**
- **B. Where? ECF = Plasma + Interstitium LS fig 1-4 p 8**
- **C. How? Simplified Homeostatic Model cf: LS fig 1-7 p 14**
  Balances LS p 9, DC pp 5-6
- **D. Why? Cell survival! LS fig 1-5 p 9, DC p 5**

BI 121 Required Texts

http://literaryduck/uoduckstore.com



DC

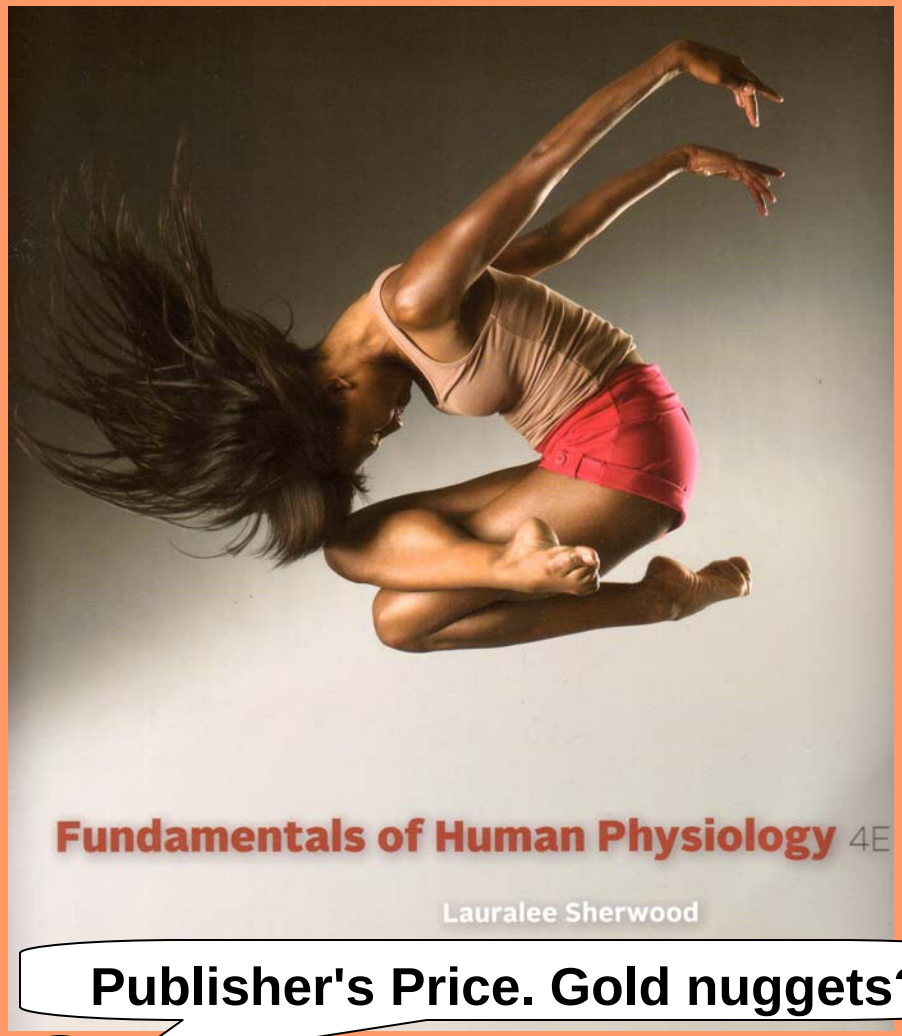
New (2013 ed) $26.00 Used $19.50

Introduction to Human Physiology
Department of Biology, BI 121
Laboratory Manual
University of Oregon
Eugene, OR 97403
Summer 2014

LM

Lab Notebook ~$ 9.75

BI 121 Optional Source @ Amazon.com or Smith Family Bookstore?



Publisher's Price. Gold nuggets?

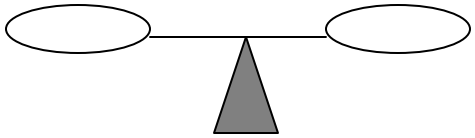
LS 2012

Text $ 212.48 New or $127.99 Kindle Edition or $20.75 Rent

Dr. Evonuk's 6 Balances

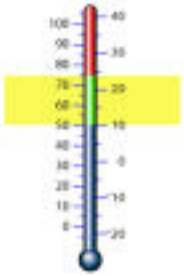
Metabolic

ANA- CATA-

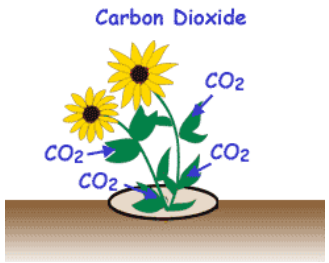


H_2O

T°C

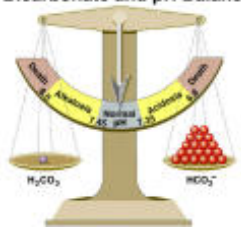


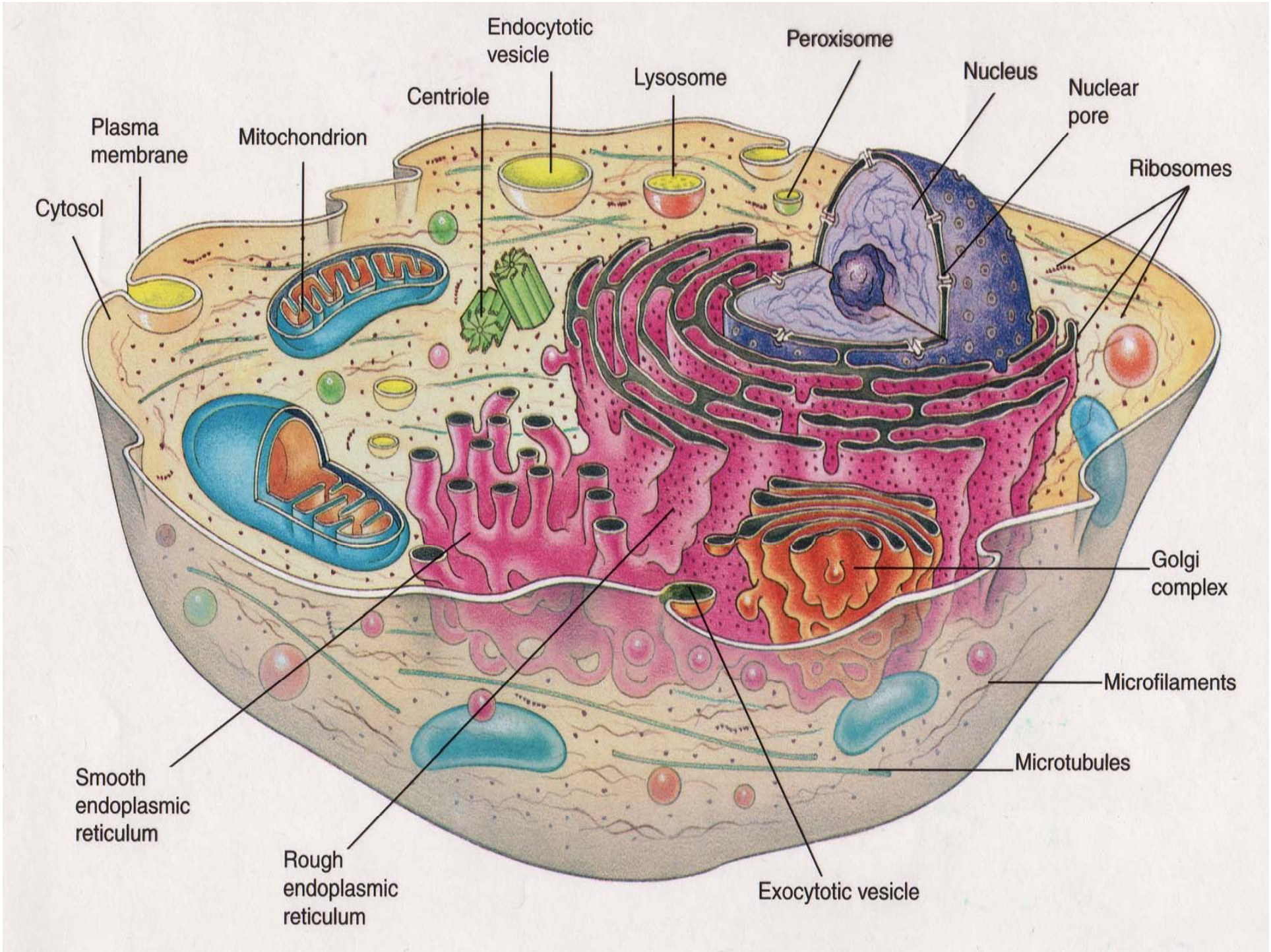
O_2/CO_2



$Ion^{+/-}$

pH




Endocytotic vesicle
Peroxisome
Lysosome
Nucleus
Nuclear pore
Centriole
Plasma membrane
Mitochondrion
Ribosomes
Cytosol
Golgi complex
Microfilaments
Microtubules
Smooth endoplasmic reticulum
Rough endoplasmic reticulum
Exocytotic vesicle

Mitochondria: Energy Organelles

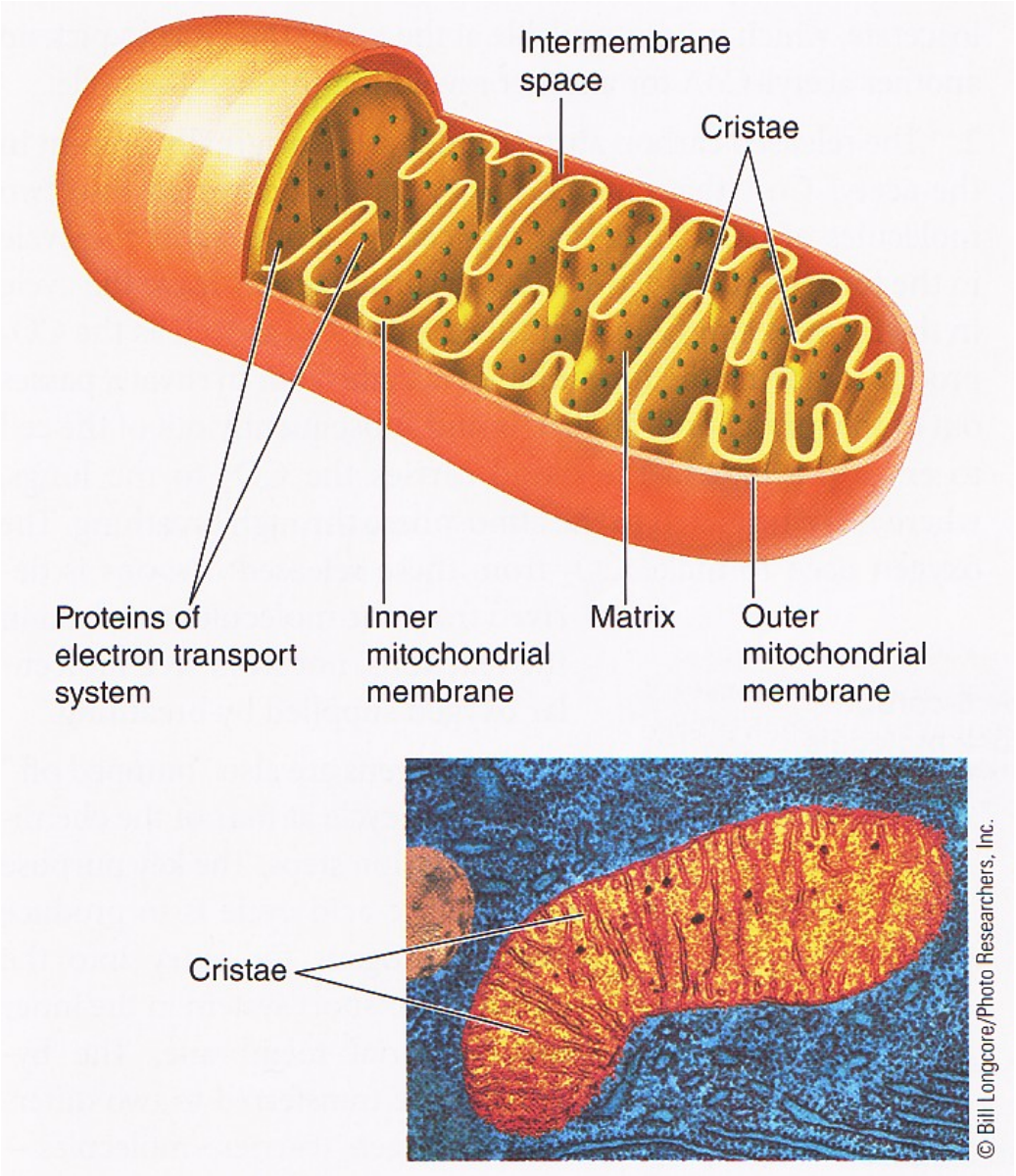
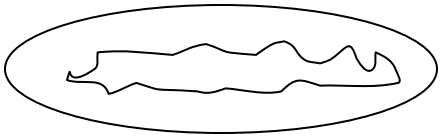


fig 2-8 LS 2012

AEROBIC w/O_2



MITOCHONDRIA

ANAEROBIC

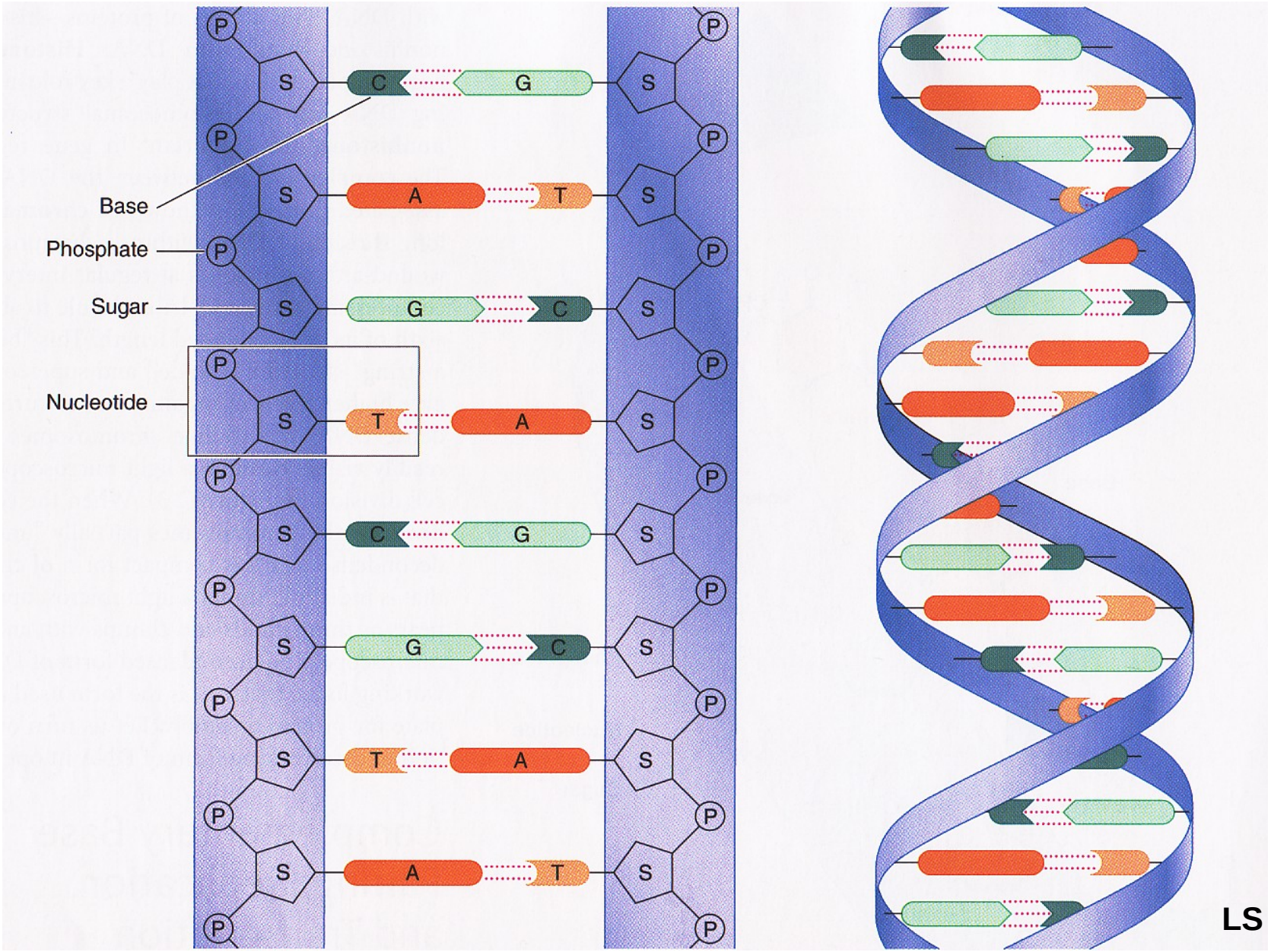
CYTOSOL

Glycolysis

Immediate/ATP-PC

PRIMARY FUEL	ACTIVITY	% AEROBIC (Oxidative Energy System)	% ANAEROBIC (Immediate & Non-Oxidative Energy Systems)	TIME (Min:Sec)
	Marathon Cross-Country Skiing	100	0	135:00
	10-K Run	90	10	29:00
FAT, CARBOHYDRATE & PROTEIN (Small Amounts)	3-Mile Run	80	20	14:00
	2-Mile Run 800-Meter Swim	70	30	
		60	40	9:00
	1-Mile Run			3:45
CARBOHYDRATE (Glucose & Glycogen)	Boxing 200-Meter Swim	50	50	
	Circuit Weight Training	40	60	
	Soccer Lacrosse	30	70	1:30
	Tennis	20	80	0:50
ATP, ADP & Creatine Phosphate (CP)	Basketball Volleyball 200-Meter Dash Football	10	90	0:20
	Conventional Weight Training	0	100	0:10

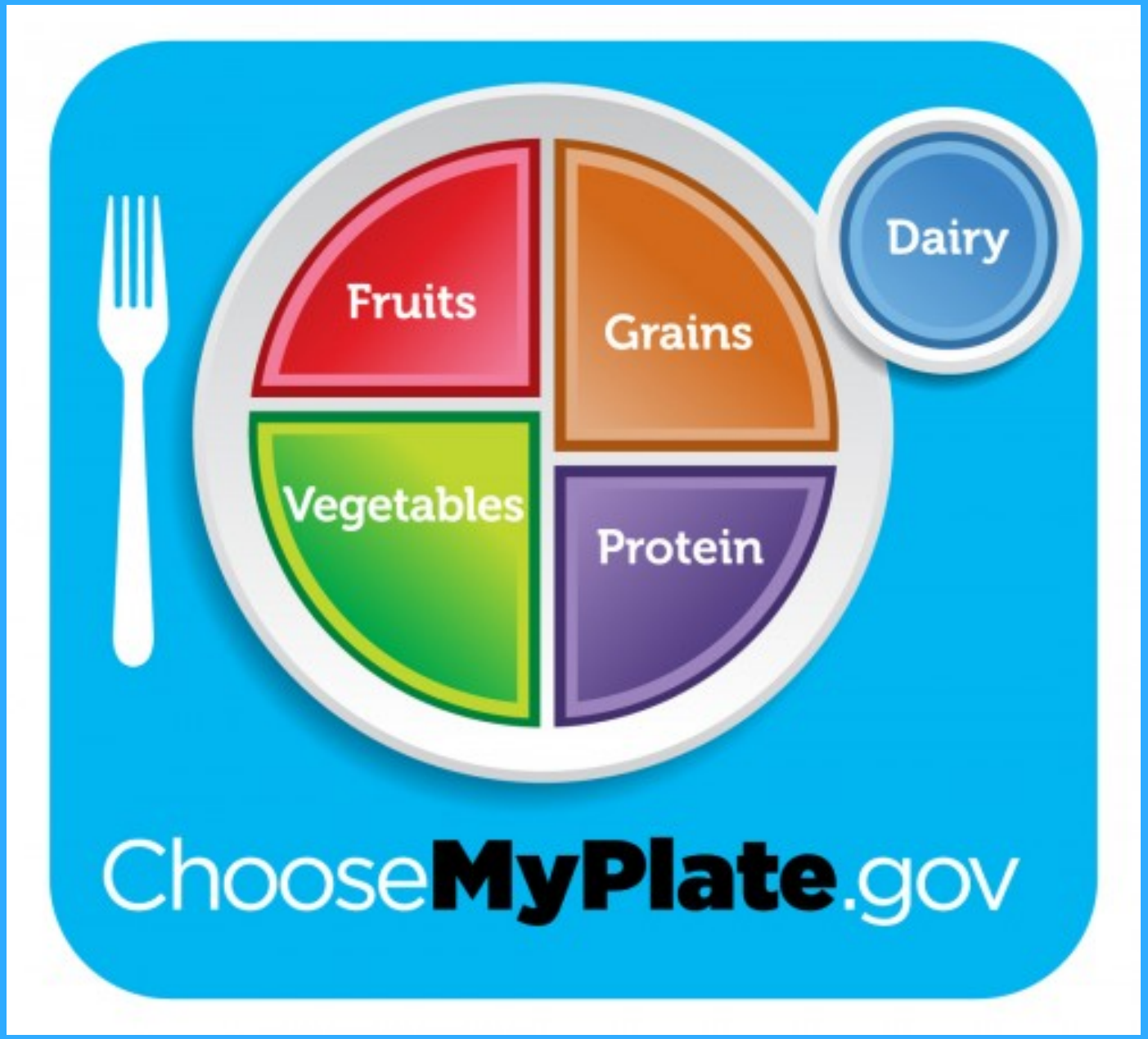
What does DNA look like? Double-helix!!



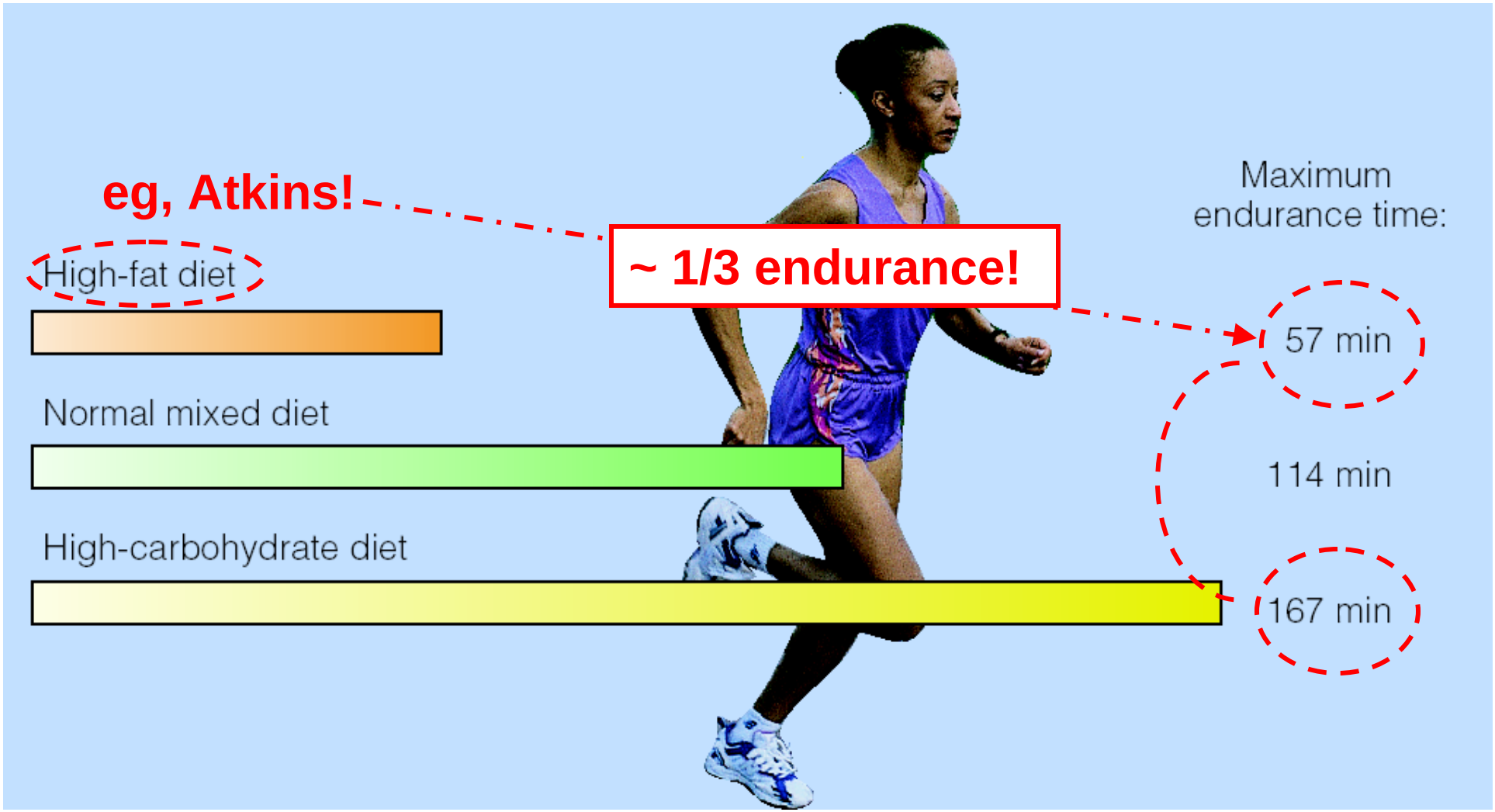
LS fig C-2

What are DNA's major functions?
Heredity + Day-to-Day Cell Function

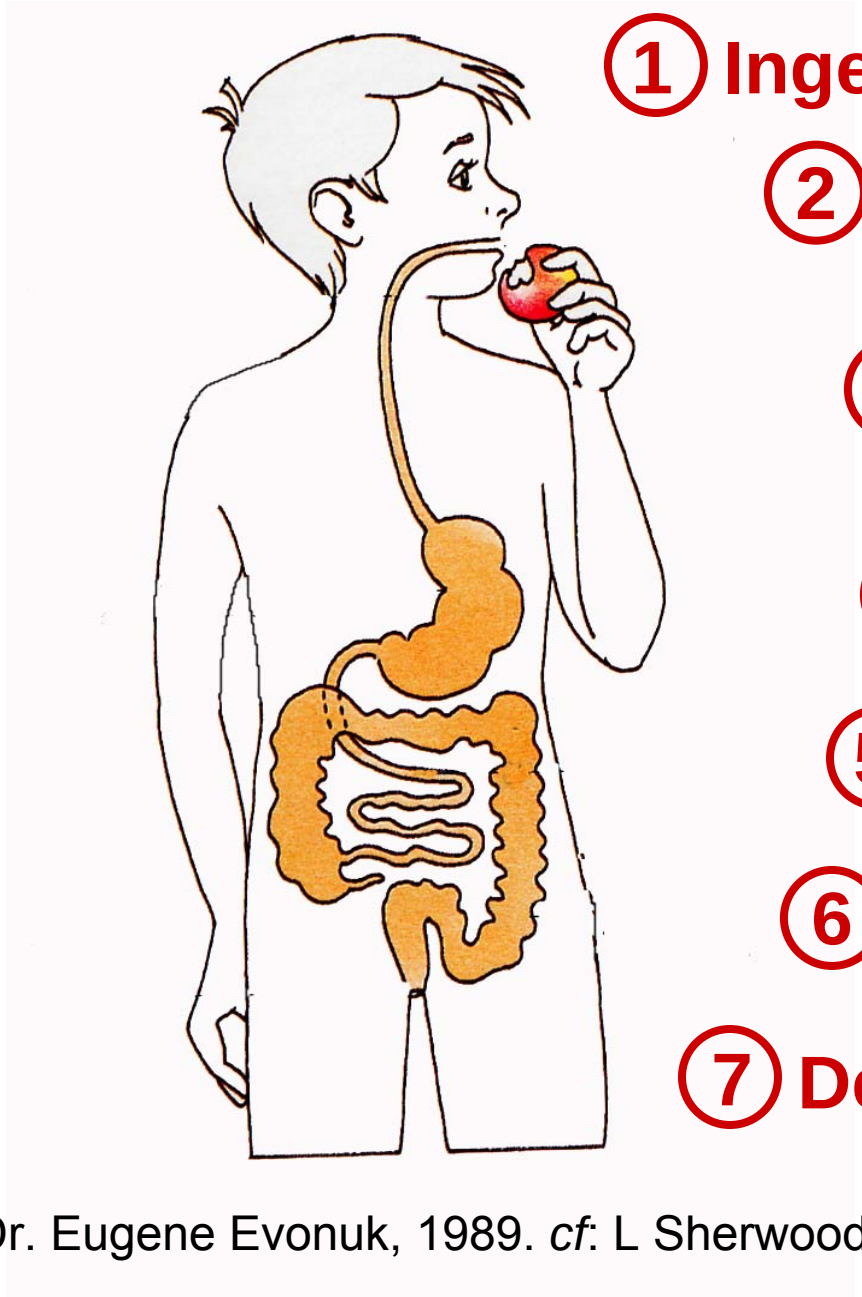
Dietary Analyses Thanks to Michelle Obama!



Dietary Composition & Physical Endurance



Digestion Steps



1. Ingestion
2. Mechanical Digestion
3. Chemical Digestion
4. Peristalsis
5. Absorption
6. Storage
7. Defecation

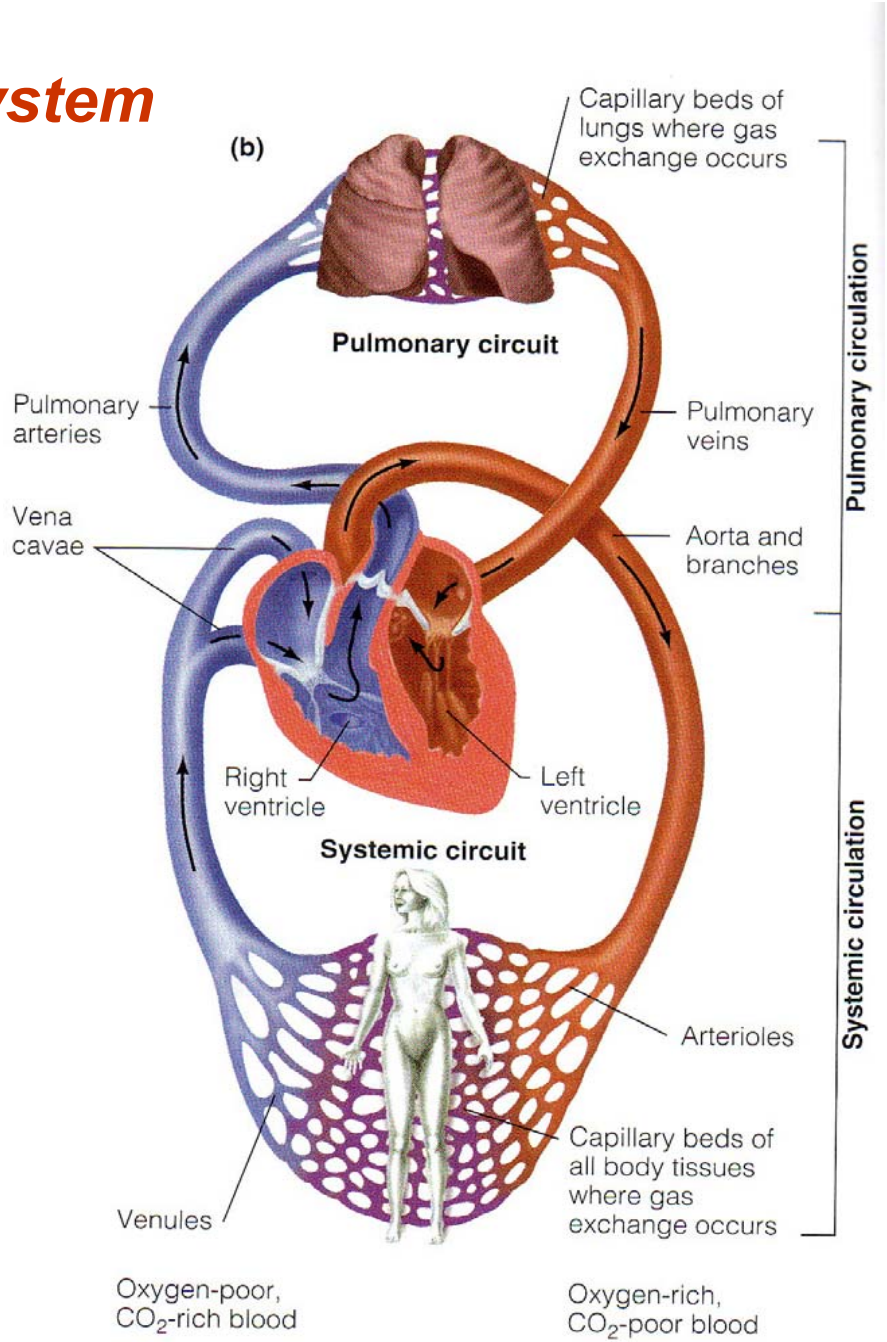
SOURCE: Dr. Eugene Evonuk, 1989. *cf*: L Sherwood, 2012 pp 437-8.

Cardiovascular System
Figure-8 Loop

Pulmonary

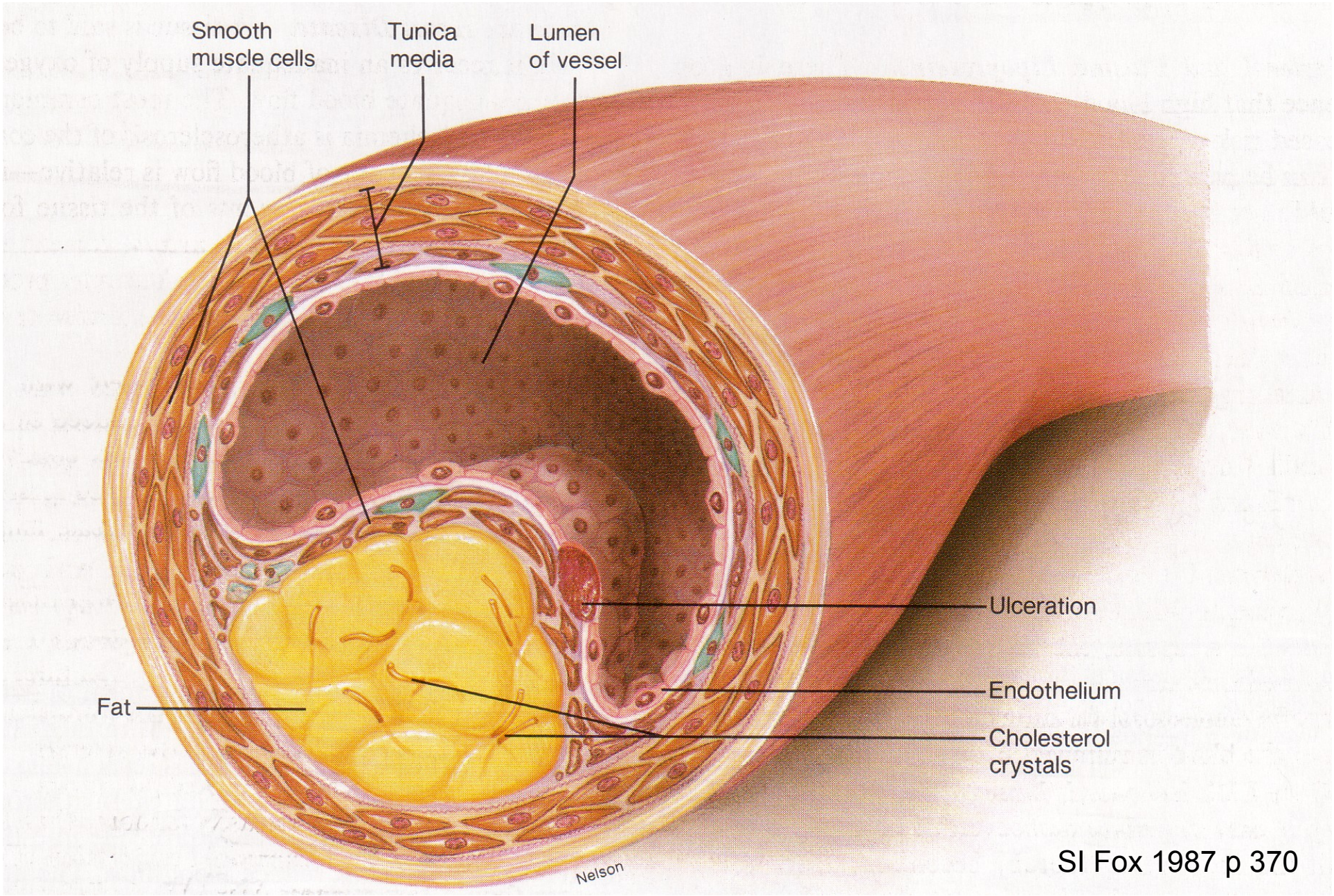
8

Systemic



DC 2003

Atherosclerosis developing within vessel walls!



SI Fox 1987 p 370

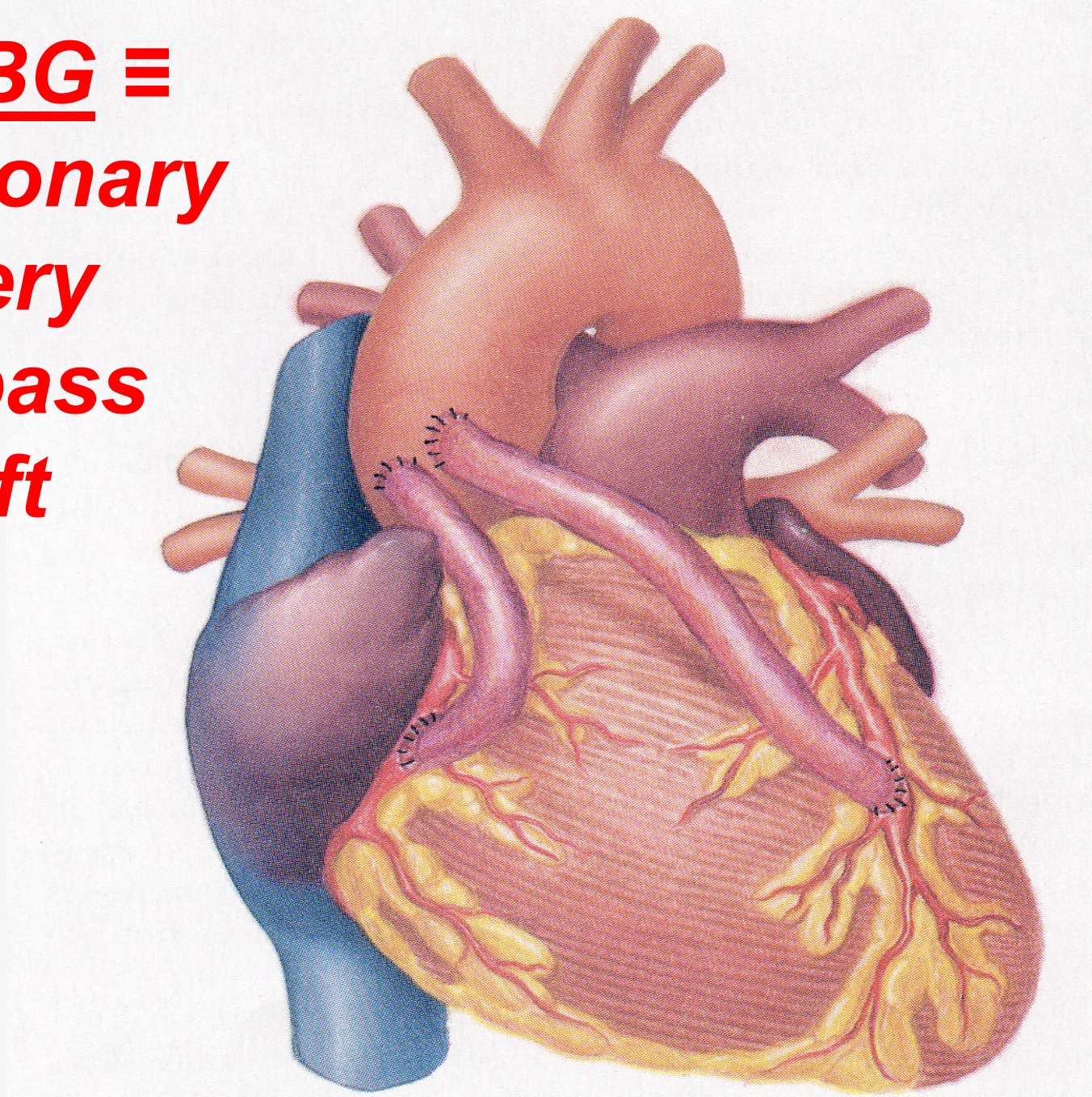
CABG ≡

Coronary

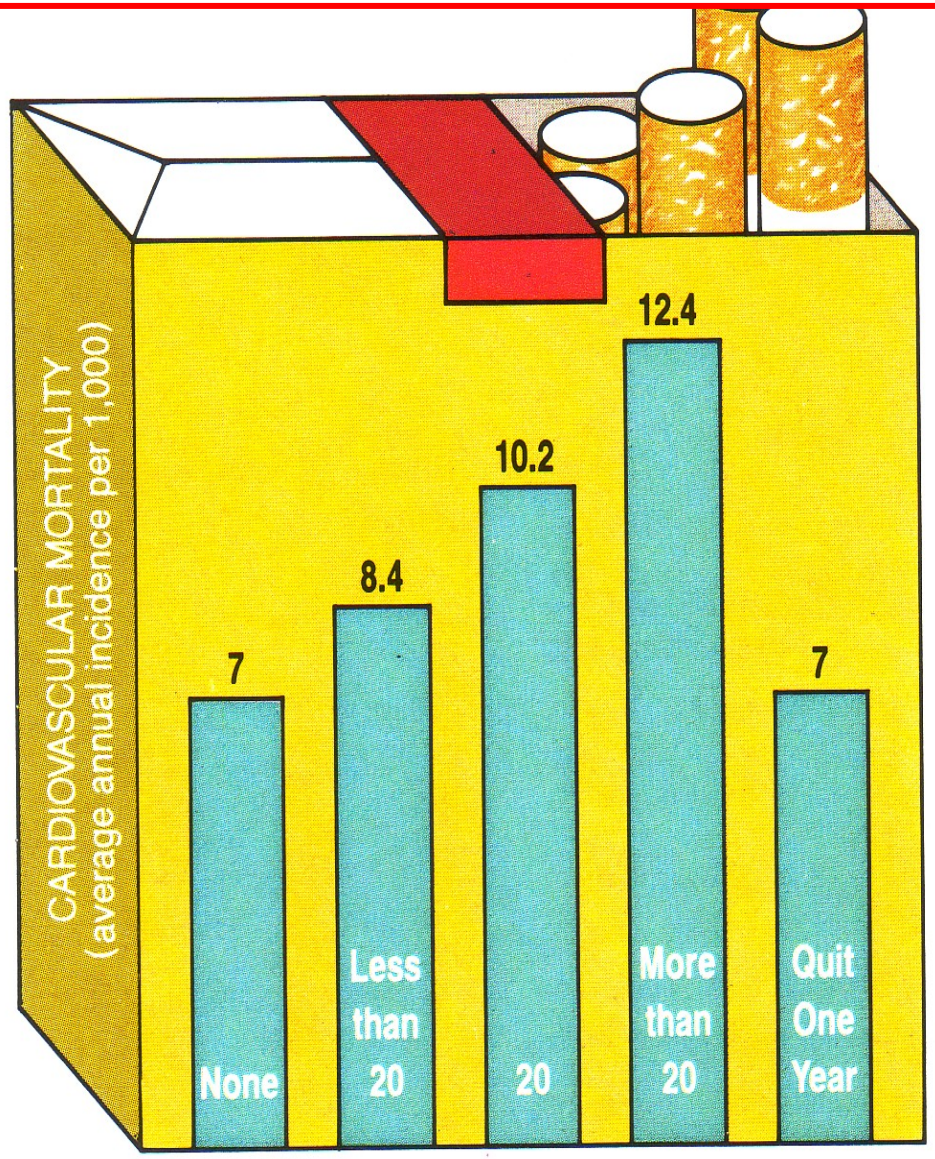
Artery

Bypass

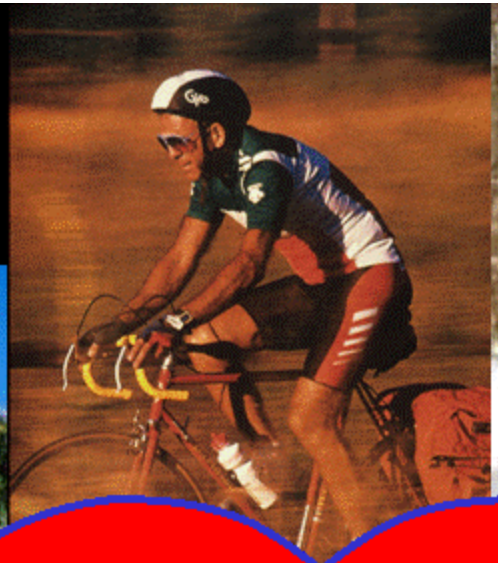
Graft



Cigarette Smoking: #1 Preventable Cause of Premature Death in the US



How much aerobic?



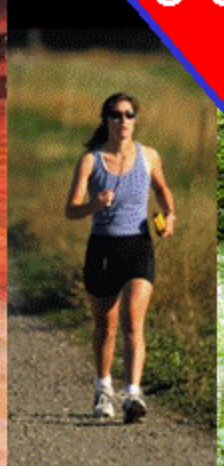
Continuous exercise

≥ 50% muscle mass

≥ Conversational pace

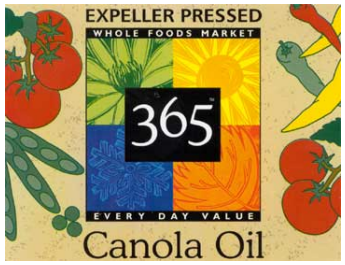
20-60 min/session

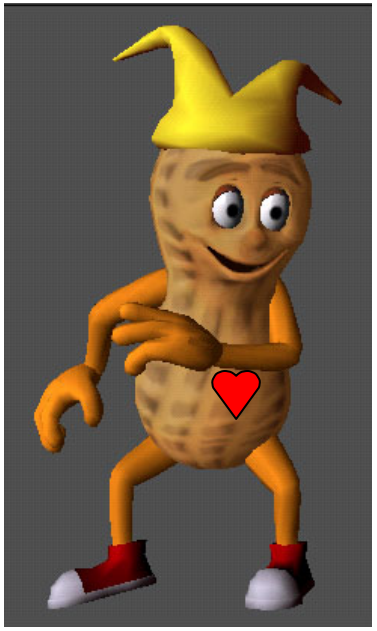
3-5 days/wk



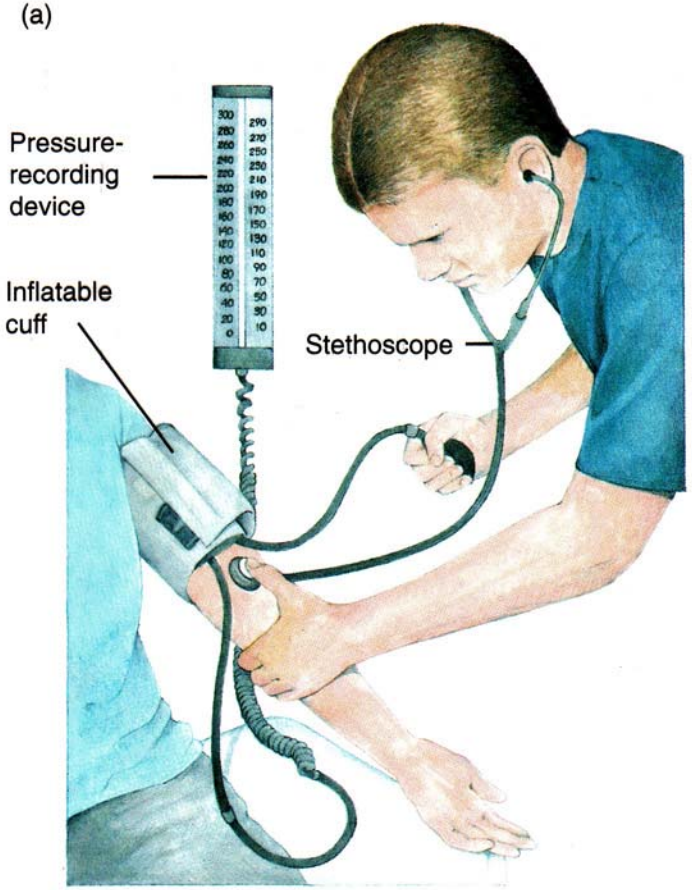
Healthy Oils to Minimize Atherosclerosis

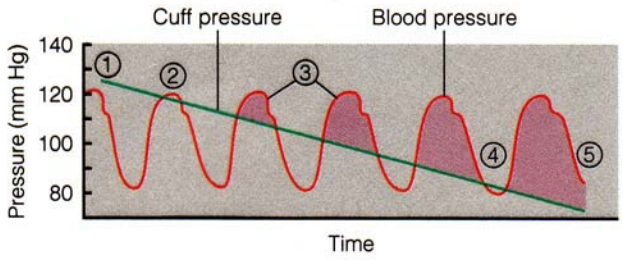
HAPOC?





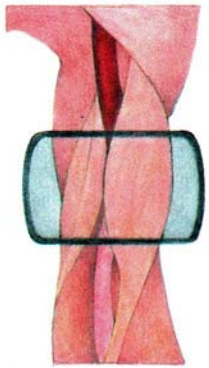
(a)





(b)

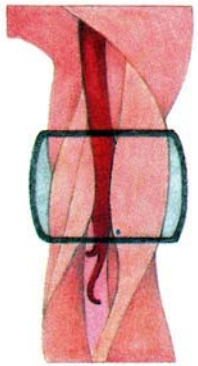
(c) When blood pressure is 120/80:



Cuff pressure is greater than 120 mm Hg.

No blood flows through vessel.

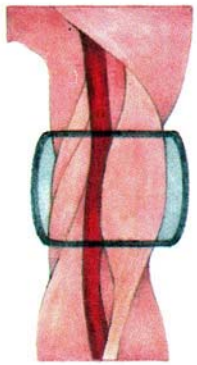
No sound is heard.



Cuff pressure is between 120 and 80 mm Hg.

Blood flow through vessel is turbulent whenever blood pressure exceeds cuff pressure.

Intermittent sounds are heard as blood pressure fluctuates throughout cardiac cycle.

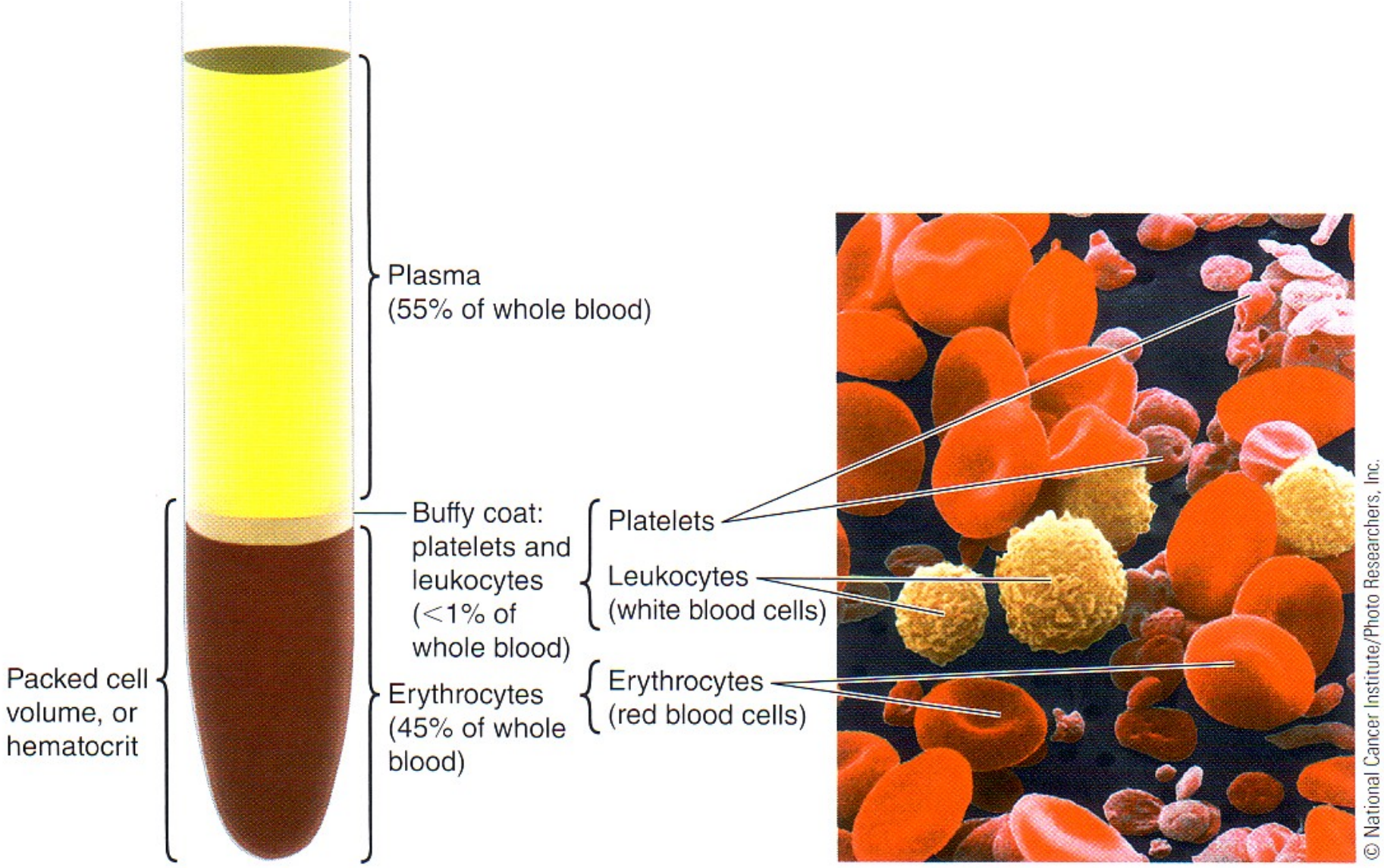


Cuff pressure is less than 80 mm Hg.

Blood flows through vessel in smooth, laminar fashion.

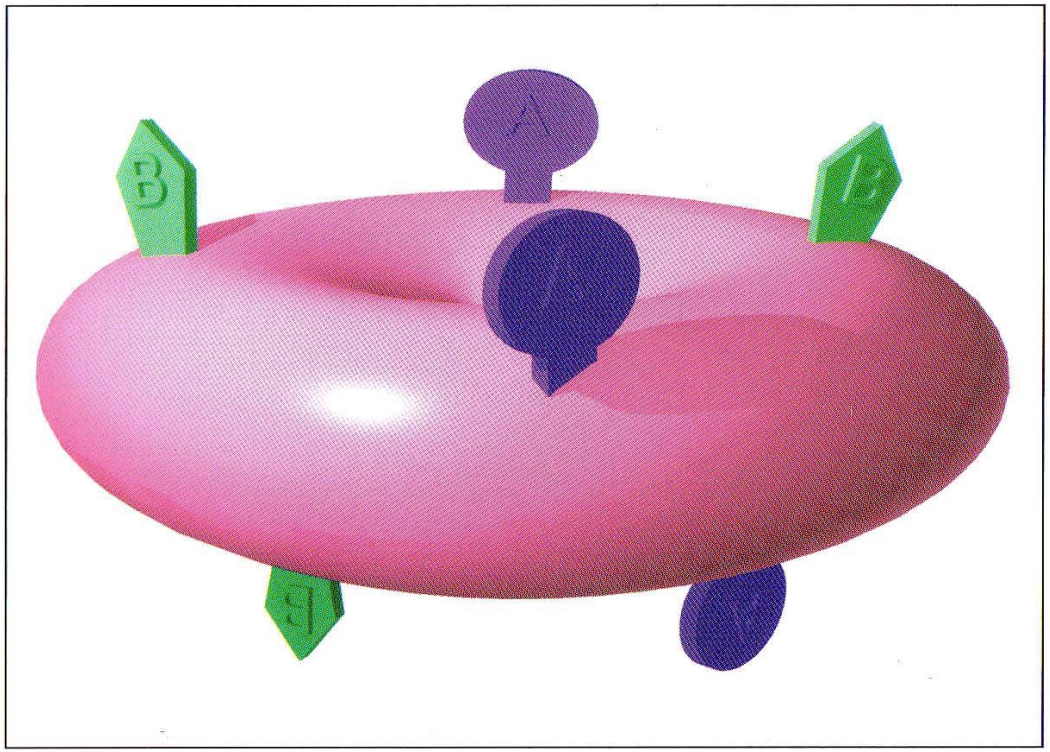
No sound is heard.

What's in Blood? Plasma & Blood Cells



LS 2012 fig 11-1

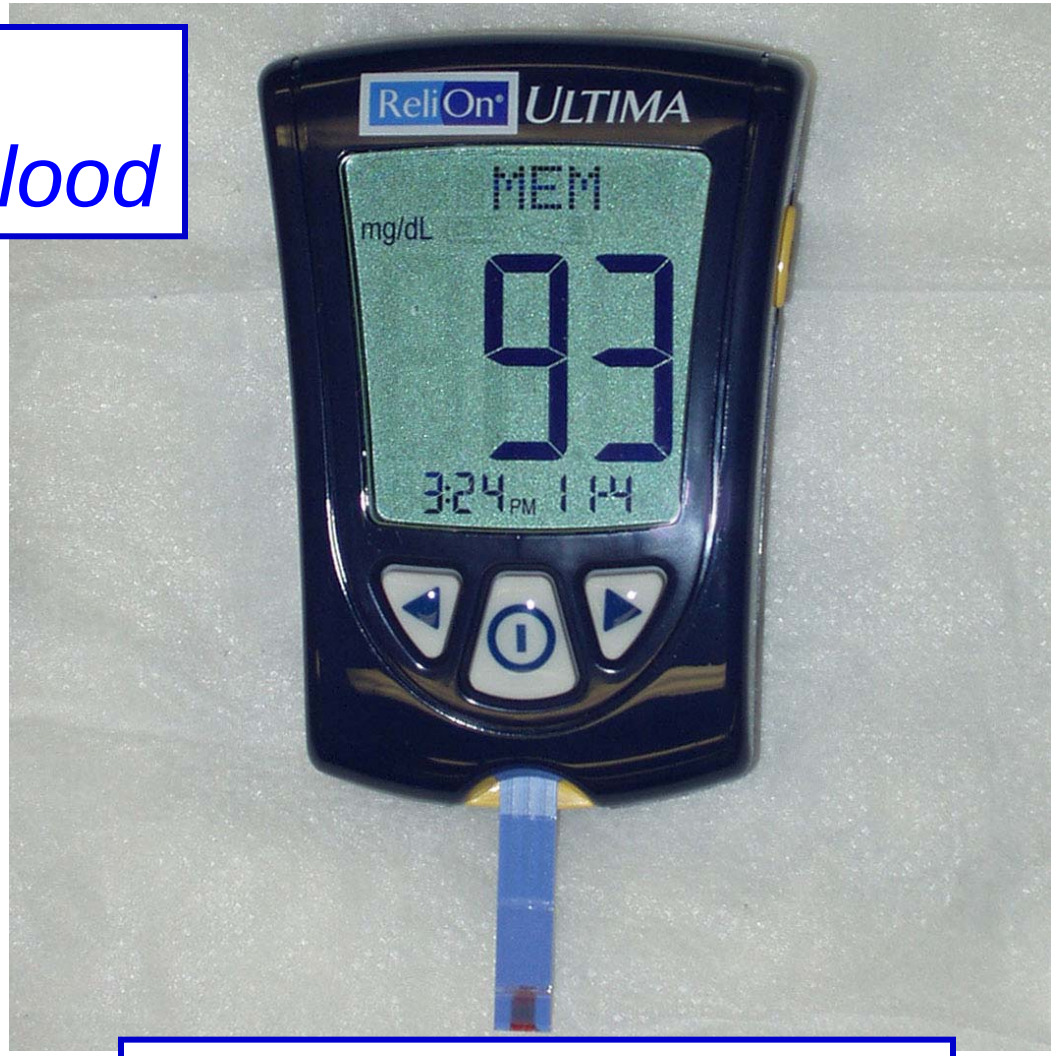
AB



A & B Antigens

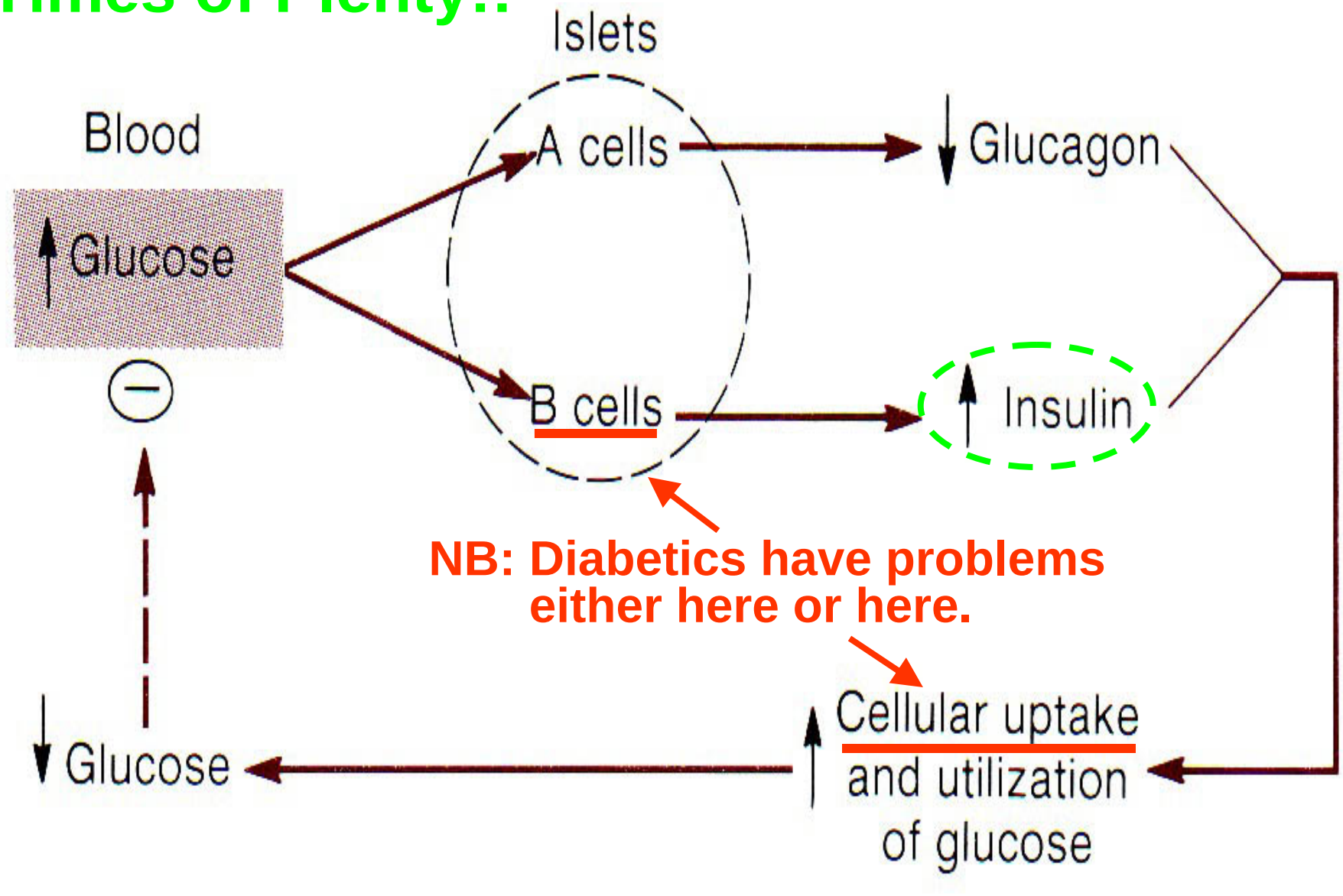
(Agglutinogens)

Glucose:
Sugar in Blood



Normal: 70-99
Pre-Diabetes: 100-125
Diabetes: ≥ 126 mg/dL

Times of Plenty!!



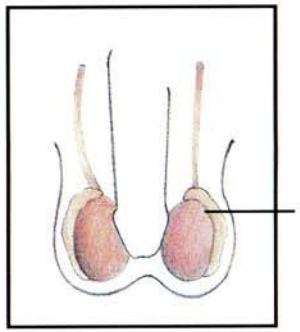
Fox 1987

Store!

Endocrine System

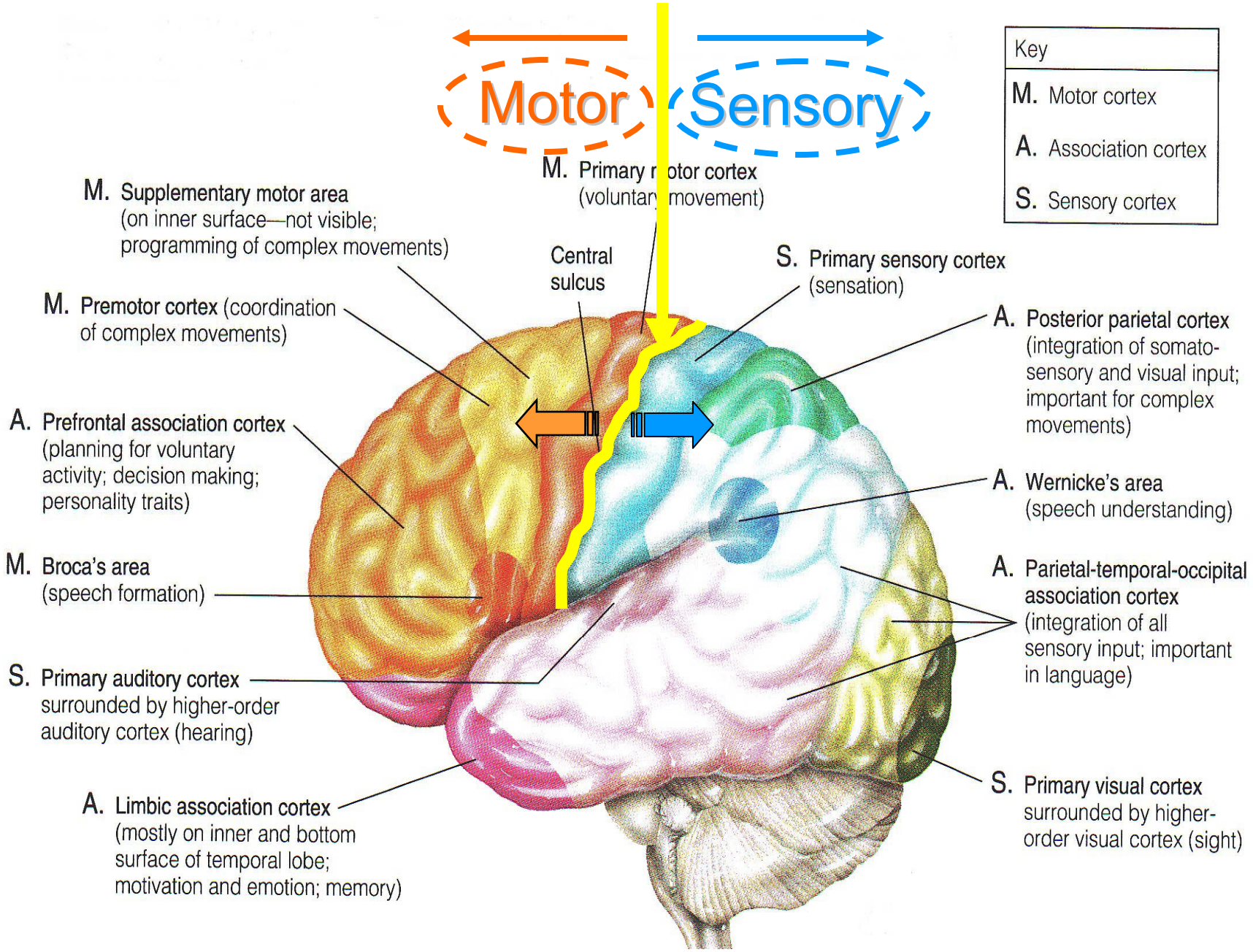
ANP = Atrial Natriuretic Polypeptide

- Solely endocrine function
- Mixed function
- Complete function uncertain

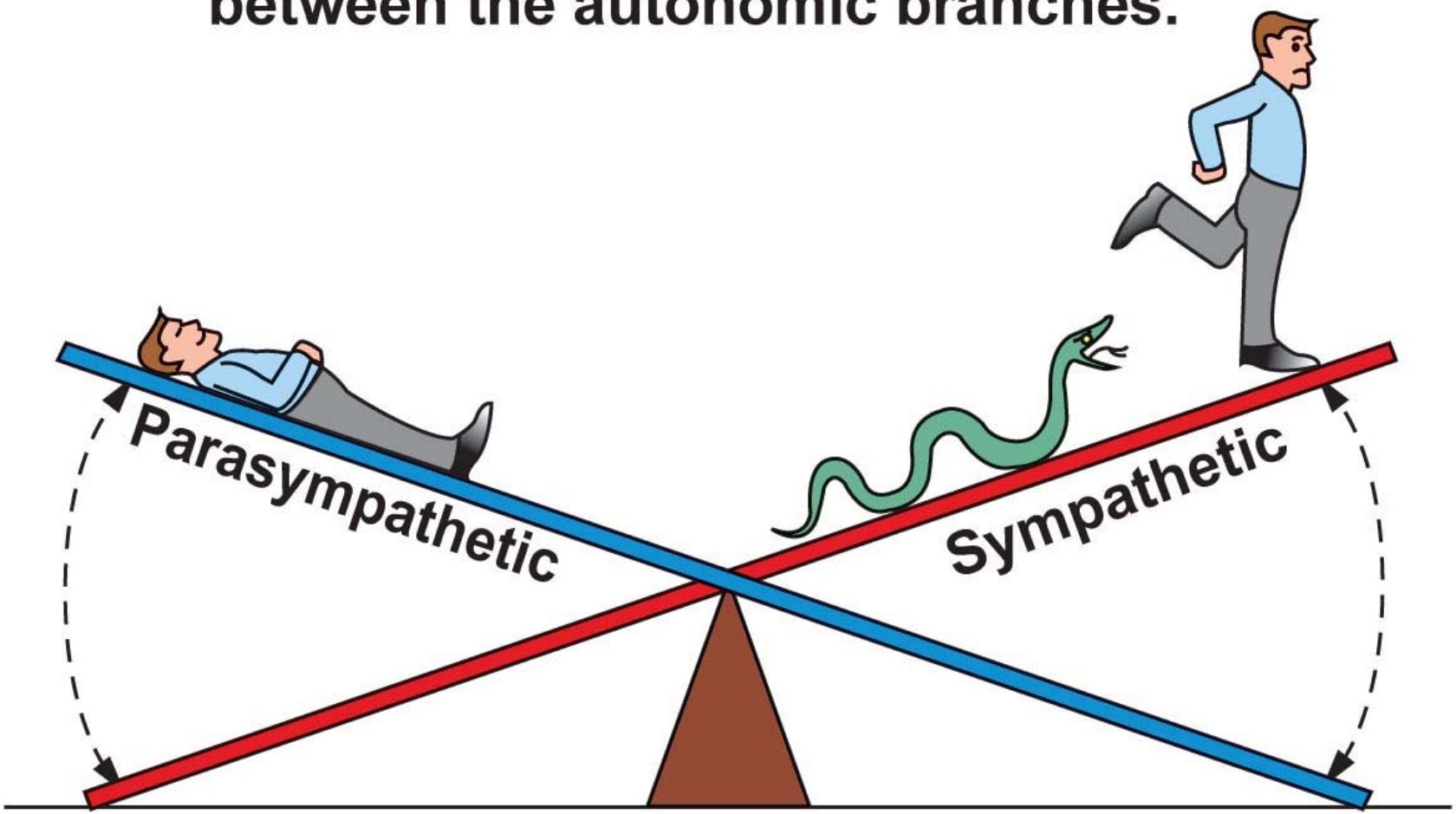


Testes in male

Pineal
Hypothalamus
Pituitary
Parathyroid
Thyroid
Thymus
Heart
Stomach
Adrenal gland
Pancreas
Duodenum
Kidney
Skin
Ovaries in female
Placenta in pregnant female


Motor
Sensory
Key
M. Motor cortex
A. Association cortex
S. Sensory cortex
M. Primary motor cortex (voluntary movement)
M. Supplementary motor area (on inner surface—not visible; programming of complex movements)
Central sulcus
S. Primary sensory cortex (sensation)
M. Premotor cortex (coordination of complex movements)
A. Posterior parietal cortex (integration of somato-sensory and visual input; important for complex movements)
A. Prefrontal association cortex (planning for voluntary activity; decision making; personality traits)
A. Wernicke's area (speech understanding)
M. Broca's area (speech formation)
A. Parietal-temporal-occipital association cortex (integration of all sensory input; important in language)
S. Primary auditory cortex surrounded by higher-order auditory cortex (hearing)
S. Primary visual cortex surrounded by higher-order visual cortex (sight)
A. Limbic association cortex (mostly on inner and bottom surface of temporal lobe; motivation and emotion; memory)

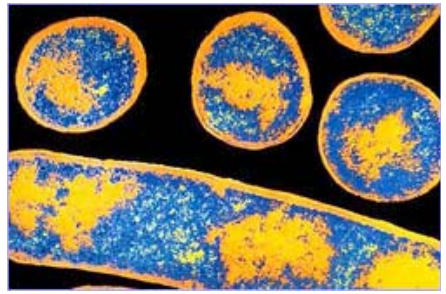
Homeostasis is a dynamic balance between the autonomic branches.



Rest-and-digest: Parasympathetic activity dominates.

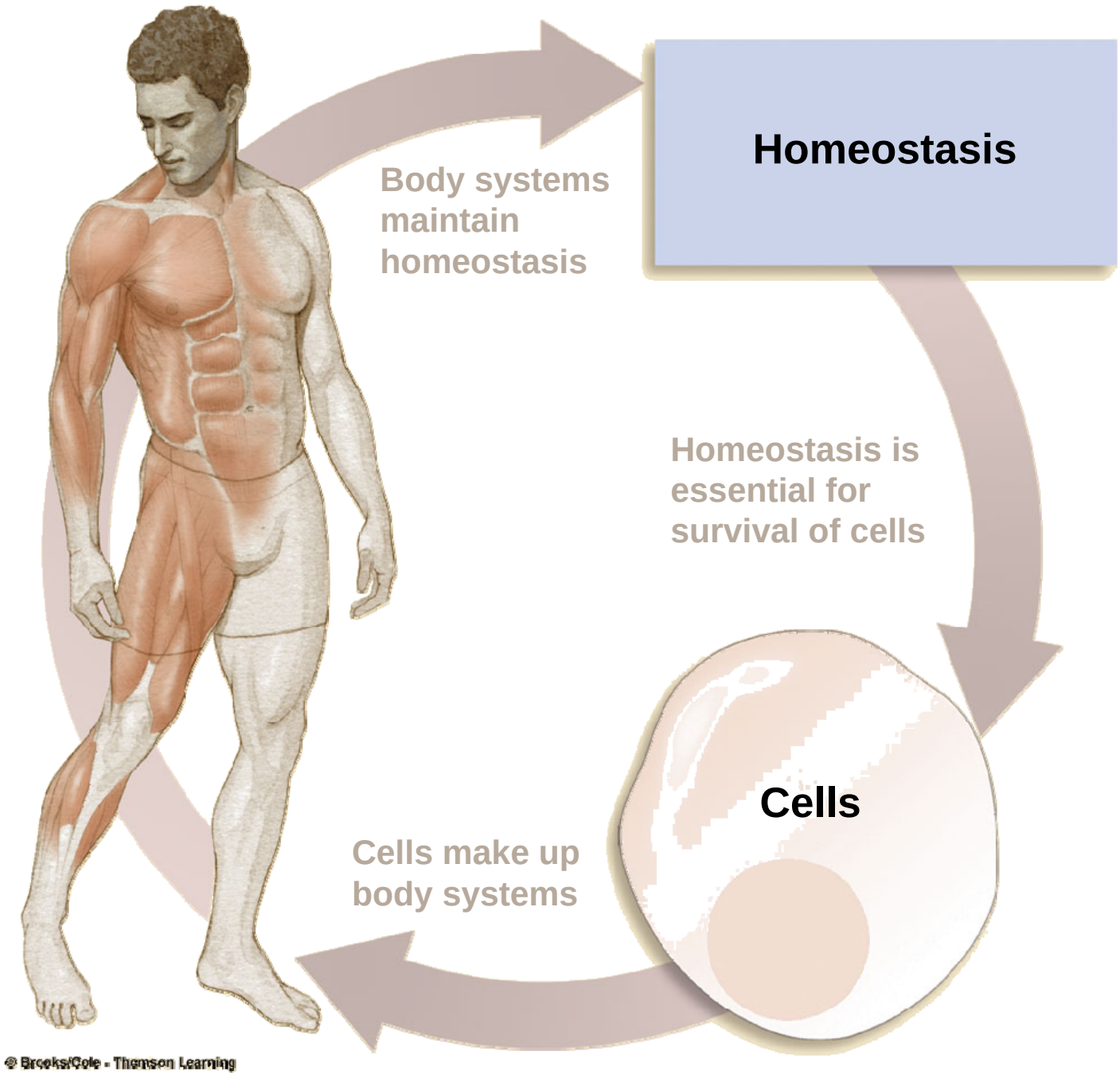
Fight-or-flight: Sympathetic activity dominates.

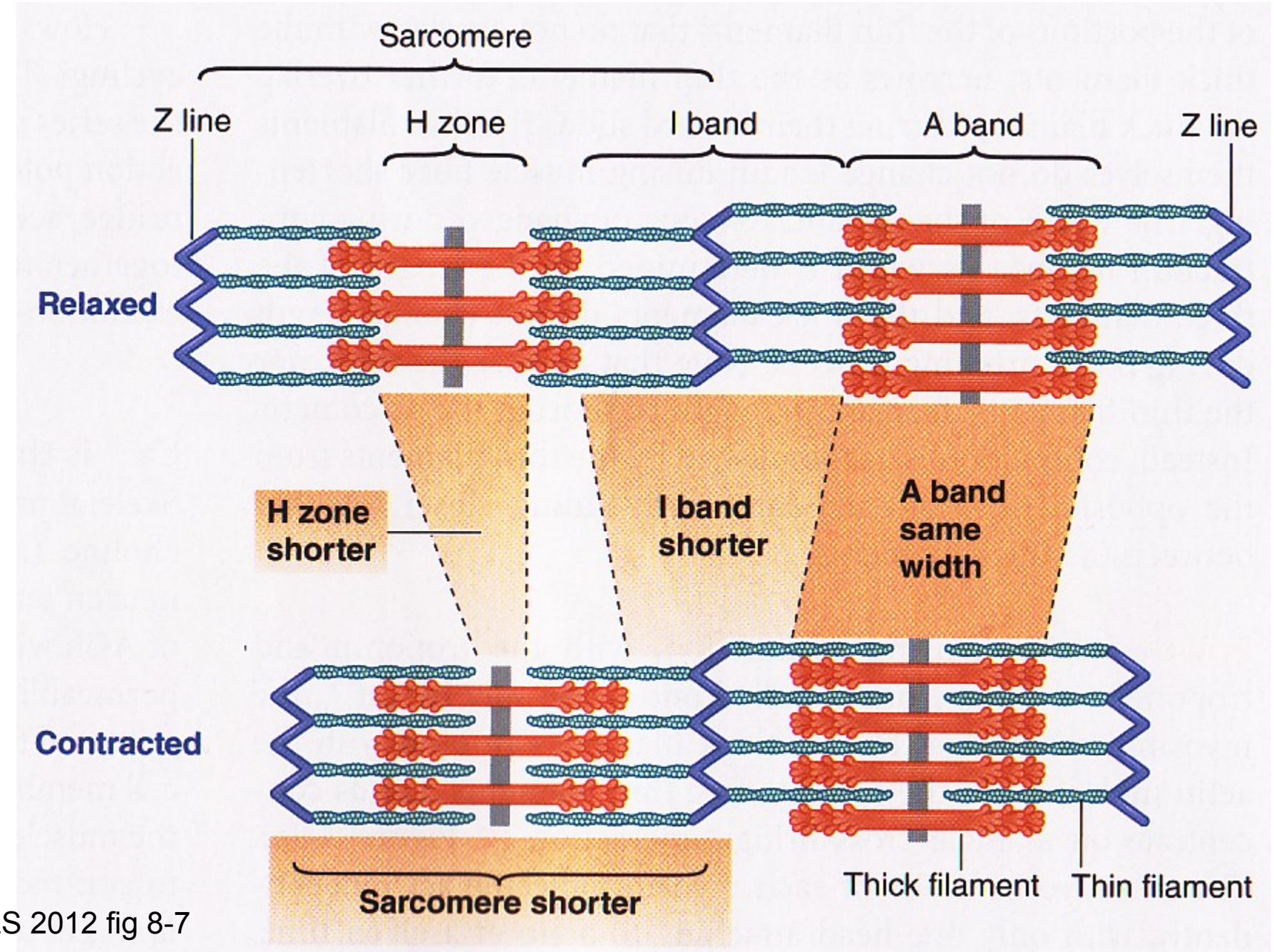
D Silverthorn 2010



Axon of motor neuron
Myelin sheath
Action potential propagation in motor neuron
1
Axon terminal
Terminal button
Vesicle of acetylcholine
Ca^{2+}
Calcium channel
2
Action potential propagation in muscle fiber
6
3
Muscle fiber
Plasma membrane of muscle fiber
4
K^+
Acetylcholine receptor site
5
Cation channel
Na^+
7
Acetylcholinesterase
Local current flow between depolarized end plate and adjacent membrane
Motor end plate
Contractile elements within muscle fiber

Muscular System





LS 2012 fig 8-7

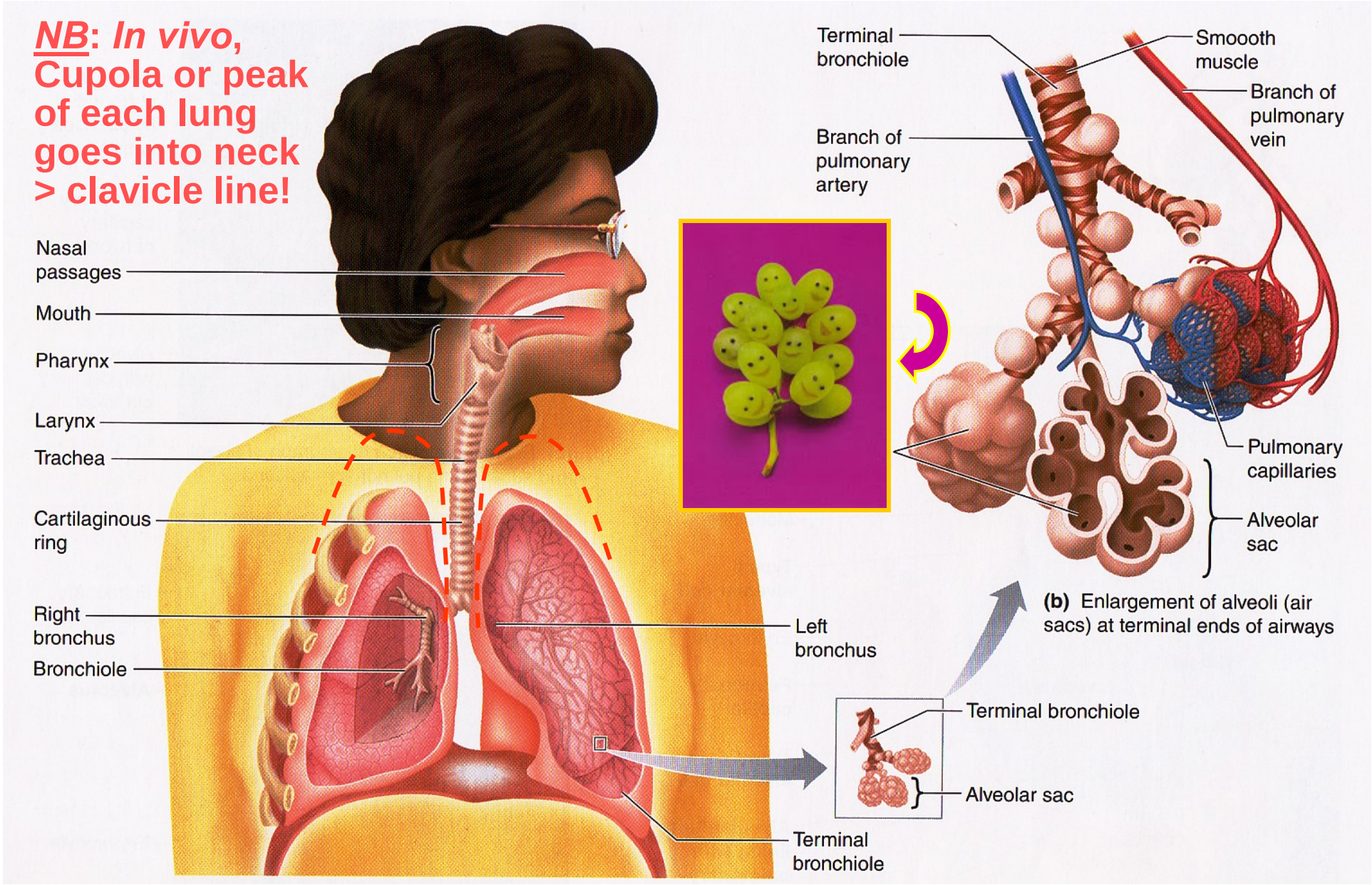
Atrophy

decrease in size & strength

Hypertrophy

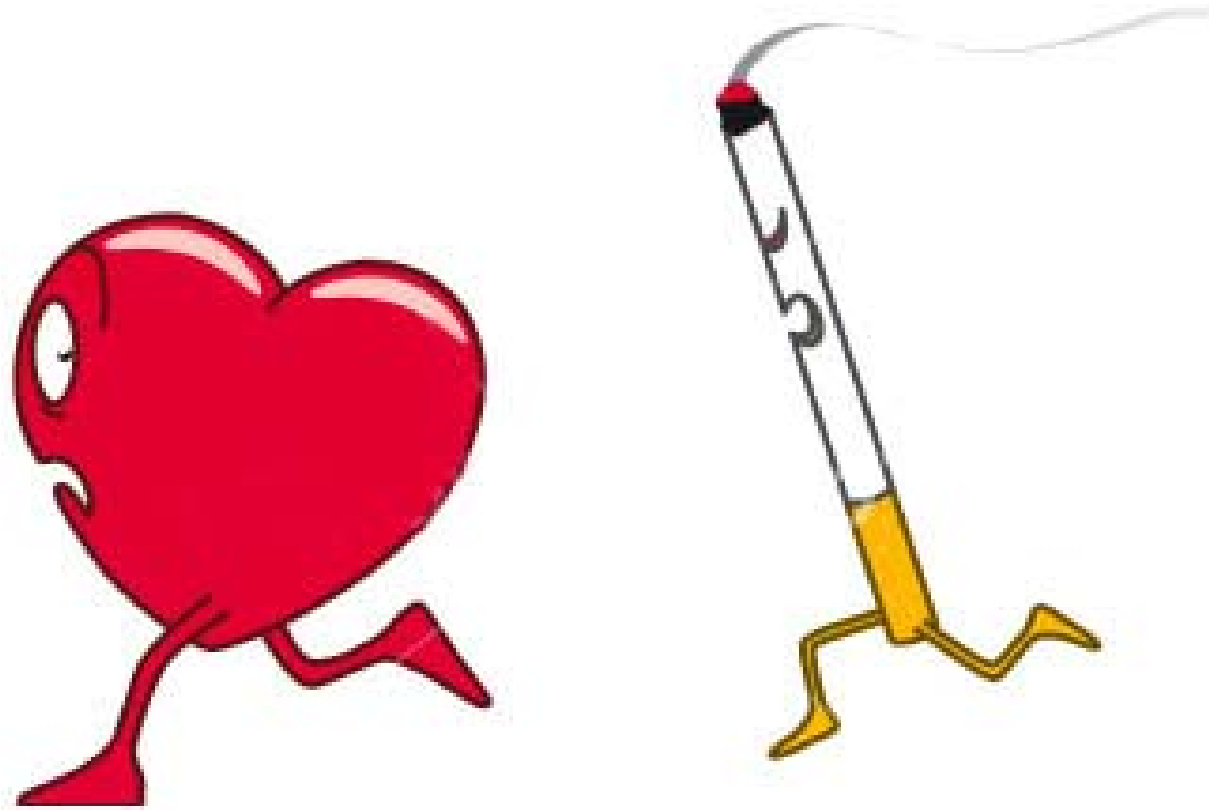
increase in size & strength

Respiratory System Anatomy



LS 2012 fig 12-2

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



☞☺...I ♡ U of O!

Students who succeed are usually those who:

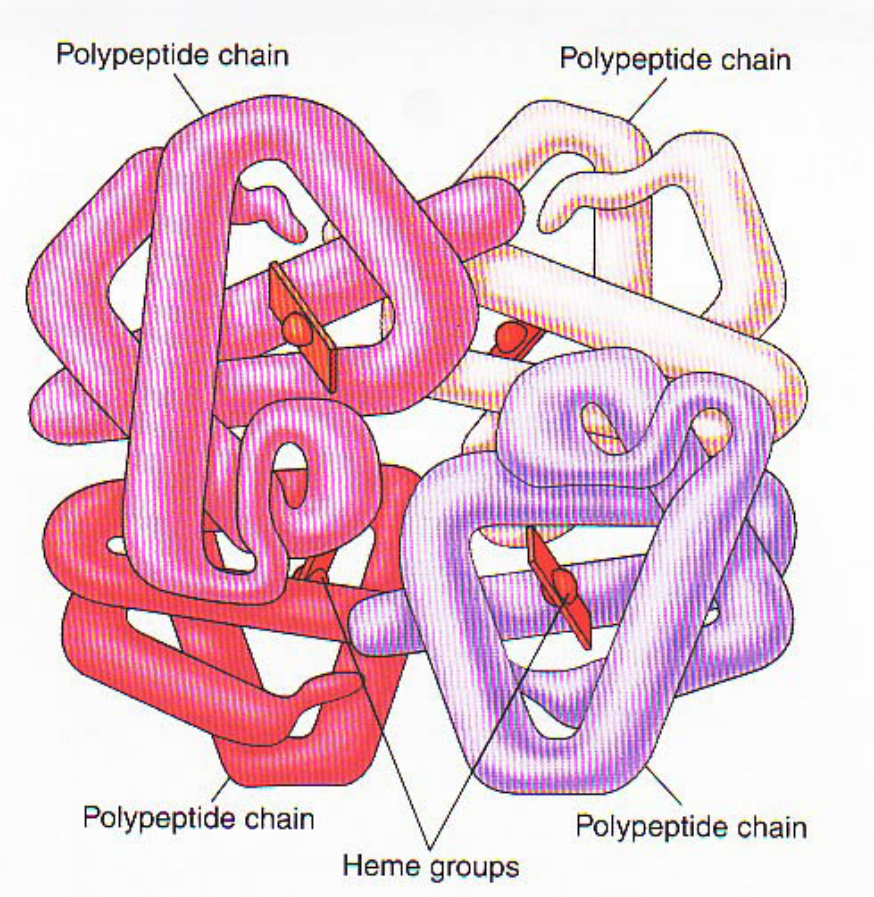
(1) **Attend** class regularly
(2) **Ask** questions
(3) **Come** to office hours & problem-solving sessions
(4) **Study** outside class both alone & in study groups
(5) **Seek** to understand methods & overarching principles/concepts rather than specific answers
(6) **Teach** or tutor others &
(7) **Discuss** concepts informally with fellow students.

Science Teaching Reconsidered, National Academy Press, 1997.

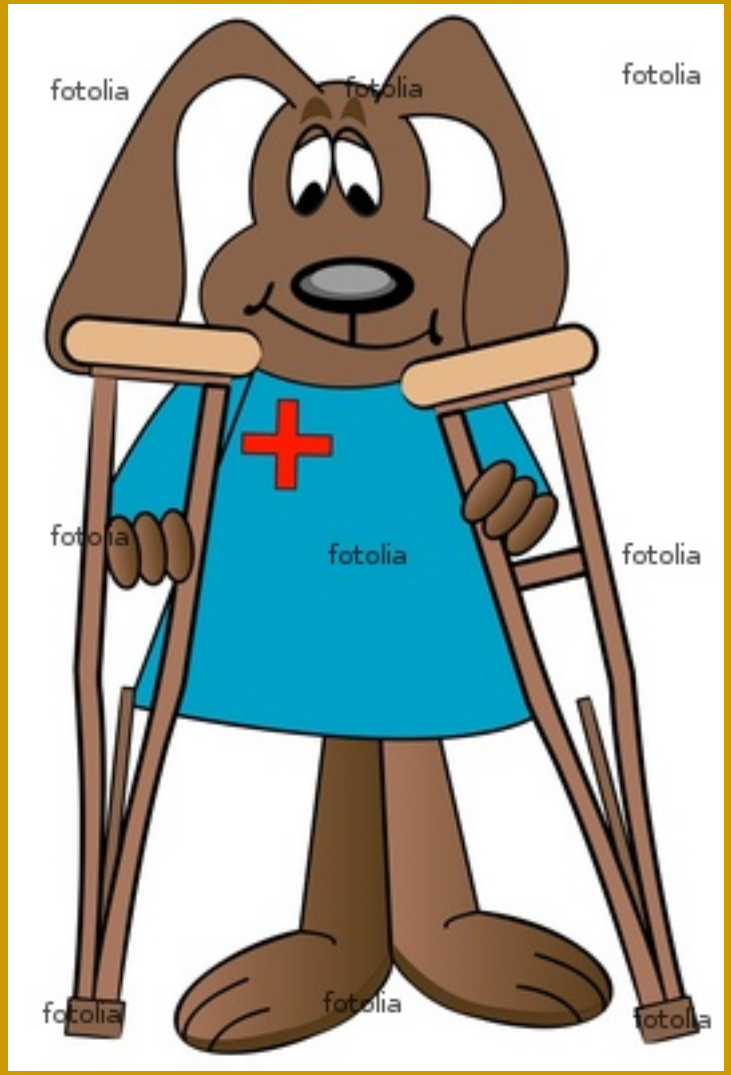
ANATOMY	**vs**	**PHYSIOLOGY**
STRUCTURE	**vs**	**FUNCTION**
WHAT?	**vs**	**HOW?**
WHERE?	**vs**	**WHY?**

vs

Structure* begets *function!
Structure* gives rise to *function!
Structure & *function* are inseparable!



Knee Structure-Function?



Preoperative Diagnoses: R Knee

Degenerative Joint Disease (DJD) = arthritis

Varus malalignment = bow-leg

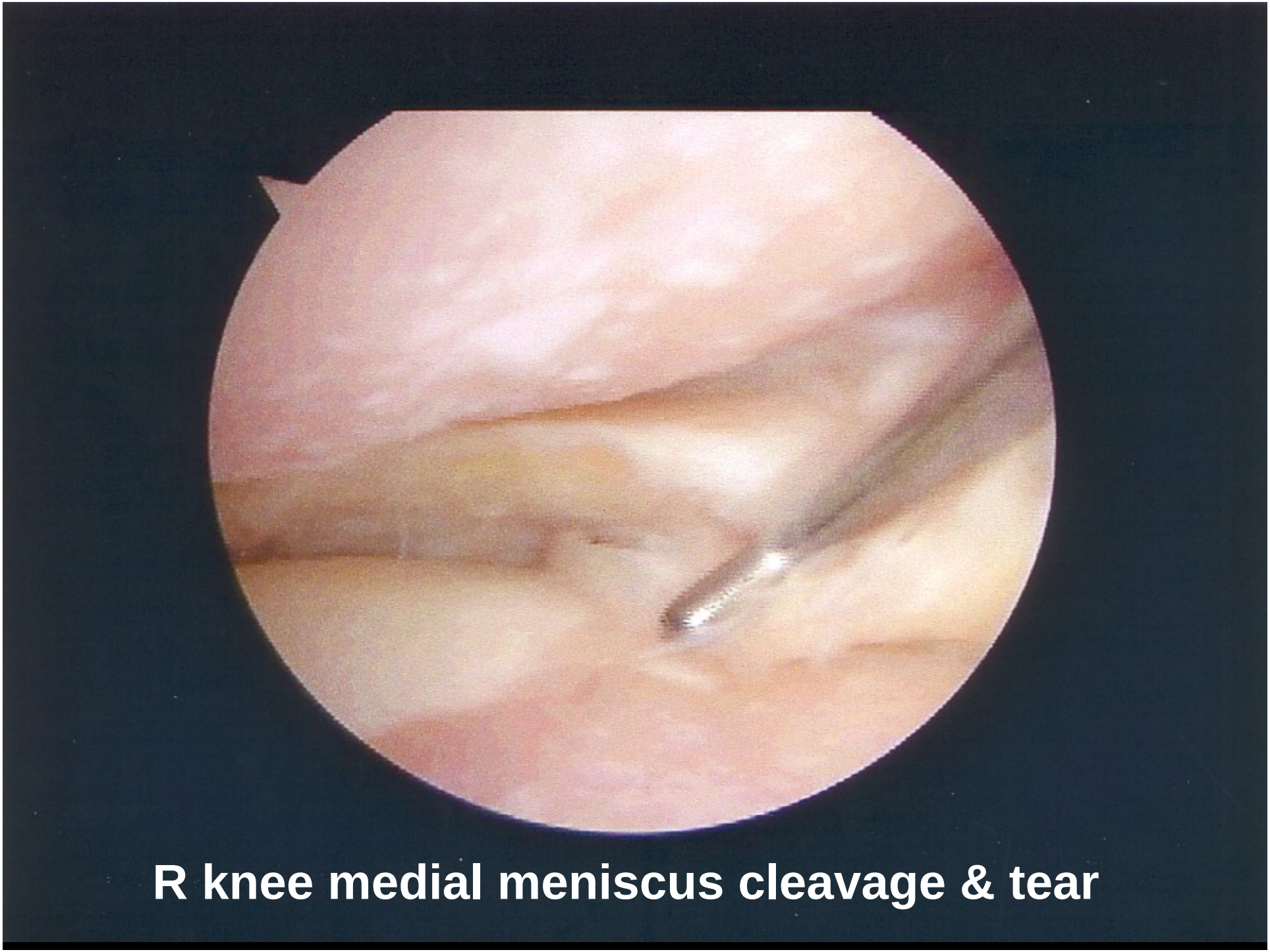
William Sterett, MD
Ben Hogan, PAC
Vail Summit Orthopedics

Procedures:

Arthroscopy & microfracture
High Tibial Osteotomy (HTO)
Packing bone graft substitute

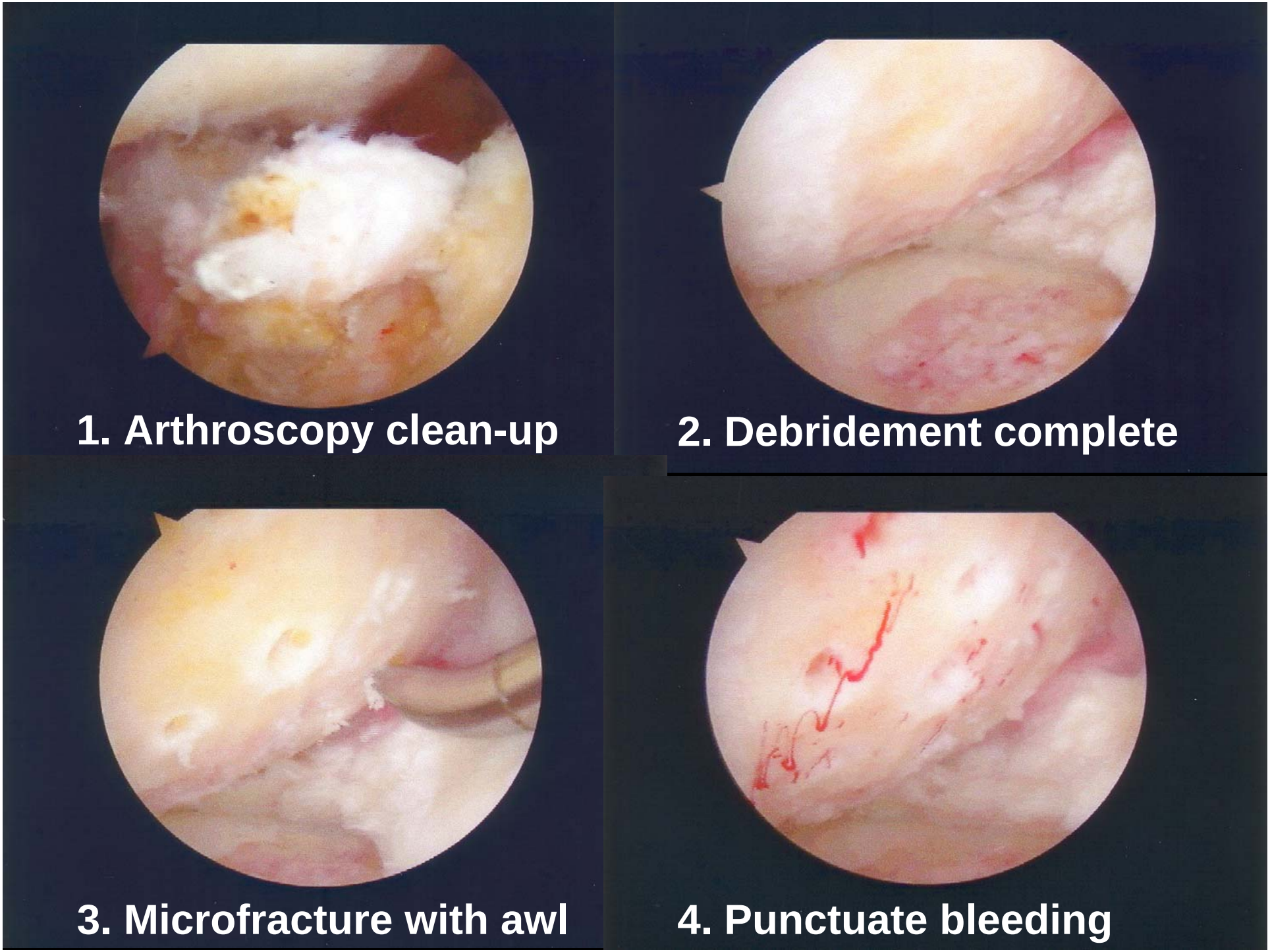
Blocks/Medications:

Femoral n. block
General anesthesia
IV Morphine, Oral Oxycontin + Oxycodone, Tylenol, Injectable Lovenox (enoxaparin Na)



R knee medial meniscus cleavage & tear

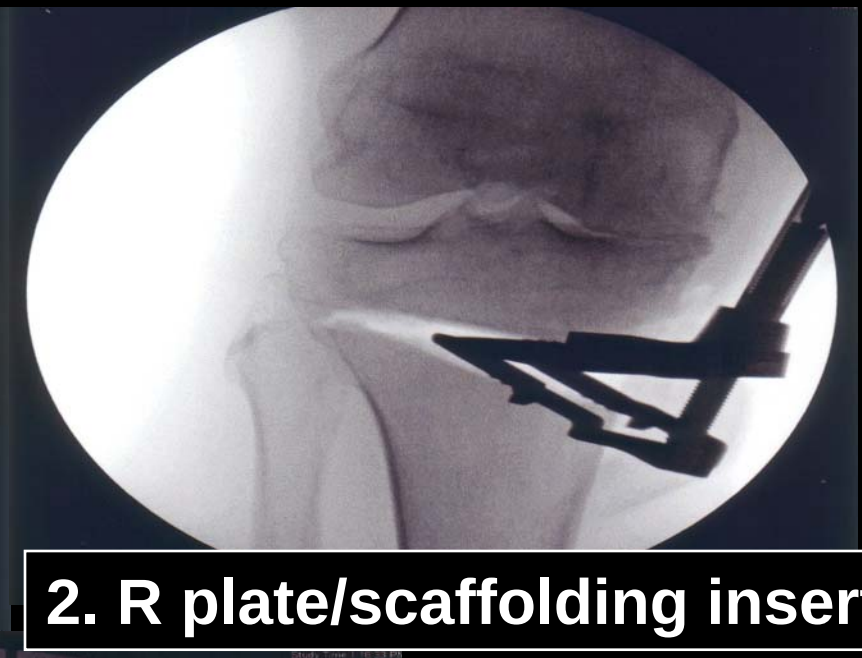

R knee lateral compartment in good shape!


1. Arthroscopy clean-up
2. Debridement complete
3. Microfracture with awl
4. Punctuate bleeding


Further bleeding to create superclot!

High-Tibial Osteotomy (HTO) to Realign the Joint

1. Oscillating saw cut



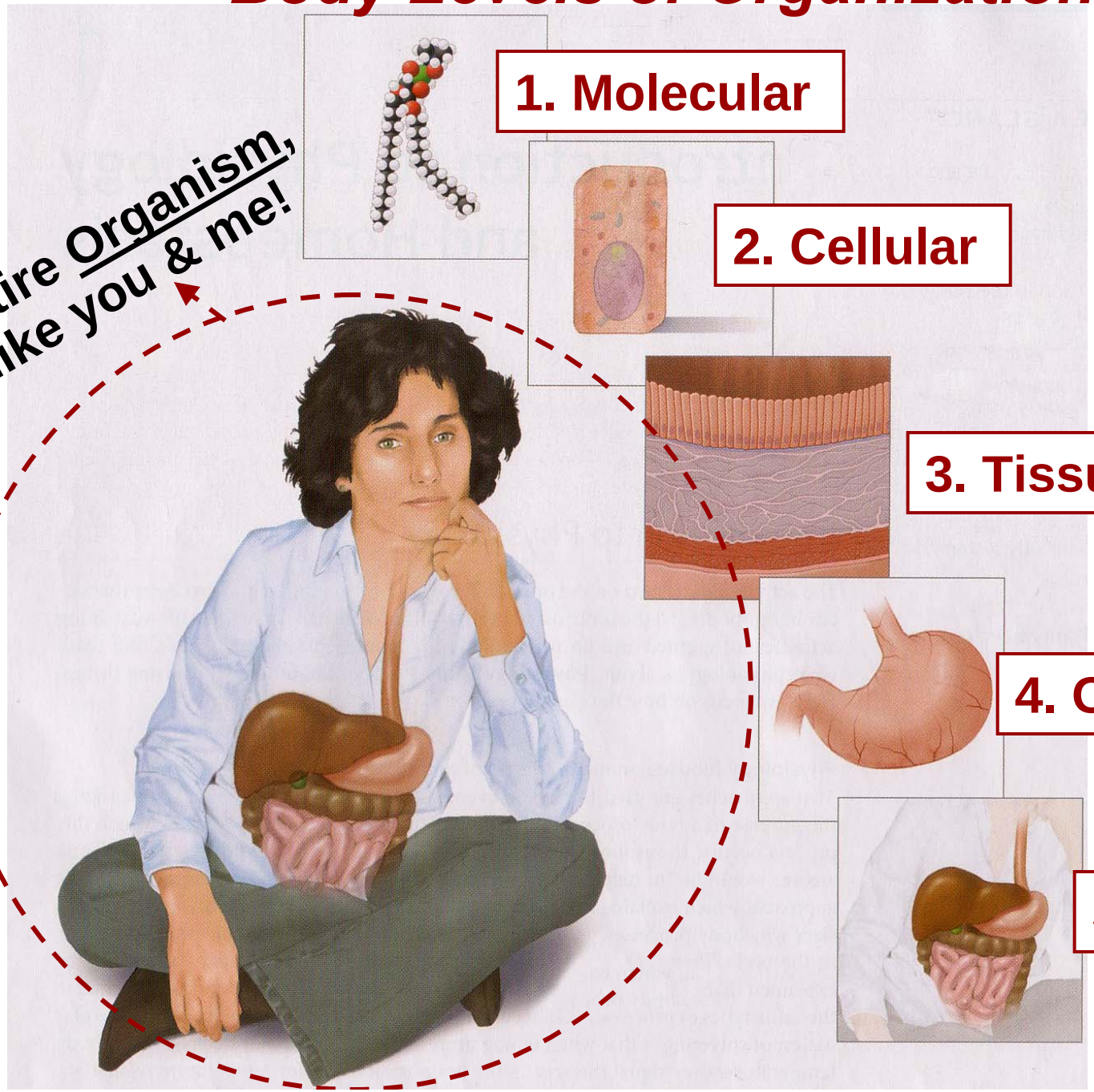
2. R plate/scaffolding insert

3. Align, stabilize w/screws & pack defect

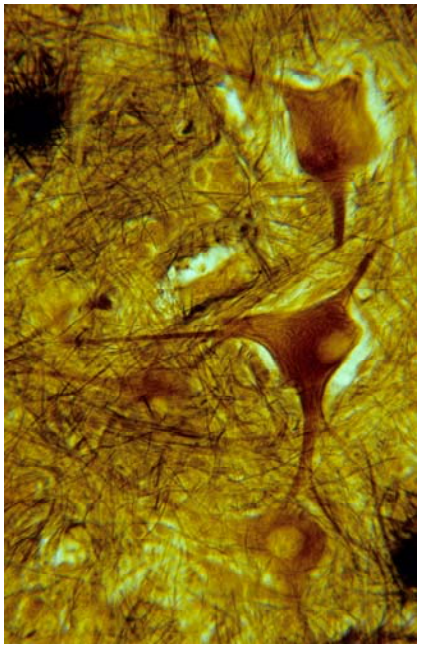

Post-Operative Reality: 10 d injectable anti-coagulant, 3 wk oral anti-coagulant, 4 wk CPM machine, non-wt bearing 8 wk,12 wk PT, 3-5 d/wk,...
480
CPM ≡ Torture Device

Break for discussion/questions!

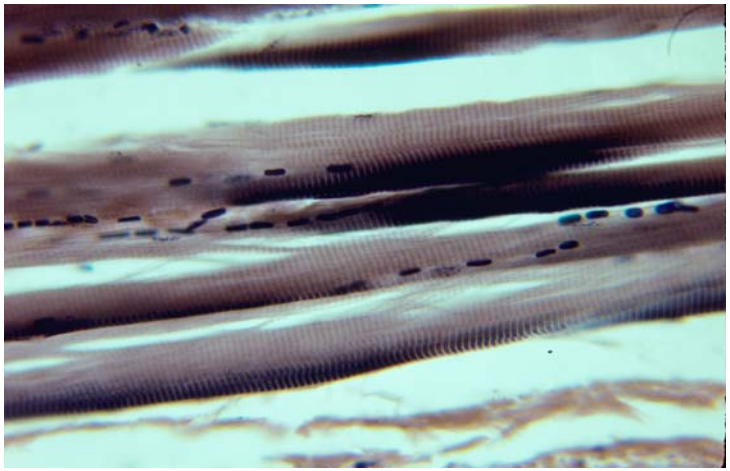
Body Levels of Organization



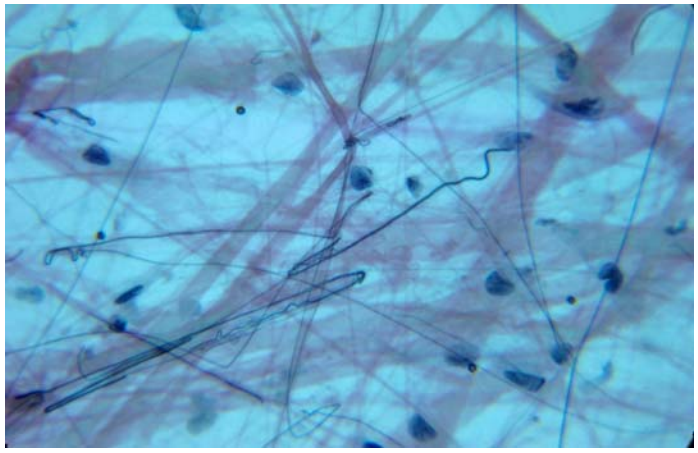
LS fig 1-1 p 2



Nerve conducts



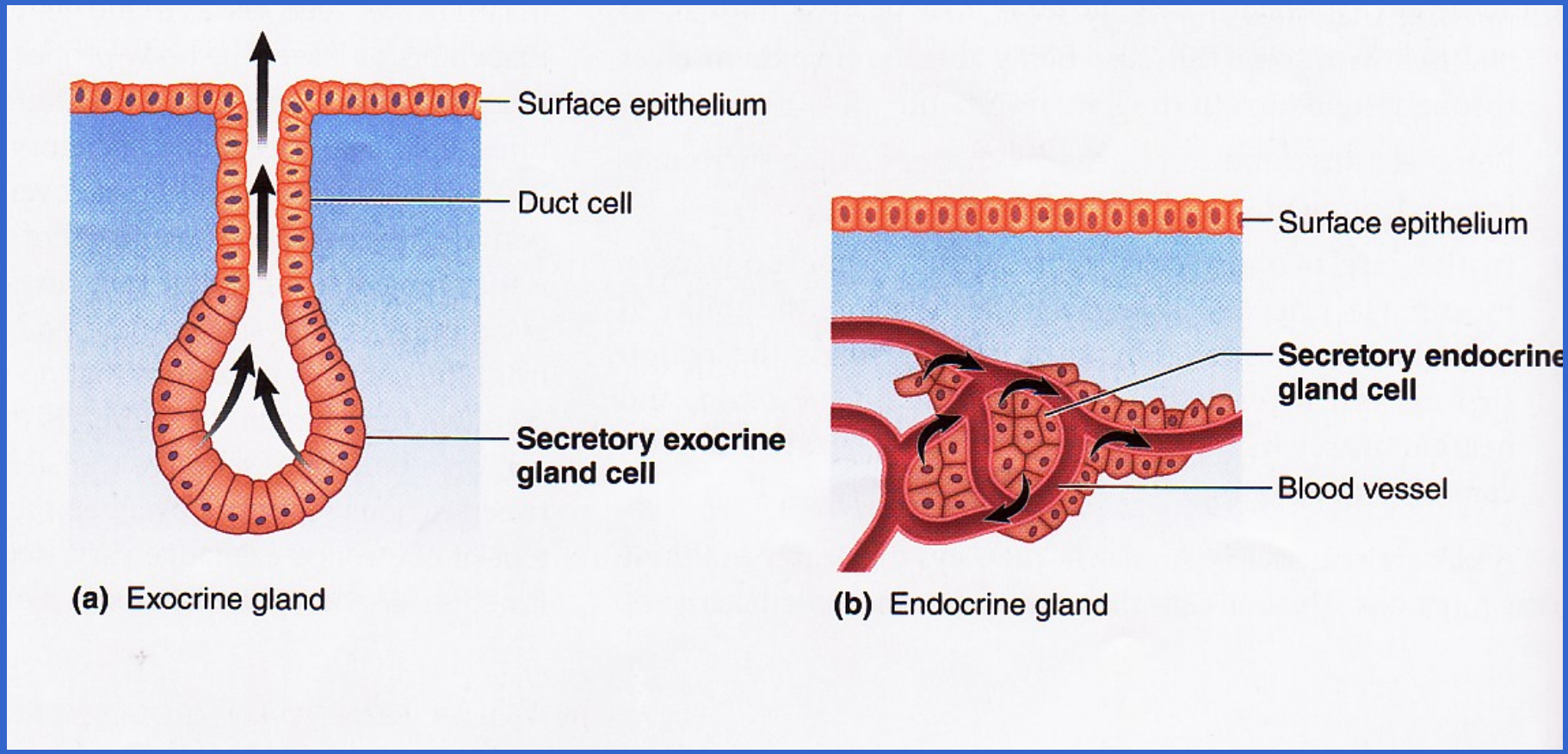
Muscle contracts



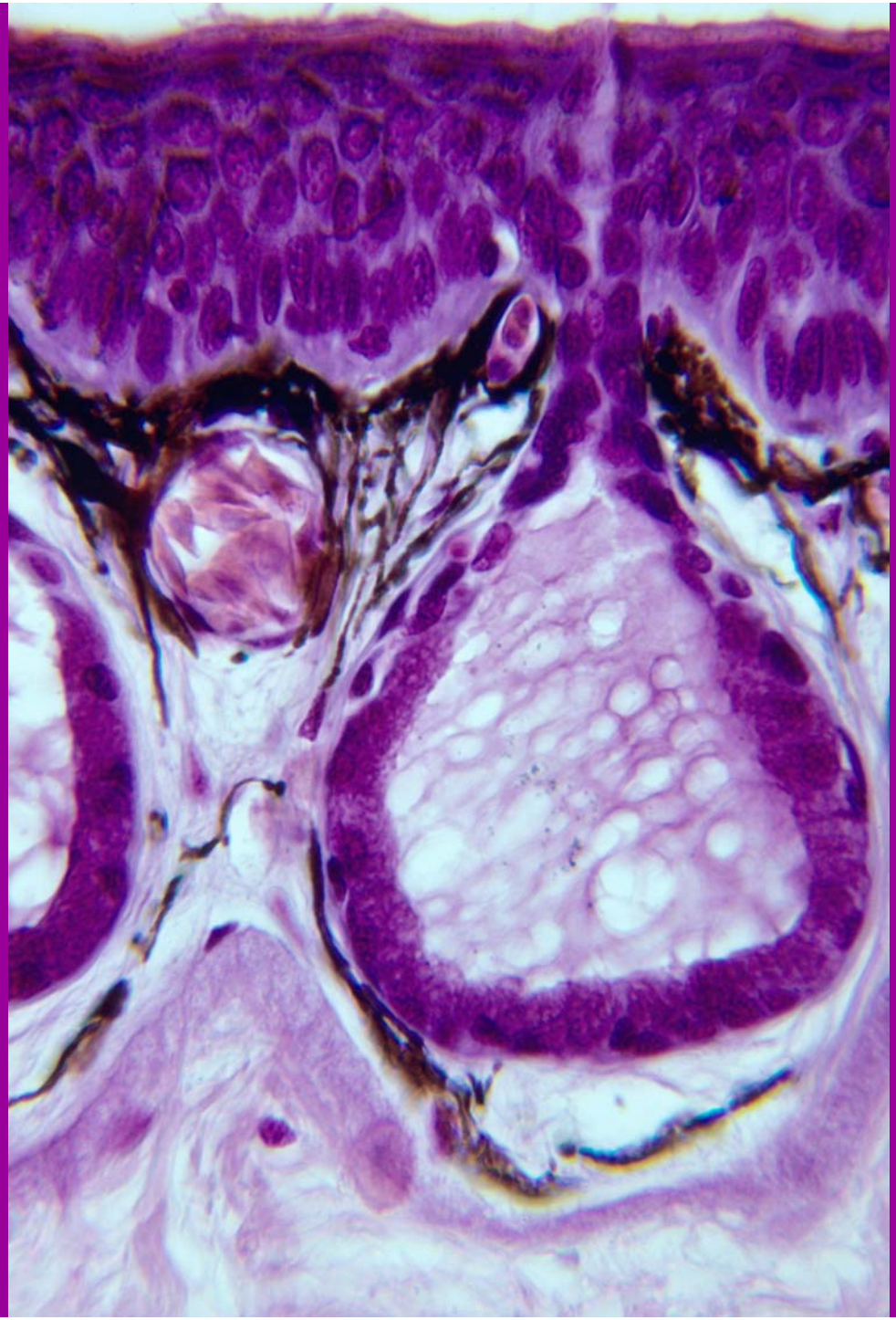
Connective connects!!

Epithelial covers

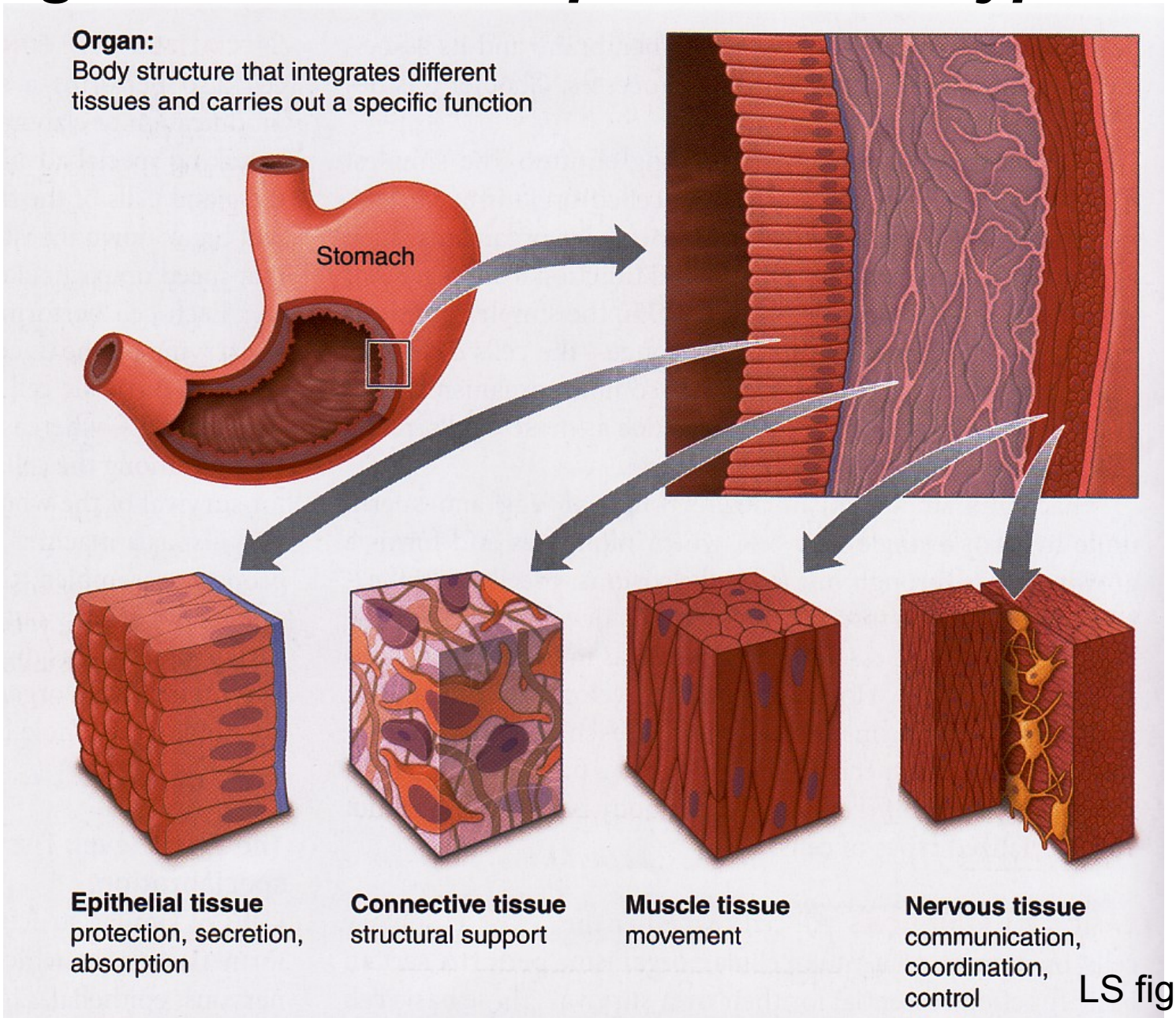
Epithelial tissue gives rise to glands: (a) exocrine & (b) endocrine



LS fig 1-3 p 4

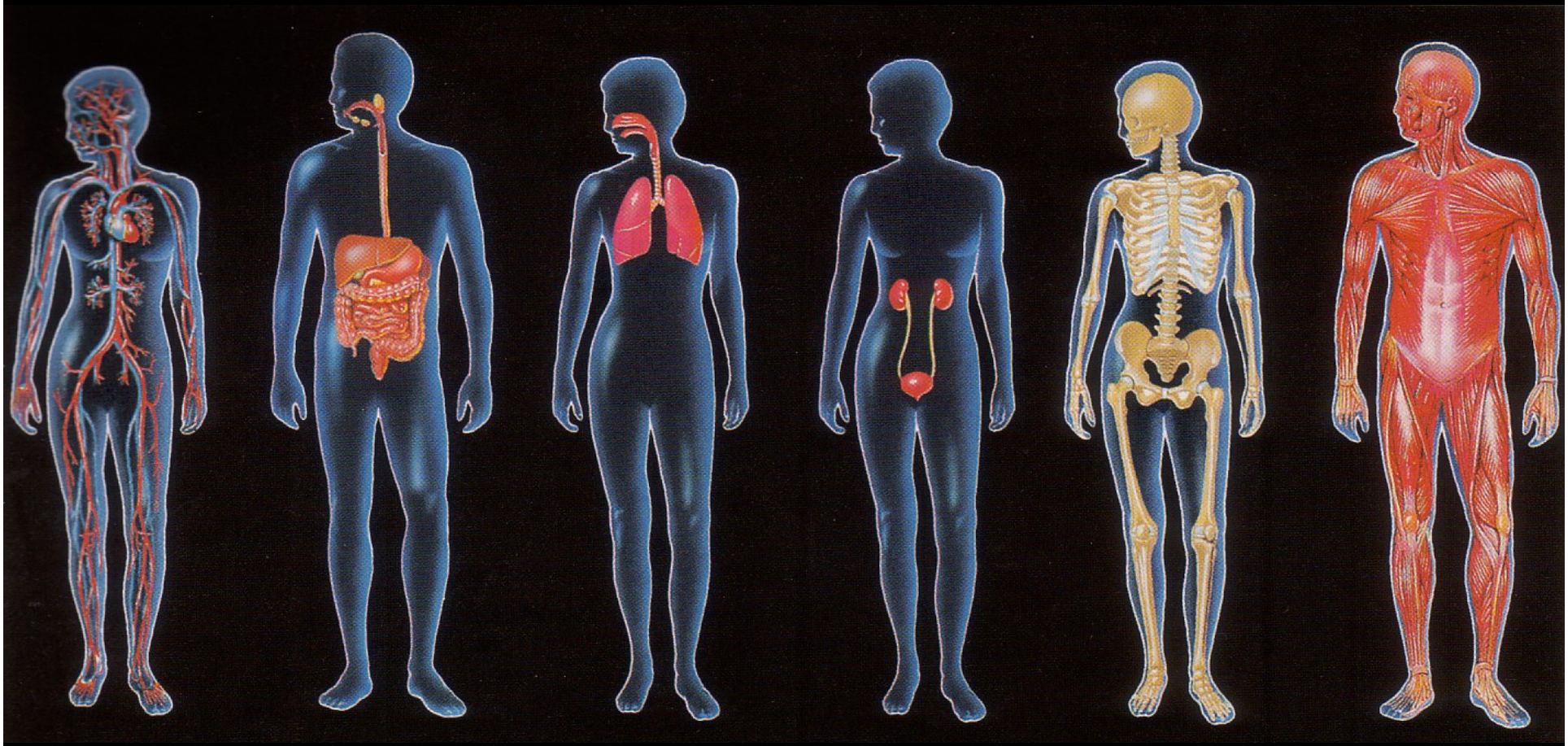


Organs are made up ≥ 2 tissue types



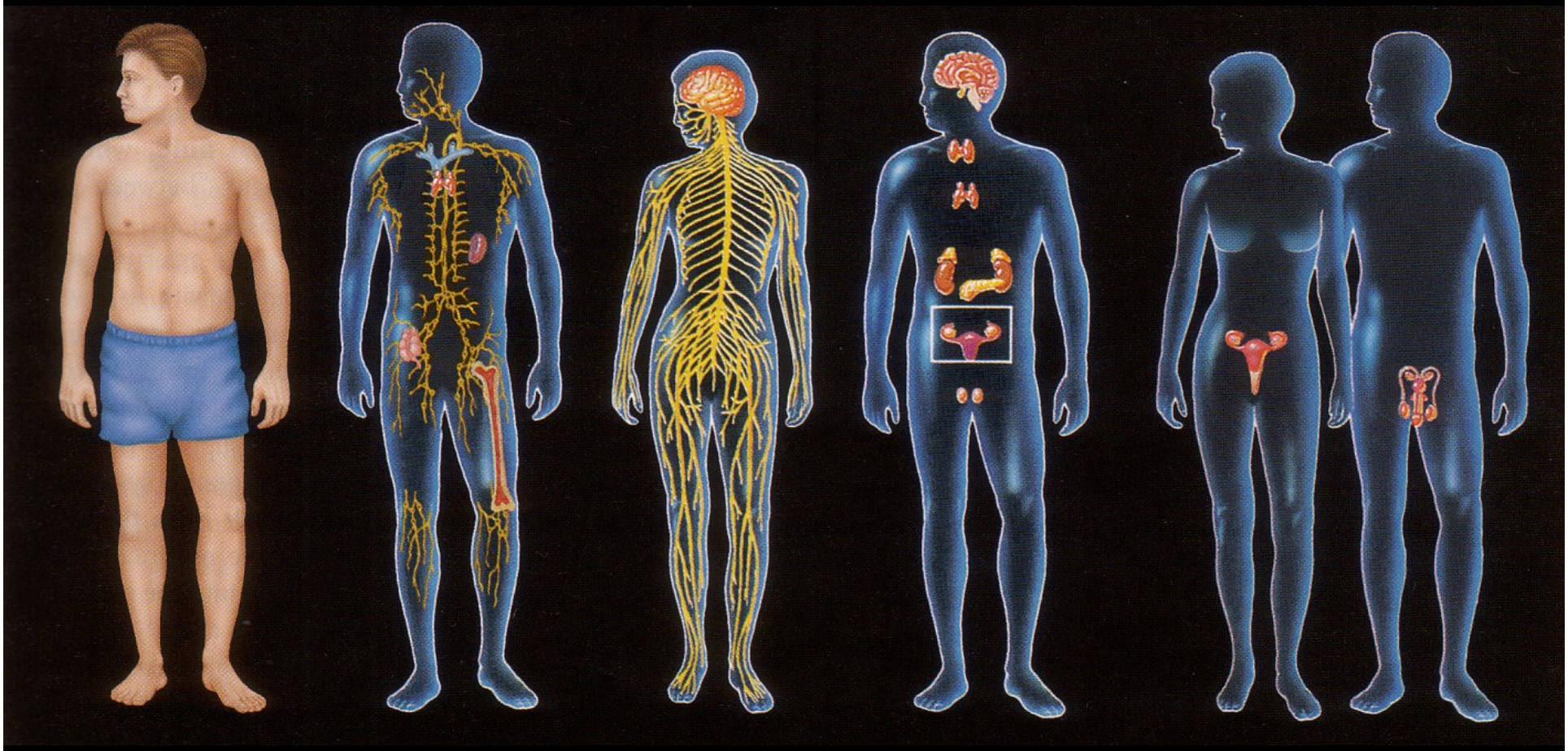
LS fig 1-2 p 4

Which body systems?



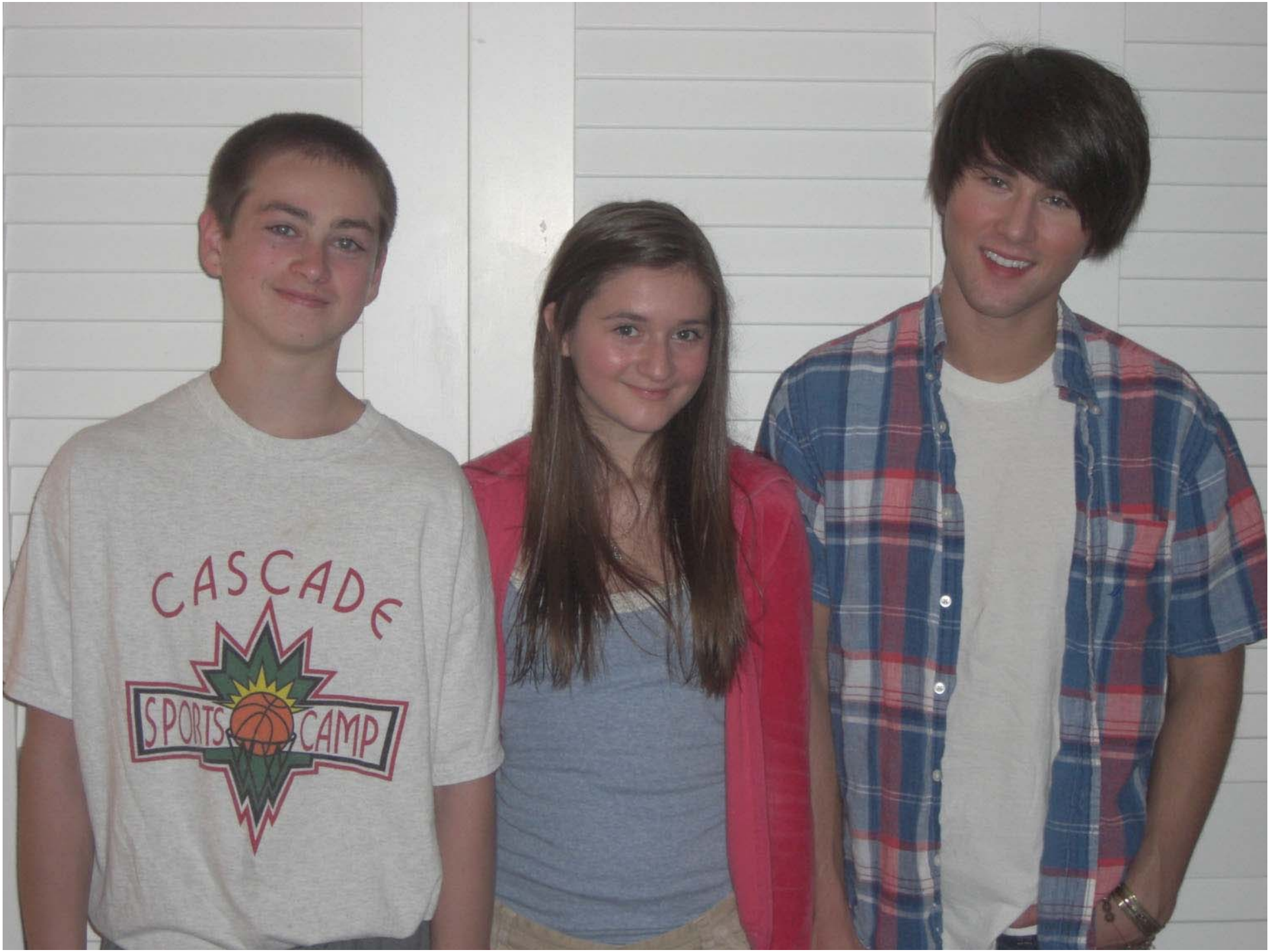
LS fig 1-4 p 6

Which body systems?



LS fig 1-4 p 6

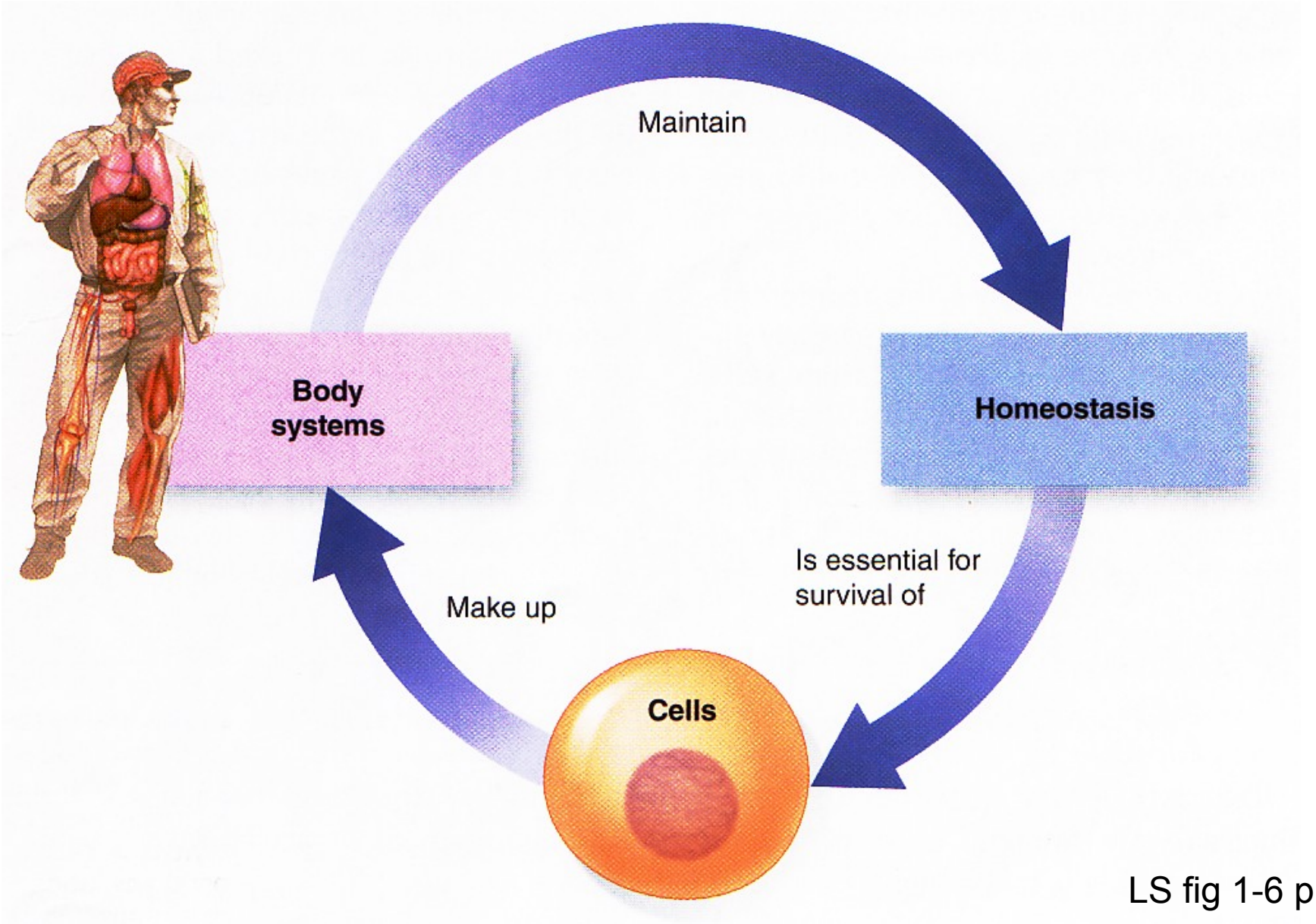
Why study human physiology?


CASCADE
SPORTS CAMP

KNOWLEDGE IS POWER!!!

Thomas Hobbes of Malmesbury
English Philosopher, 1658

Homeostasis is essential for cell survival!

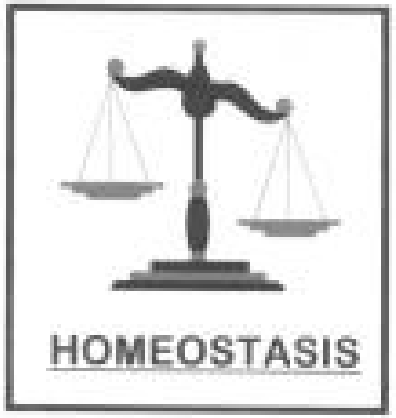


LS fig 1-6 p 7

Maintenance of a relative constancy in the Internal environment = ECF = fluid outside of cells

milieu interieur?

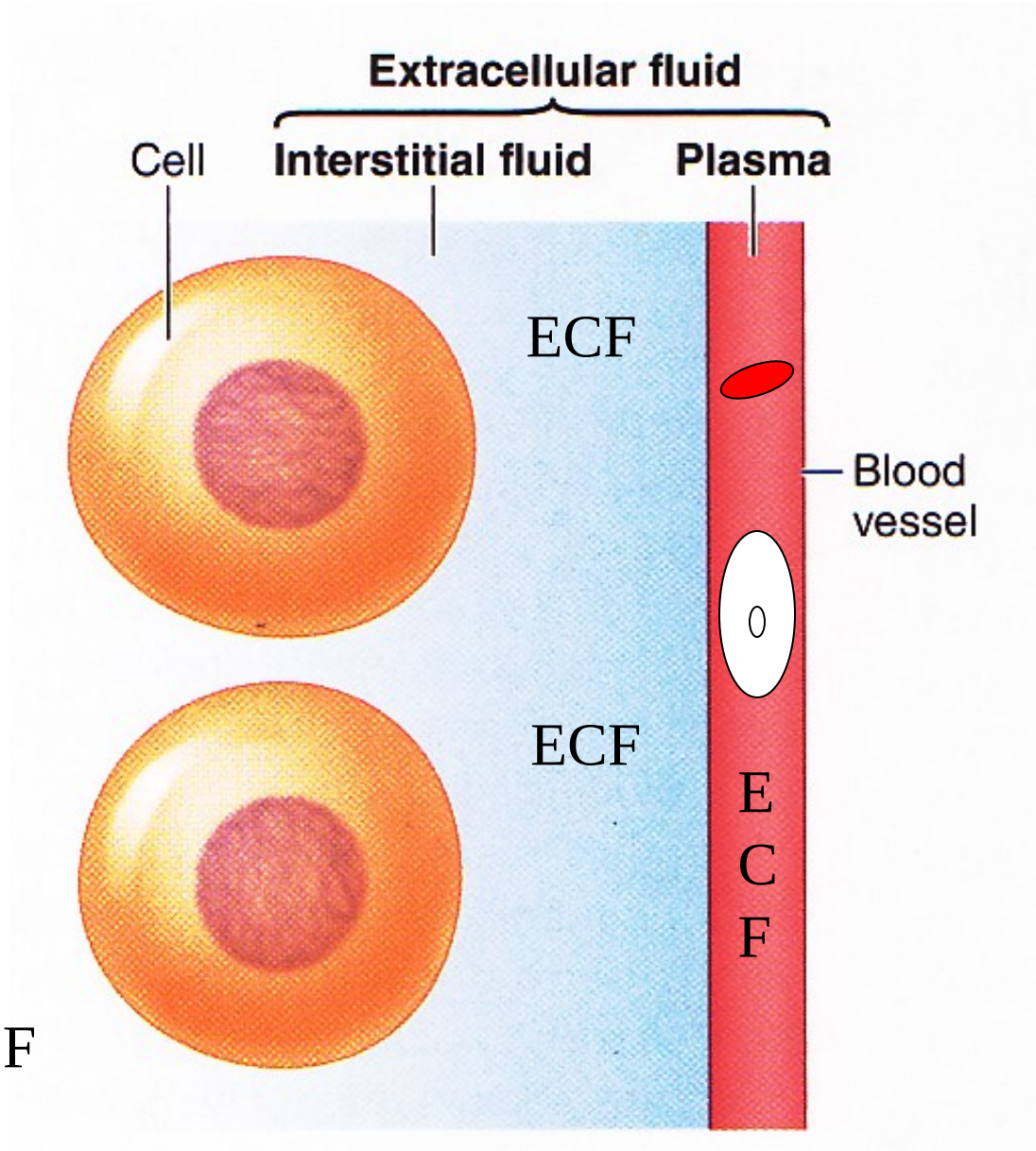
Claude Bernard



100 trillion cells working intimately

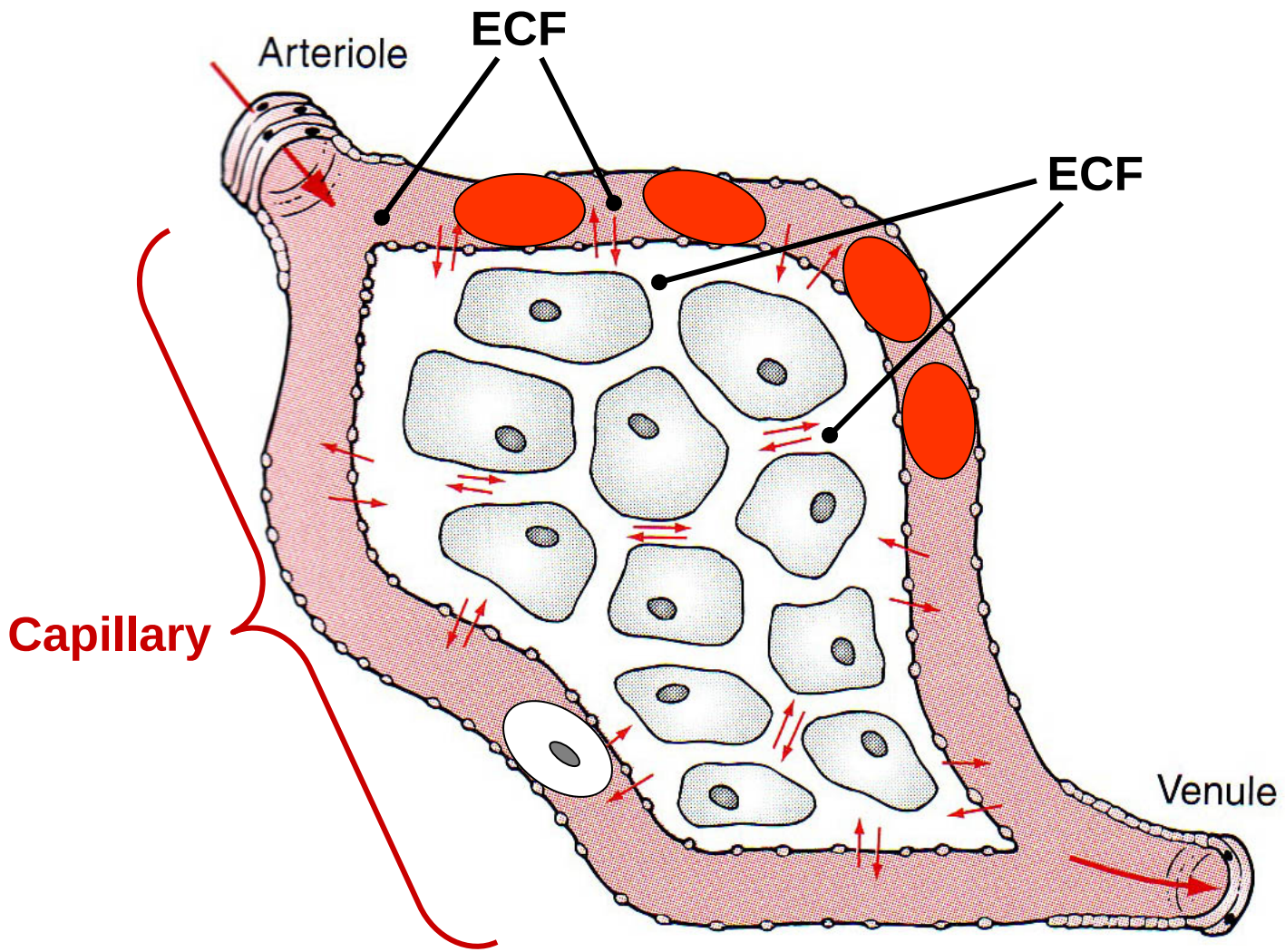
Walter B. Cannon

Where is extracellular fluid?



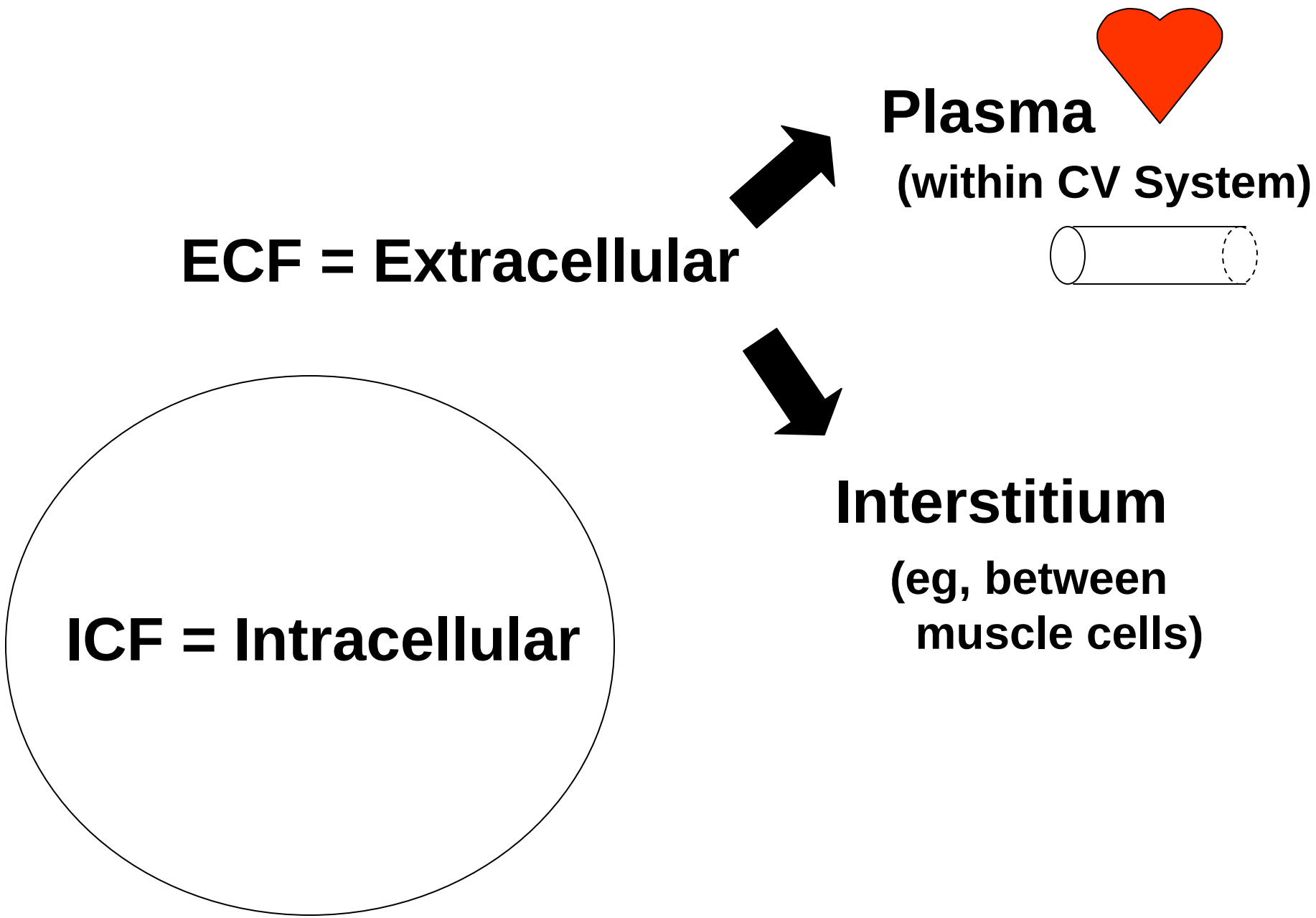
LS fig 1-5 p 7

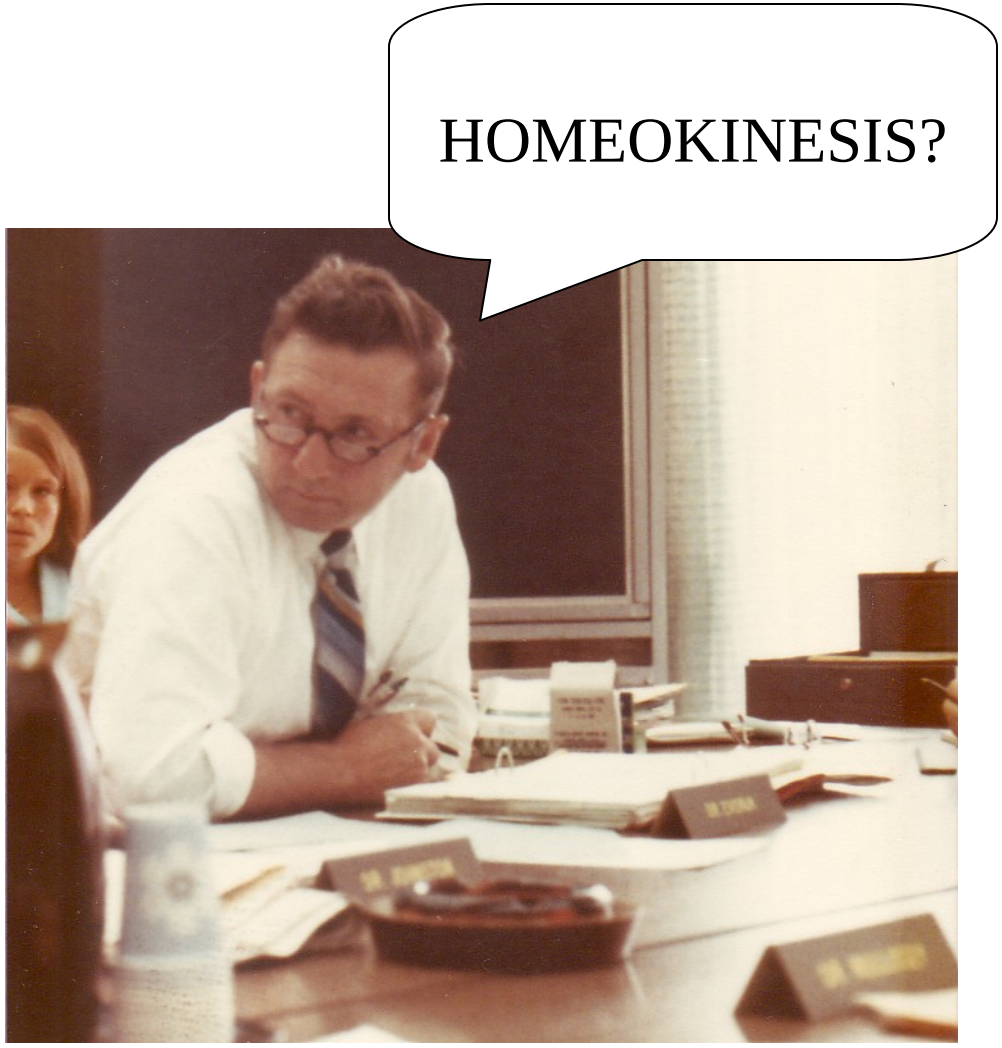
Where is extracellular fluid?



As long as <u>between/outside</u> cells, ECF everywhere?

G&H 2011

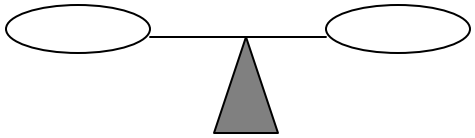

Plasma
(within CV System)
ECF = Extracellular
Interstitium
(eg, between
muscle cells)
ICF = Intracellular


HOMEOKINESIS?

Dr. Evonuk's 6 Balances

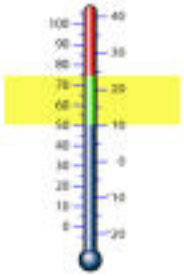
Metabolic

ANA- CATA-

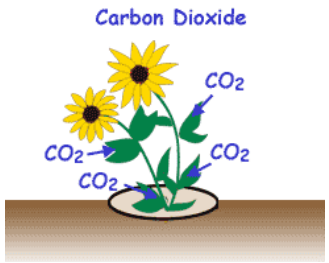


H_2O

T°C

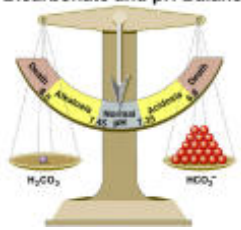


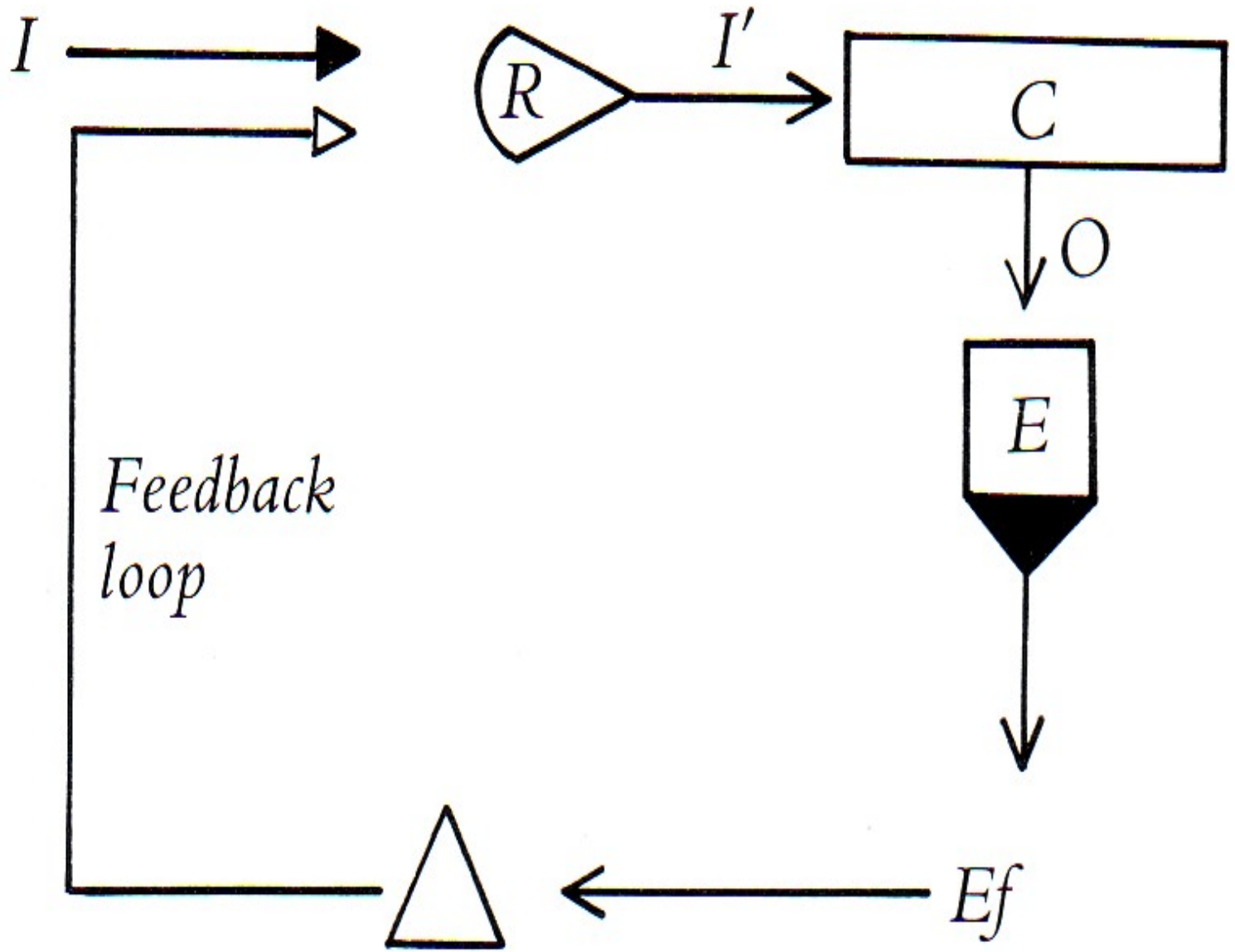
O_2/CO_2



$Ion^{+/-}$

pH




I
R
I′
C
O
E
Feedback
loop
Ef