Teaching in Virtual Environments

APRU Global Health Program at the University of Southern California

in collaboration with

Global STEM Education Program at the University of Oregon

March 3, 6-7:30pm US Pacific
March 4, 10-11:30am Hong Kong
Supporting Students Beyond the Classroom
Eleanor Vandegrift, University of Oregon &
Catherine Zhou, Hong Kong University of Science and Technology

March 29, 6-7:30pm US Pacific
March 30, 9-10:30am Hong Kong
Creating an Active Learning Environment
Eleanor Vandegrift, University of Oregon
Maria Vassileva, Nagoya University

April 26, 6-7:30pm US Pacific
April 27, 9-10:30am Hong Kong
The imperative need for collaboration during COVID for Higher Education
Eleanor Vandegrift, University of Oregon
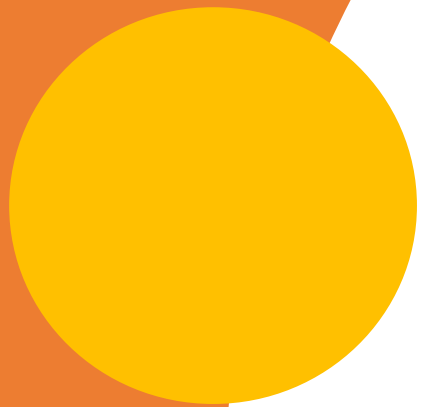*Claudia Tobar, Universidad San Francisco de Quito*

USC • APRU Global Health • UNIVERSITY OF OREGON

More info or to register: apru.org/our-work/pacific-rim-challenges/global-health

Welcome and Introduction
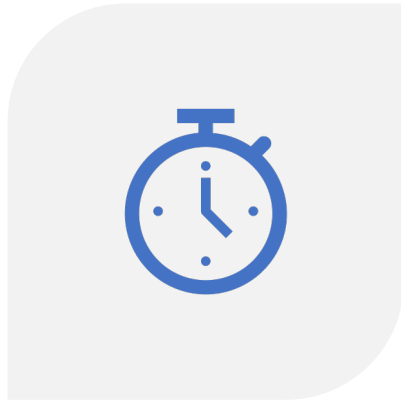
Mellissa Withers, University of Southern California
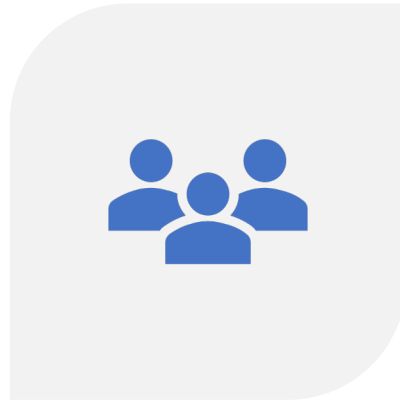
Goals for today:

1. Provide pedagogical, technology, and peer support to faculty across the APRU network teaching remotely.

2. Create opportunities for APRU affiliated faculty to connect and share resources and experiences
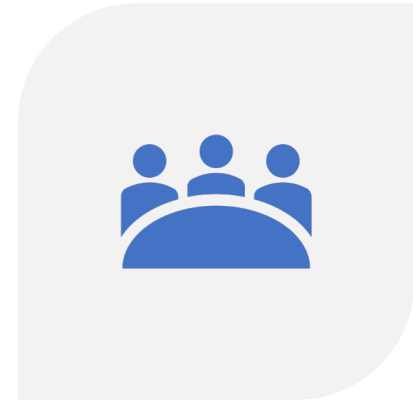
Format

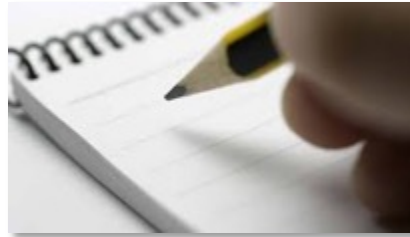**30 MINUTES EXPERT PANEL**

30 MINUTES SMALL GROUP DISCUSSION

30 LARGE GROUP DISCUSSION

Zoom Interactions Today

Feedback and Polls

Writing

Video and Audio
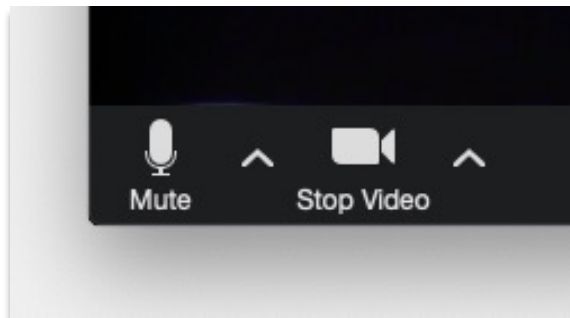
Breakout Rooms
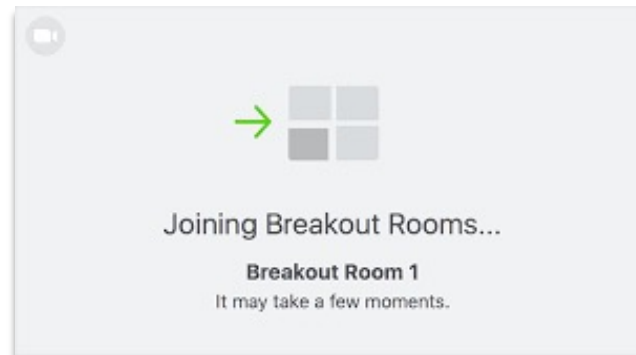
Chat #Aha
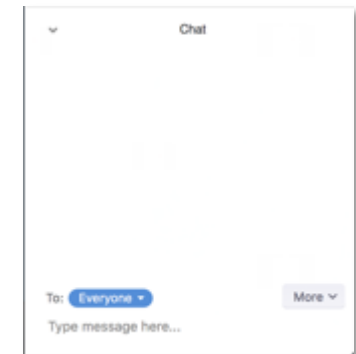
Elly Vandegrift,
University of Oregon

Chat: How do you know when you've learned something?

Chat: How do you know when your students have learned something?

Active Learning Meta-analysis 225 papers

(1942-2009)

Chat: What do you see in the data?
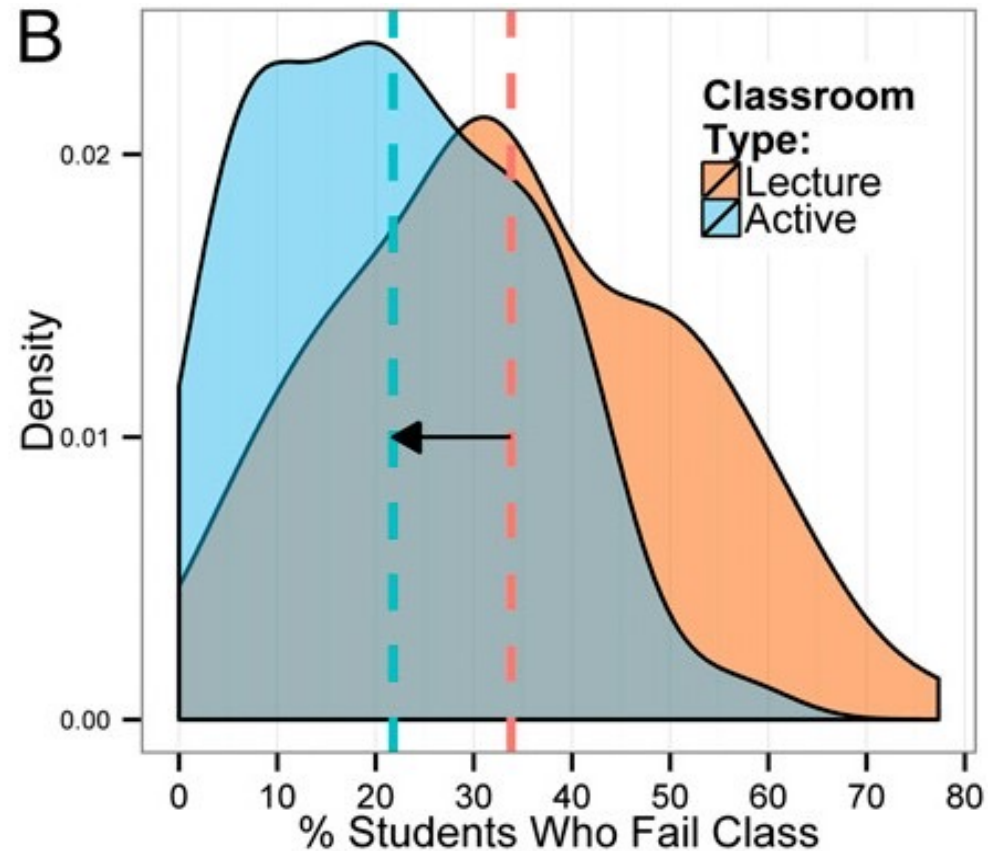
Figure 1B

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. PNAS, 201319030.

Active Leraning Meta-analysis 225 papers

(1942-2009)

Fail rate

Active learning   21.8%

Lecture   33.8%

55% increase with lecturing!

Grades

Half of letter grade increase
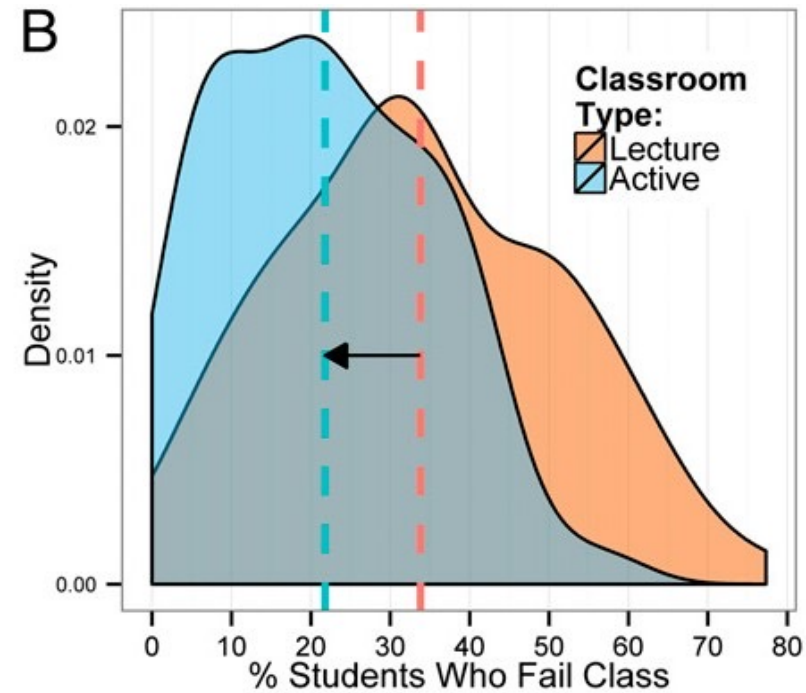
Figure 1B

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. PNAS, 201319030.

Average achievement gaps are smaller in **active-learning** classes than traditional-lecturing classes.

Theobald, E. J., Hill, M. J., Tran, E., Agrawal, S., Arroyo, E. N., Behling, S., ... & Freeman, S. (2020). Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math. *Proceedings of the National Academy of Sciences*, 117(12), 6476-6483.
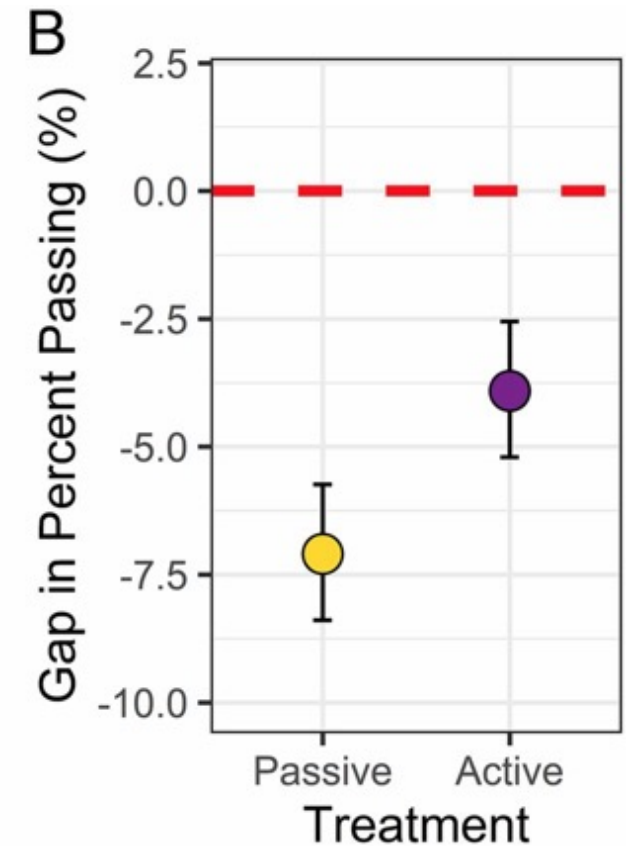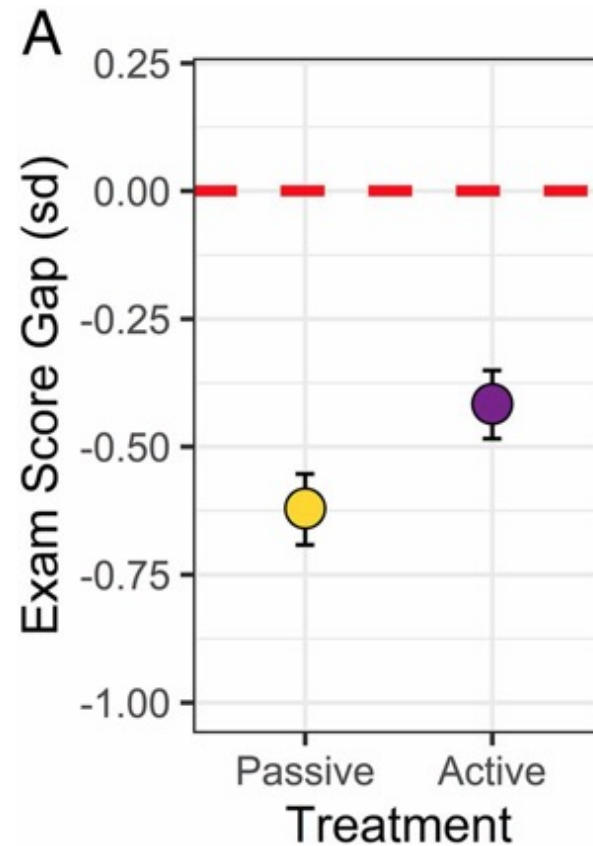
Active Learning supports….

1. Confronting alternate conceptions or misconceptions
2. Constructing new knowledge
3. Monitoring progress during learning
4. Learning for all students

Q1 Poll

Consider a tiny acorn, and a giant oak tree.

A log from that tree weighs 10,000x as much as the acorn.

Where does *MOST* of the mass come from?

1. Sunlight

2. Water

3. Dirt

4. Minerals in the soil

5. The air
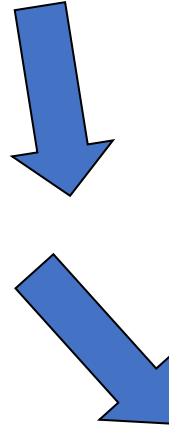
Making Thinking Visible

- How do you know what you know?

- What evidence from your experience supports your choice?
    - Ashes in campfire
    - Increasing atmospheric CO_2 with decreasing forests
    - No hole in the ground as tree grows

- *If you don't think about your process very often then it is hard to make your thinking visible to students.*

Photosynthesis

6 CO$_2$ + 12 H$_2$O $\longrightarrow$ C$_6$H$_{12}$O$_6$ + 6 O$_2$ + 6 H$_2$O
carbon water sugar oxygen water
dioxide
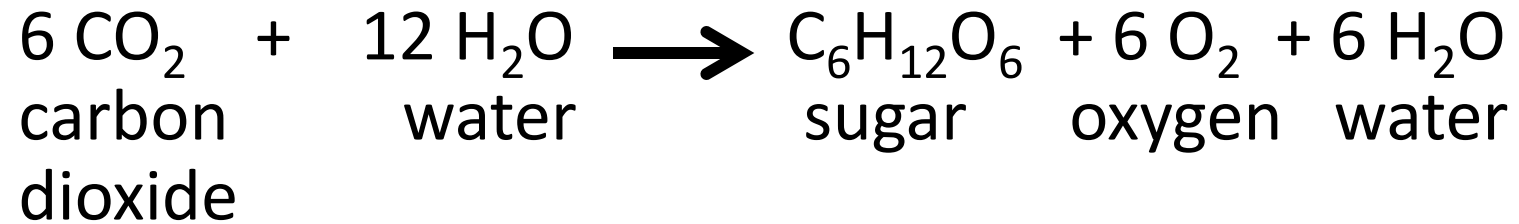
The correct answer is 5. "The air."

Carbon dioxide from the air!

Polling Method
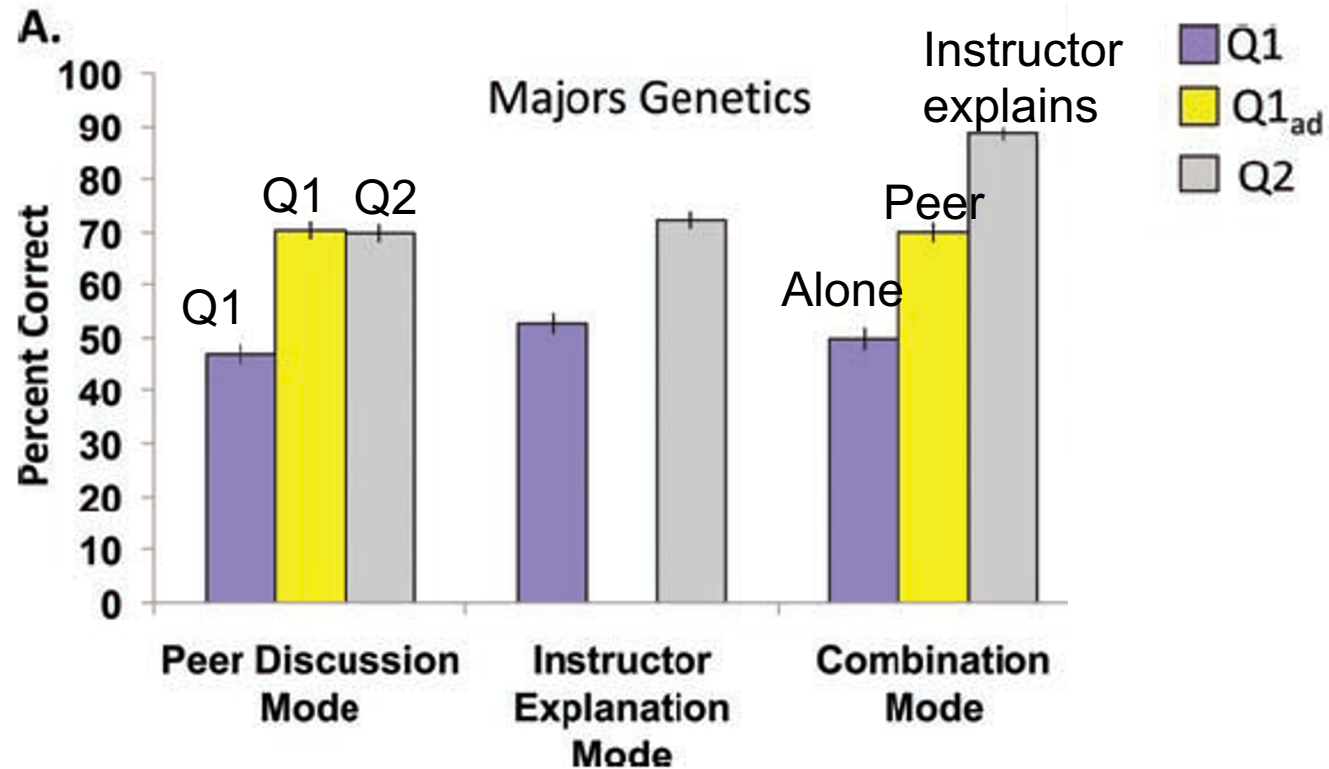
Smith, M. K., Wood, W. B., Adams, W. K., Wieman, C., Knight, J. K., Guild, N., & Su, T. T. (2009). Why peer discussion improves student performance on in-class concept questions. *Science, 323*(5910), 122-124.

Smith, M. K., Wood, W. B., Krauter, K., & Knight, J. K. (2011). Combining peer discussion with instructor explanation increases student learning from in-class concept questions. *CBE-Life Sciences Education, 10*(1), 55-63.

Q2 Poll

During weight loss, where does the mass of body fat go?

A) It's mostly breathed out.
B) It's mostly excreted as solid waste.
C) It's mostly excreted as liquid waste.
D) It's mostly converted to heat energy.

Maria Vassileva,
Nagoya University

Breakout Room Questions (30 minutes)

Introduce yourselves (Name + Institution)

Select a Discussion Leader, Time Keeper

Questions.

1. How do you already use active learning?
2. What is one topic that you lecture about that students struggle with that could be designed into active learning?
3. What are the benefits and challenges with online active learning?

Joining Breakout Rooms...

Breakout Room 1

It may take a few moments.

Chat: What one idea from today would you like to try out in your courses?

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TBD
Eleanor Vandegrift, University of Oregon
TBD

More info or to register: apru.org/our-work/pacific-rim-challenges/global-health

How do you know when you've learned something of value?

How do you know what you need to learn?

Course's learning objective

We often define learning objectives around mastery of FACTUAL information.

What is our LONG TERM GOAL for our students?

How do we teach it?

How do we test it?

To students new academic material often looks like a thick forest of facts

Lecturers task is often seen as creating a path in the woods

and walking students through it

However our real goal for our students is for them to grasp the bigger picture, and see the facts in their interconnection and hierarchy
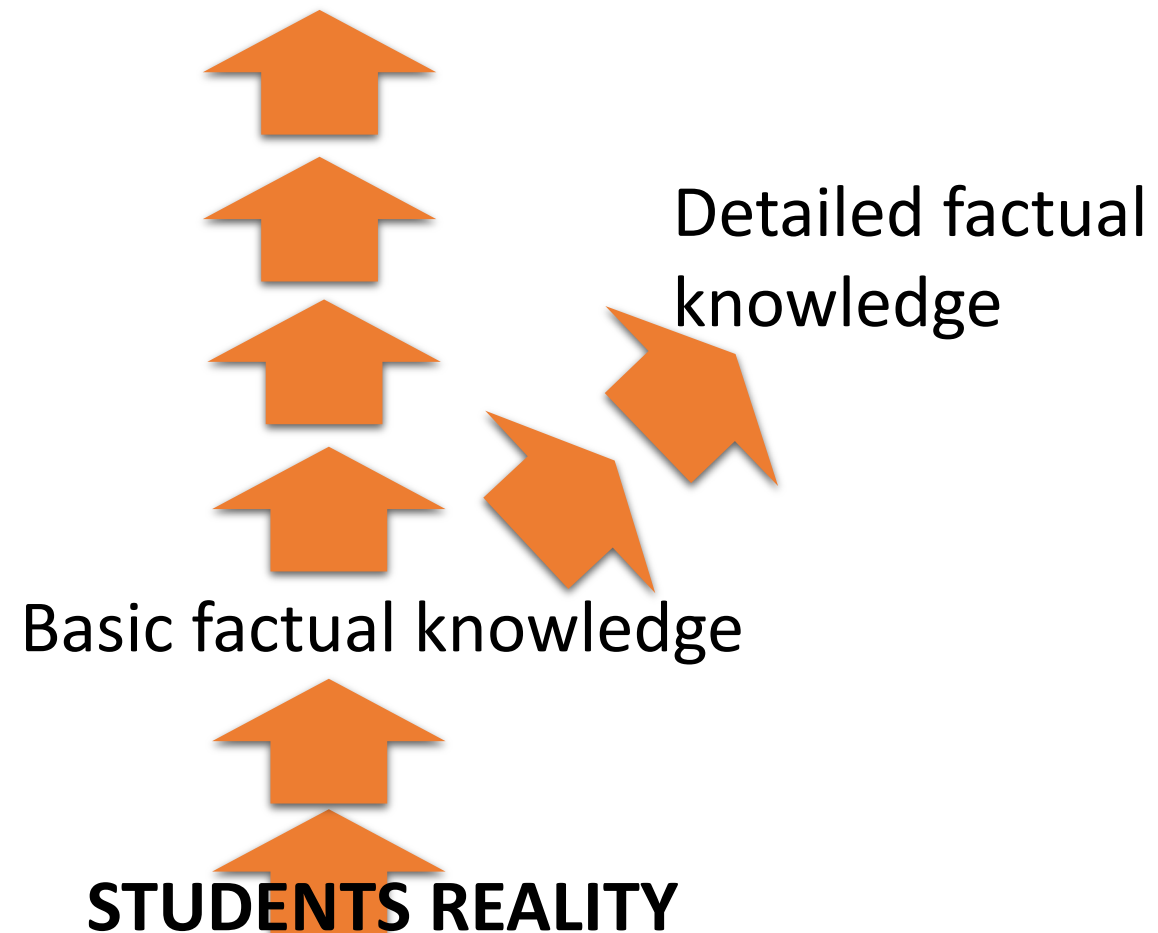
Horisontal VS Vertical learning

One can learn new facts by spreading them horizontally as independent entities,

or by creating vertical hierarchy connections

Horisontal VS Vertical learning

How do we take students from "pile" to "stacks"?

We can build stacks for them,
or we can show them how to build themselves.
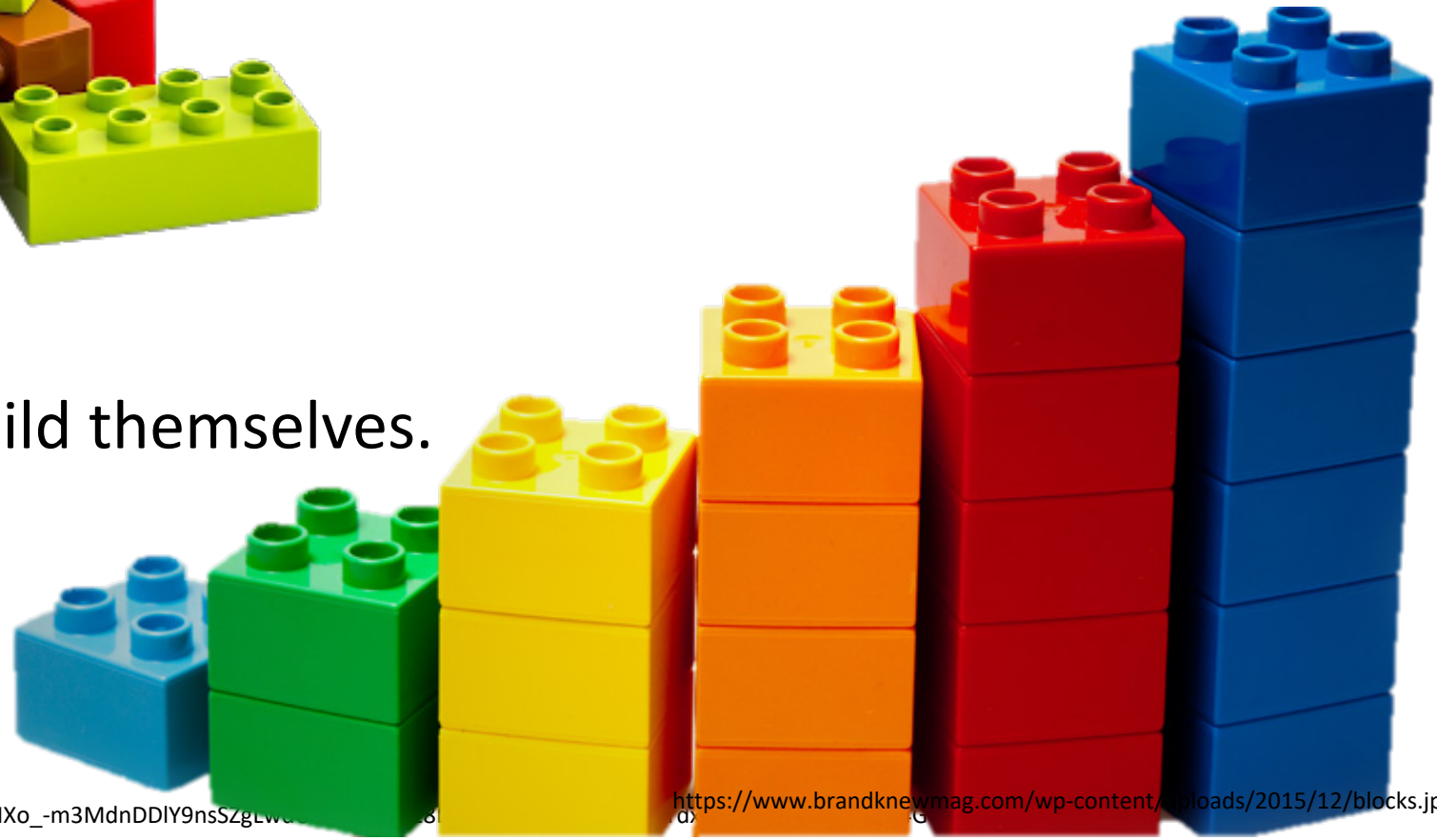
How to TEACH conceptual learning?

- Focus on concepts in lectures

- Separate facts on "important" and "details"

- Center in-class discussions around "how" and "why" questions

- Provide tasks on summary or application of concepts
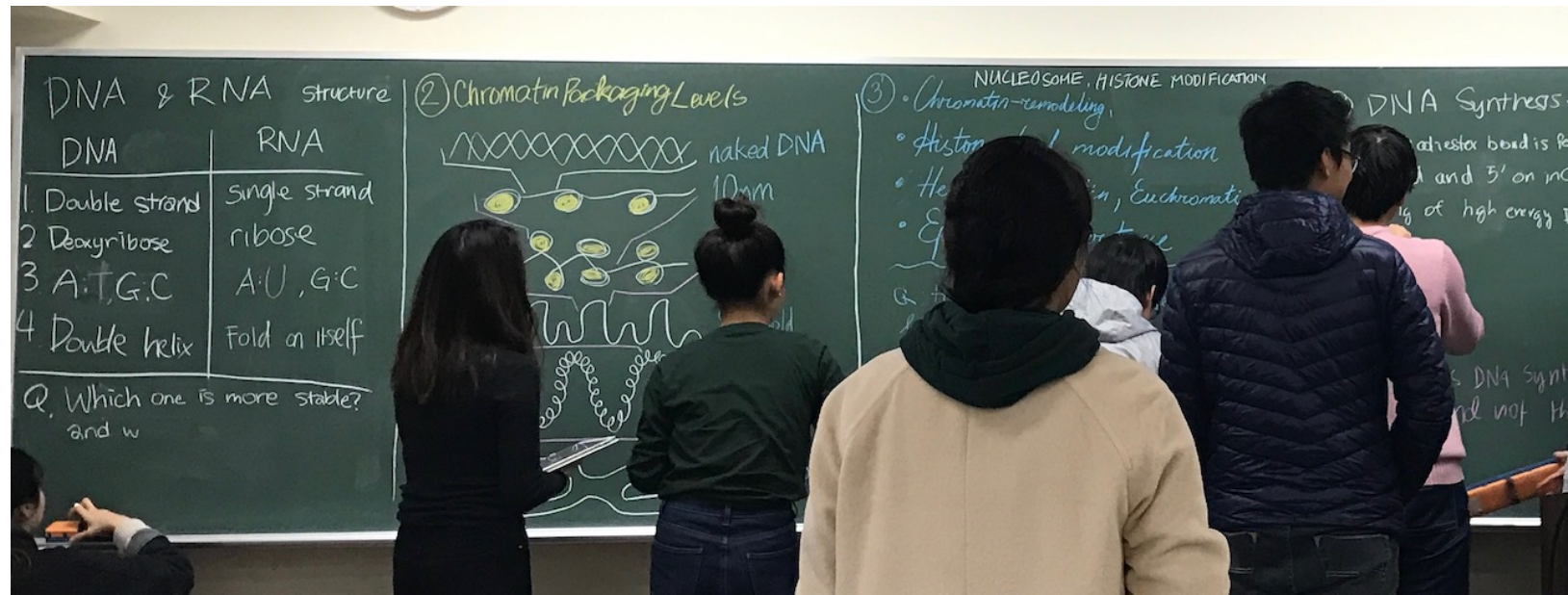
How to TEACH independent analysis?

- Give (low-stake) chances to summarize content BEFORE class:

- Scaffolded summaries

- Free summaries
  - Mindmaps
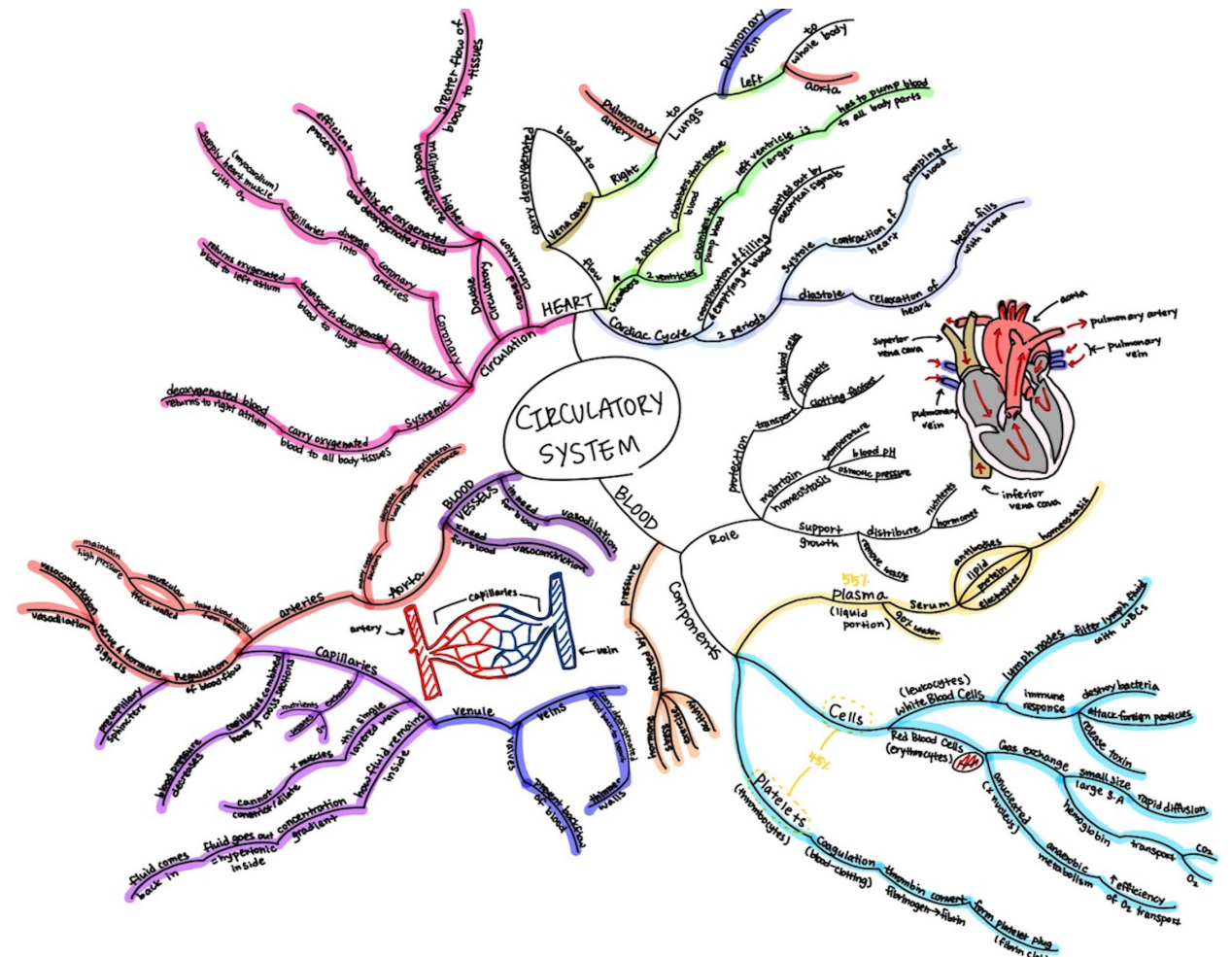
Assignments description:

<u>Mindmap</u>

Create a <u>summary of the chapter content in the form of a visual hierarchical map.</u>
The mind map should be made in a way to be enough for you to revise the course material before exam.

Rules:
1. <u>Format: 1 page per chapter (A4), hand-drawn/written;</u>
2. <u>Think about hierarchy - how concepts connect with each other?</u> Which is the big theme, the sub-themes and which are details under it?
3. Think about color - use color codes to identify groups of concepts; draw diagrams and images to enforce the visual power of your mind map

Mindmap summaries for an introductory human physiology course

Too many details!

(Handwritten mindmap — The Musculoskeletal System)

Bone tissue — cell type, bone types

osteoblasts – bone formation
osteoclasts – contain lysosomal enzymes and acids
osteocytes – main cells in bony connective tissue
osteoprogenitor squamous stem cells

Bone types: long, short, flat, irregular, sesamoid, sutural

lamellae, trabeculae, compact → external, osteons
osteon, spongy → internal, trabeculae
Haversian canal

Development of Bones

Intramembranous ossification:
1. Mesenchymal cells form a template
2. Differentiate into osteoblasts that secrete extracellular matrix and deposit calcium
3. Osteoid continues to form around blood vessels, forming spongy bone
4. Connective tissue → red bone marrow (matrix)
5. spongy bone → thin layer of compact bone

Endochondral ossification:
1. Chondrocytes form a template
2. Matrix begins to calcify
3. Blood vessels invade the cavities
4. Osteoblasts & osteoclasts modify the calcified cartilage matrix into spongy bone
5. Osteoblasts break down spongy bone to create a marrow in the center of diaphysis
6. dense connective tissue forms periosteum around the bones
7. Bone continues to grow

Growth of Bone

thickening of long bones (appositional growth):
osteoblasts at the bone surface secrete bone matrix
osteoclasts on the inner surface break down the bone
osteoblasts differentiate into osteocytes

lengthening:
chondrocytes divide
one cell remains

Bone remodelling
Bone deposition by osteoblasts
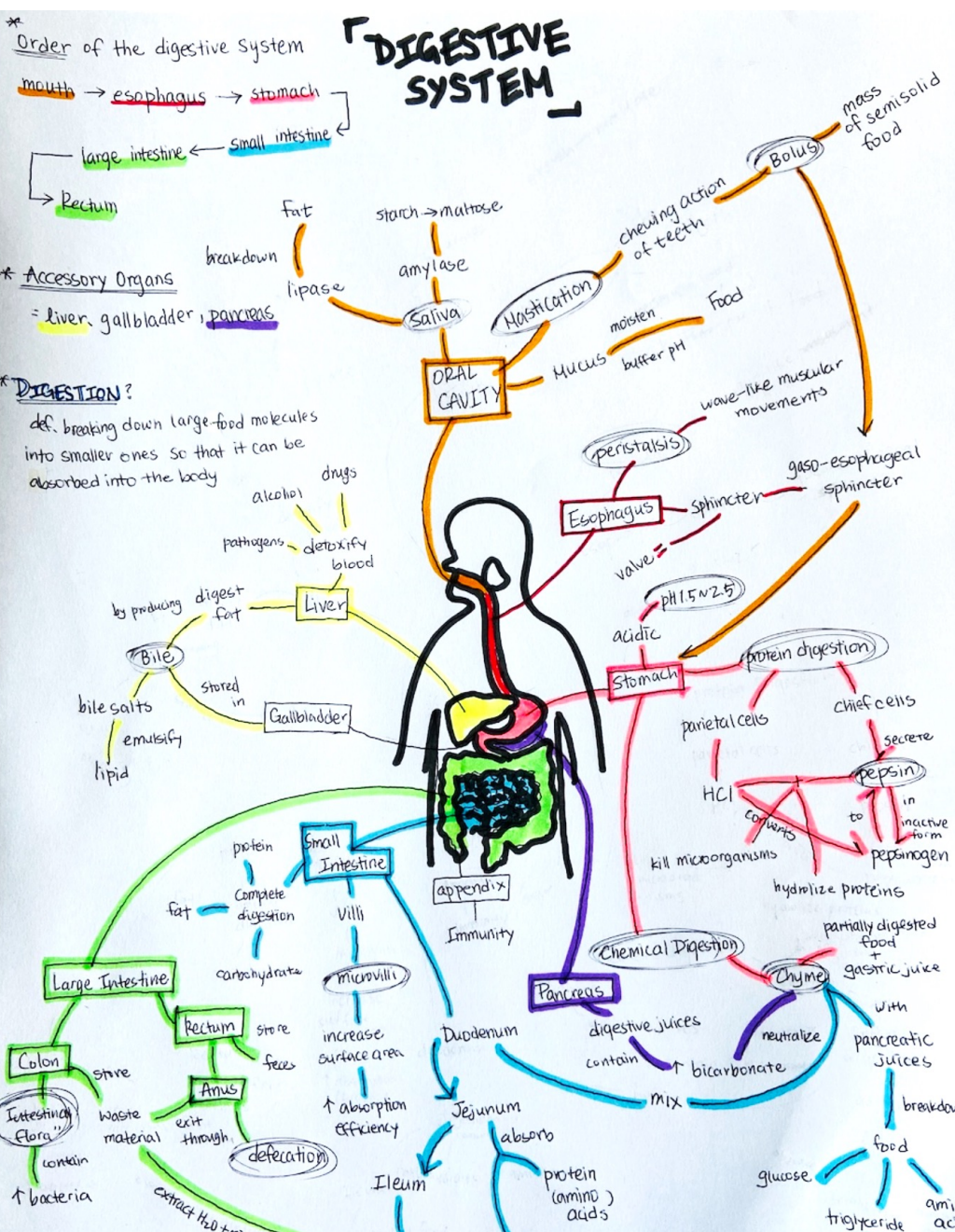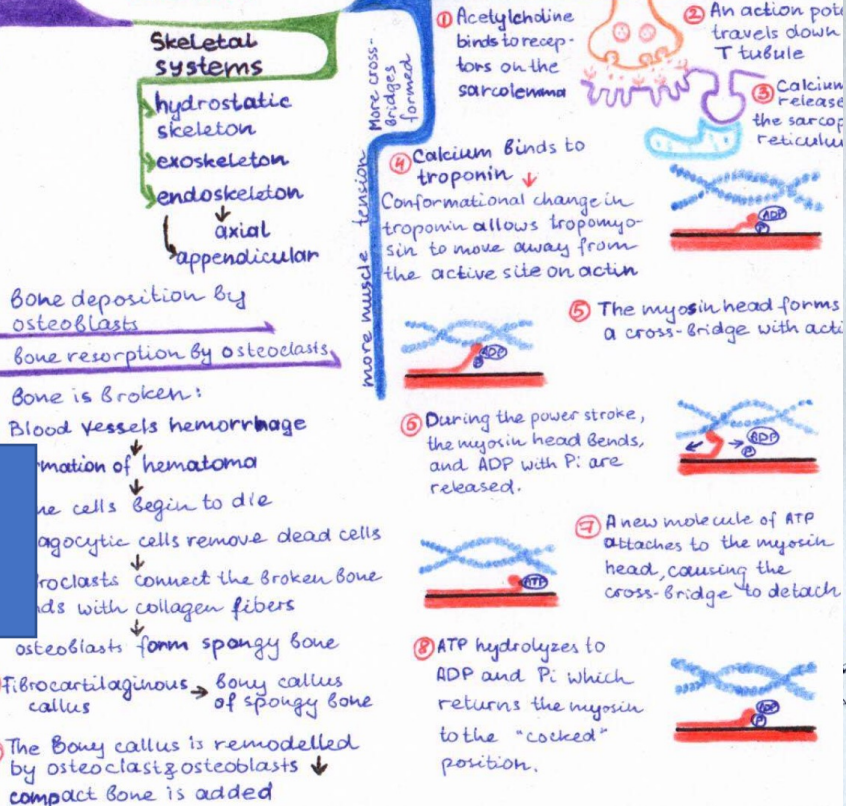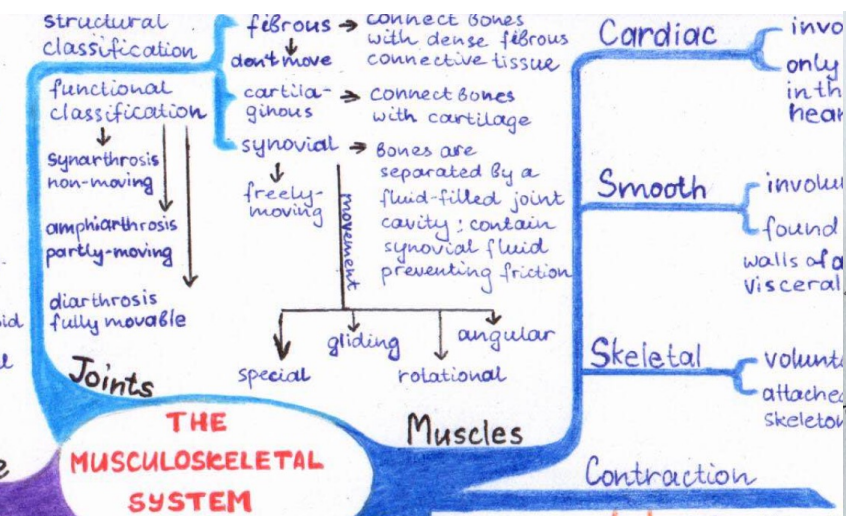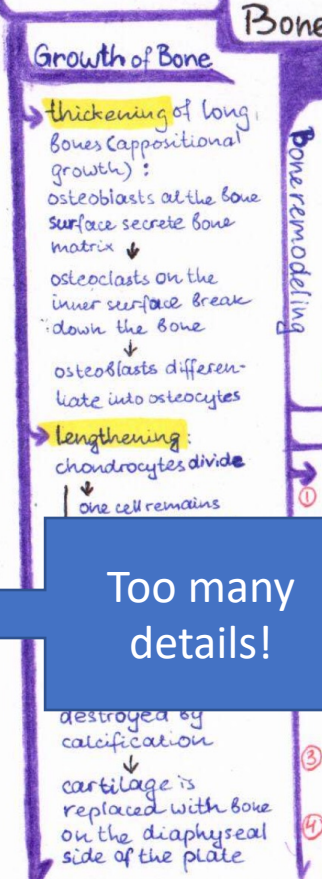Bone resorption by osteoclasts

Bone is broken:
1. Blood vessels hemorrhage, formation of hematoma, cells begin to die, phagocytic cells remove dead cells
2. osteoblasts connect the broken bone ends with collagen fibers ... osteoblasts form spongy bone
3. Fibrocartilaginous → bony callus of spongy bone
4. The bony callus is remodelled by osteoclasts & osteoblasts, compact bone is added

Joints
Structural classification
Functional classification:
Synarthrosis – non-moving
amphiarthrosis – partly-moving
diarthrosis – fully movable

fibrous → connect bones with dense fibrous connective tissue, don't move
cartilaginous → connect bones with cartilage
synovial → Bones are separated by a fluid-filled joint cavity; contain synovial fluid preventing friction

movement: gliding, angular, special, rotational

Muscles
Cardiac – involuntary, only in the heart
Smooth – involuntary, found in walls of visceral
Skeletal – voluntary, attached to skeleton

Skeletal systems
hydrostatic skeleton
exoskeleton
endoskeleton → axial, appendicular

Contraction
1. Acetylcholine binds to receptors on the sarcolemma
2. An action potential travels down T tubule
3. Calcium released from the sarcoplasmic reticulum
4. Calcium binds to troponin. Conformational change in troponin allows tropomyosin to move away from the active site on actin
5. The myosin head forms a cross-bridge with actin
6. During the power stroke, the myosin head bends, and ADP with Pi are released.
7. A new molecule of ATP attaches to the myosin head, causing the cross-bridge to detach.
8. ATP hydrolyzes to ADP and Pi which returns the myosin to the "cocked" position.

More cross-bridges formed — more muscle tension

(Handwritten mindmap — Digestive System)

DIGESTIVE SYSTEM

Order of the digestive system
mouth → esophagus → stomach → small intestine → large intestine → Rectum

Accessory Organs = liver, gallbladder, pancreas

DIGESTION?
def. breaking down large food molecules into smaller ones so that it can be absorbed into the body

ORAL CAVITY — Saliva, Mastication, Mucus, buffer pH, chewing action of teeth, amylase, moisten, Food
fat breakdown → lipase
starch → maltose → amylase
Bolus — mass of semisolid food
wave-like muscular movements → peristalsis → gastro-esophageal sphincter

Esophagus → sphincter, valve, pH 1.5~2.5, acidic

Liver — by producing digest fat, pathogens, detoxify blood, drugs, alcohol
Bile — stored in Gallbladder
bile salts, emulsify, lipid

Stomach — protein digestion, parietal cells, chief cells, HCl, converts, kill microorganisms, pepsin, pepsinogen, secrete, inactive form, hydrolyze proteins

Small Intestine — protein, Complete digestion, fat, carbohydrate, Villi, microvilli, appendix, Immunity, increase surface area, Duodenum, Jejunum, Ileum, absorb, protein (amino acids), glucose, triglyceride, amino acid, ↑ absorption efficiency

Chemical Digestion — partially digested food + gastric juice, Chyme, with pancreatic juices, neutralize, mix, breakdown food

Pancreas — digestive juices, contain bicarbonate

Large Intestine — Colon, store, Rectum, store feces, Anus, Waste material exit through, defecation, "Intestinal Flora", contain bacteria, extract H2O

Scaffolded summaries

Prep Doc preparation guide:
Use the questions provided in the Prep Doc as a scaffold to determine the significant concepts in the chapter.
Provide answers to those questions in a concise creative way.
You are welcome to choose the best way to summarize the information:
- Drawings with labels
- Diagrams
- Mindmap
- SHORT Text
- Tables

The purpose is to create your own short version of the course content that will be your main exam preparation tool.
It needs to be YOUR OWN, original document, and hand-written (we remember best when more brain centers are involved in the process).

Scaffolded summaries for a human physiology course

Handwritten study notes. Left page titled "PHYSIOLOGY & ANATOMY I (PREPDOC 5) — ENDOCRINE SYSTEM" covering Hormones (Types: Peptide & Proteins, Amine, Steroid), Transport & Action (Hydrophilic, Hydrophobic), Hypothalamus-Pituitary Axis (Posterior Pituitary, Anterior Pituitary), and Thyroid Gland (Synthesis, Transport, Action, Regulation). Right page titled "Cardiovascular physiology" with diagrams of the heart, circulation, and conduction system, plus a yellow sticky note reading "Meticulous, detailed summary, excellent diagrams & color use. Points for improvement: too many details – the purpose is to sift out only the essential; lack of logical hierarchical organization of information – adding section titles may help; many abbreviations – the summary unnecessary slowly..."
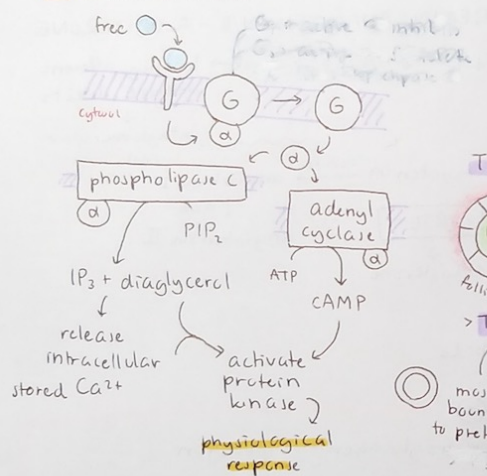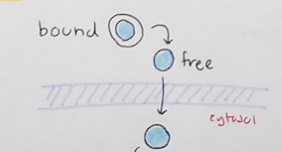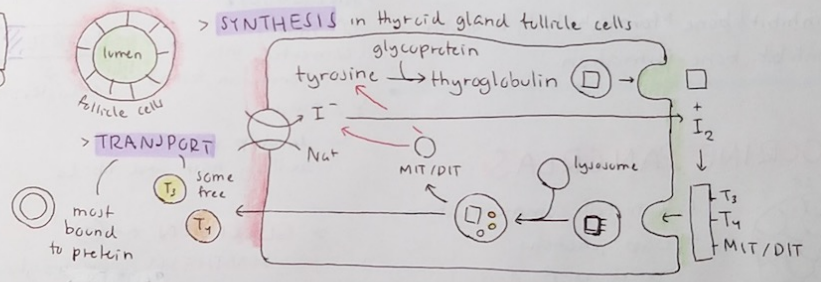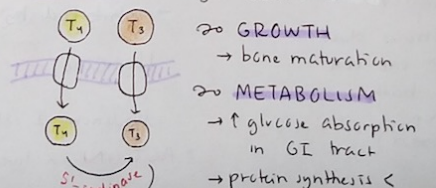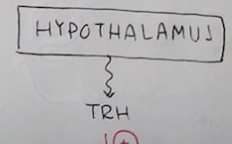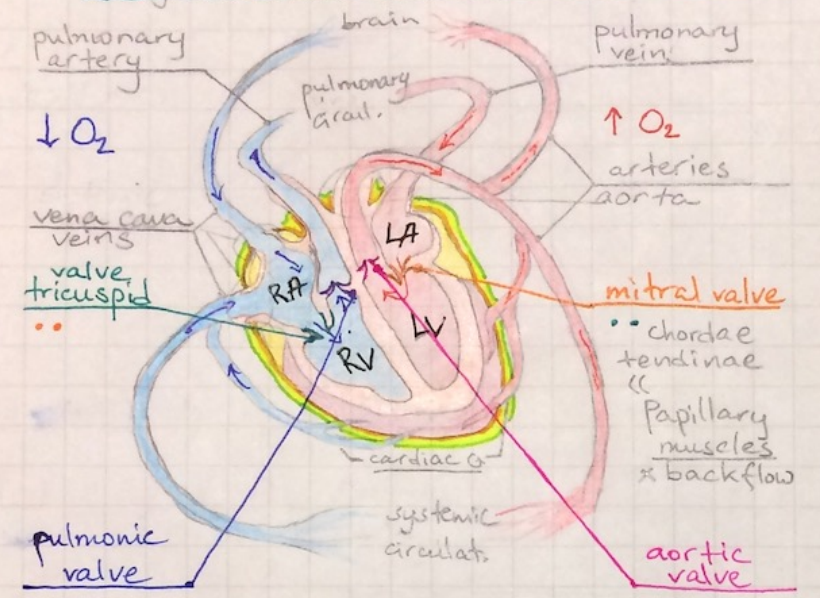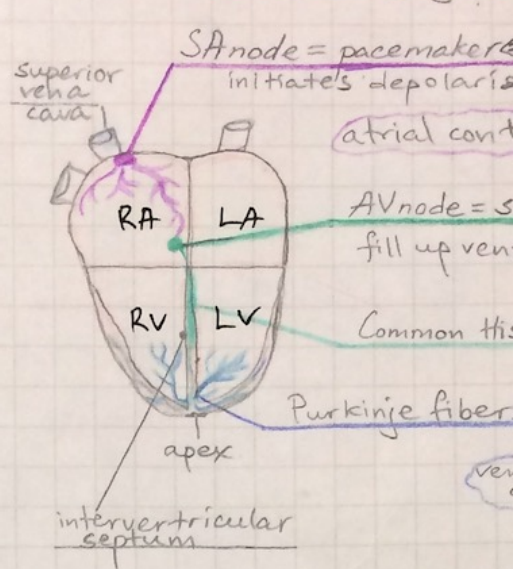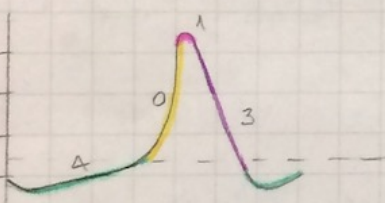
How to TEACH independent analysis?

- Give (low-stake) chances to apply content AFTER class :
- summary of a scientific paper
- case studies
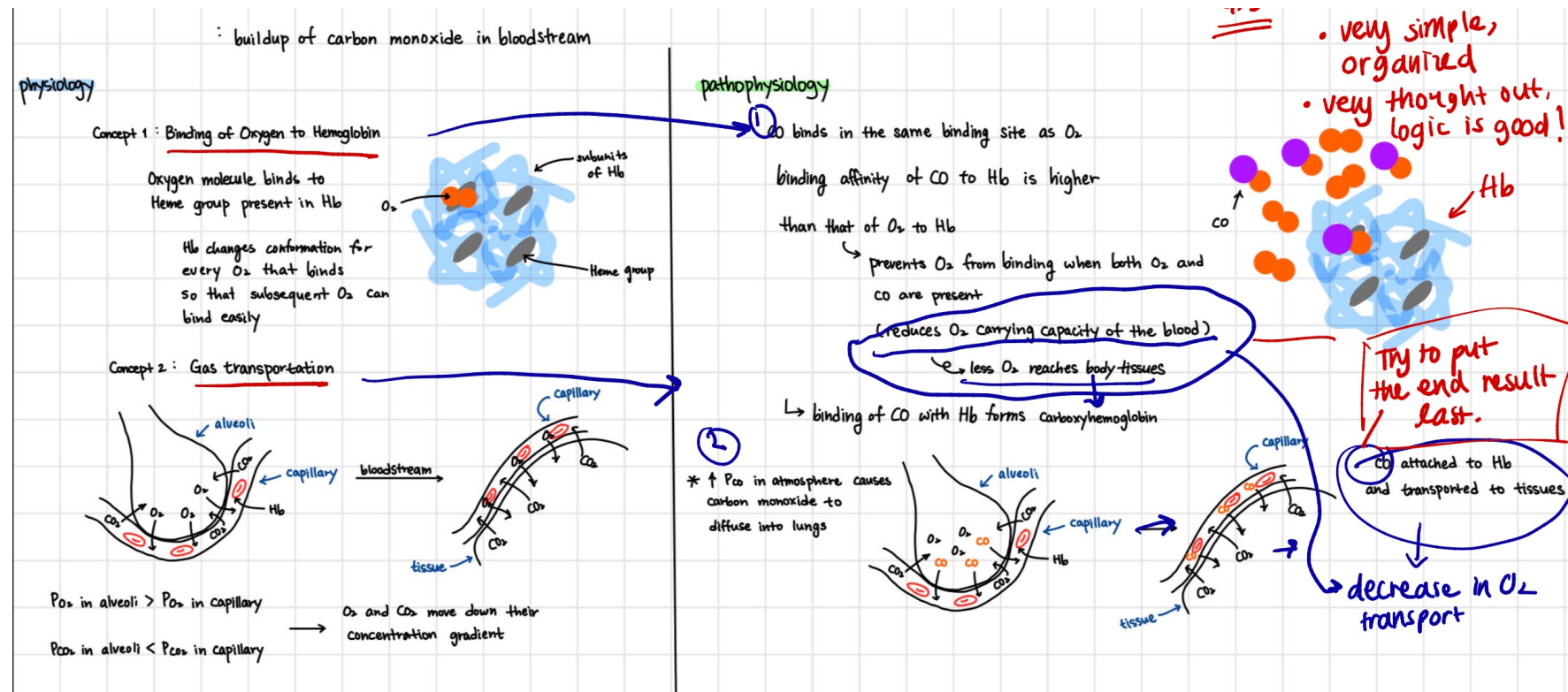
Case study preparation guide:

Purpose: Describing, from Physiology point of view, a disease/condition related to the studied organ system; practicing analytical skills (retrieving essential physiological information from a large clinical text source).

Please follow this structure to help you identify the information you need to present:

1) **Name and Description:** Name the disease/condition and provide <u>very</u> short disease description; 1-2 lines (NOTE: answer the question What is this disease about? NOT What are the detailed clinical symptoms?)	
2) **Physiology:** -1- Concept title Identify the normal physiology concepts that underline the condition and describe them to the depth we study them in class. Give titles to your concepts! This will allow you to focus your attention and description. Provide a <u>concise</u> presentation of each identified physiology concept – this is the core part of the assignment. (NOTE: there are usually only 1-2 concepts that are directly relevant).	3) **Pathophysiology:** Describe how the normal physiological mechanism(s) described in (2) is disrupted. For each identified physiology concept, provide a <u>short</u> explanation how the normal physiology is altered.

Primary hypothyroidism: a disorder of the thyroid gland, where not enough thyroid hormone is produced, due to iodine deficiency.

Physiology

Mechanism of secretion regulation

① Low metabolic rate → Hypothalamus releases the thyroid releasing hormone (TRH) which are secreted by the neuron → primary capillary plexus → hepatic portal vein → anterior pituitary. Anterior pituitary releases thyroid stimulating hormone (TSH) produced due to response to TRH, by entering secondary capillary plexus → systemic circulation.

mechanism of thyroid hormone synthesis

② TSH binds to the receptors in the follicle cells of the thyroid gland. This causes active transport of iodide (I⁻) from the bloodstream to the cytosol. I⁻ is then moved to the lumen of the follicle cells that border the colloid, where I⁻ is oxidized into I₂. I₂ is passed into the colloid.

③ In the colloid: peroxidase link iodine to tyrosine in thyroglobulin to produce 2 intermediaries: Tyr-I & Tyr-I-I
Tyr-I + Tyr-I-I → T₃ hormone } via covalent
Tyr-I-I + Tyr-I-I → T₄ hormone } bonding
↳ TSH stimulates endocytosis of T₃ & T₄ out of the colloid to the follicle cell → lysozyme break apart thyroglobulin colloid → T₃ & T₄ are free to diffuse across the follicle cell membrane → bloodstream

Effect of hormone in target cells
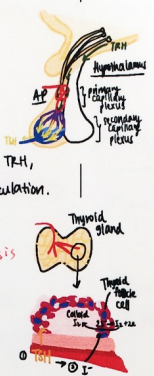
④ T₃ and T₄ release increase basal metabolic rate of body cells → increased nutrient breakdown, initiation of transcription of genes needed to cause glucose oxidation
calorigenic effect
by expressing Na-K ATPase mRNAs
Mitochondria ↳ binding of T₃ & T₄ to intracellular receptor in mitochondria

Negative feedback regulatory mechanism

⑤ Elevated T₃ and T₄ in bloodstream inhibits TRH and TSH release (negative feedback loop).
↳ homeostasis is achieved.

Pathophysiology

① Low metabolic rate → hypothalamus releases TRH, which causes production and secretion of TSH. TSH then is released into systemic circulation.

② TSH binds to receptors in the follicle cell of the thyroid gland, which should cause uptake of iodide. Due to iodine deficiency, not enough iodide is transported into the follicle cell, which disrupts process ③

③ Production of T₃ and T₄ hormones is depleted, because synthesis of these hormones require prior synthesis of the intermediaries Tyr-I and Tyr-I-I, which needs iodine.

④ Lack of T₃ and T₄ produced would not increase the metabolic rate of the cells to the needed rate
↳ overtime, continued low metabolic rate impairs growth and development. (low level of energy)
• feeling cold a lot, due to less calorigenic effect
decreased glucose oxidation due to decrease of transcription for enzymes responsible for glucose metabolism

⑤ Because metabolic rate was not elevated, TRH and TSH continues to be expressed. TSH is especially secreted in increasing amount
↳ hyperstimulation creates accumulation of thyroglobulin in the thyroid gland follicle, increasing deposit of colloid → accumulation creates goiter by increasing overall size of the thyroid gland.

Case studies for a human physiology course

Left page

1) pneumothorax
⌐→ chest wall gets pierced.

Air stays in the thoracic cavity because of the bankruptcy of the parietal pleura or the visceral pleura. It is classified by causes into natural (spontaneous), traumatic and iatrogenic pneumothorax. (part of traumatic)

*Make the definition general, no need to explain the types of pneumothorax.

next time, you can

2) ~~natural~~ Spontaneous pneumothorax

TITLE: The process of being the natural pneumothorax.

→ Air inflows into the external elastic plate which has been thin because of the bankruptcy of the internal elastic plate. ⇒ It causes the bankruptcy of air sac.

bankruptcy of air sac
collapse of lung
external elastic plate
air / internal elastic plate
alvedi
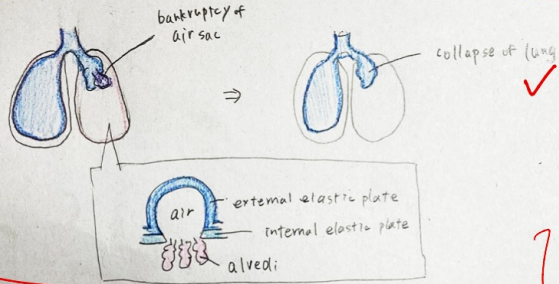
} Pathophysiology

3) ~~Pathoo~~ Pathophysiology ⇒ how pleural cavity normally optimizes breathing.

Normal
lung
Battlement

Pneumothorax
AIR
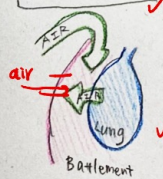air
AIN
lung
Battlement

nice Drawing!

A lung trys to shrink to inside.
On the other hand, a battlement trys to expand to outside.
As the result, of that intrathoracic pressure is negative.
↳ (negative pressure occurs)
Lung volume increase → inhalation occurs

Air enters from outside of intrathoracic or whole of lung ✗ to inside of intrathracic ✓
So, the pressure of inside of intrathracic increases
||
and a lung capacity decreases. same as atmosphere

Right page
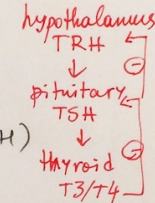
Case Study (Endocrine Physiology)

Hypothyroidism

Description: A disorder of the endocrine system in which the thyroid gland doesn't produce enough thyroid hormone.

PHYSIOLOGY

Concept 1 Mechanism of regulating thyroid secretion

·) Hypothalamic - pituitary - thyroid axis ←describe! is NOT disturbed. ?

↳ production of Thyroid stimulating hormone (TSH) is stimulated by Thyrotropin- releasing Hormone (TRH)

↳ Production of TSH and TRH is decreased by thyroxine ↝ ⊖ feedback

hypothalamus
TRH ↓ ⊖
pituitary
TSH ↓ ⊖
thyroid
T3/T4

·) When blood calcium is low,
↳ parathyroid hormone (PTH) is released
→ blocks Na^+ channel so that more sodium can go in
→ blood calcium ↑

→ this is not thyroid hormone

PATHOPHYSIOLOGY

·) Hypothalamic- pituitary- thyroid axis is disturbed → how? what happens?

·) When blood calcium is low
↳ PTH is not secreted because the gland doesn't function properly
→ Ca^{2+} level in blood is still low → inability to block Na^+ channels
↝ less sodium goes in
↝ blood calcium level stays low. ?

main
Your job in this assignment is
① identify concepts that are related to the disease
② describe thes concepts at the level of detail we study them in class

How to TEACH independent analysis?

Key elements of effective analytical assignment:

- **Limit space!** 1 page/ 5 slides

- Focus evaluation on
  - Identification of key concepts
  - Short schematic descriptions
  - Logical hierarchy of information
  - Student –own visuals

Consider assigning individual work or team work

How to TEST conceptual learning?

- Short-answer questions rather than multiple choice questions (if possible)
  - "How" and "why" questions

  - Application questions

- Grade not only the provided information, but also logic of organization

PROS and CONS of conceptual learning approach

- PROS: getting closer to our real goal of fostering independent thinkers

- CONS: time and effort consuming,

  both for students and faculty
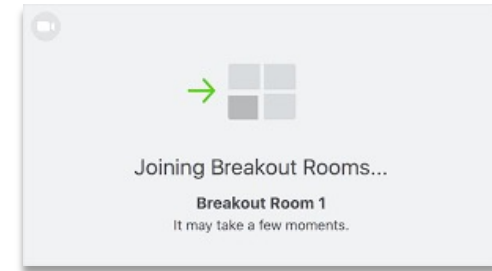
Thank you

Breakout Room Questions (30 minutes)

Introduce yourselves (Name + Institution)

Select a Discussion Leader, Time Keeper

Questions:

1. How do you already use active learning?
2. What is one topic that you lecture about that students struggle with that could be designed into active learning?
3. What are the benefits and challenges with online active learning?
4. How important is conceptual learning for your major/topic, and what strategies do you use to encourage students to learn conceptually?

Chat: What one idea from today would you like to try out in your courses?

Teaching in Virtual Environments

APRU Global Health Program at the University of Southern California

in collaboration with

Global STEM Education Program at the University of Oregon

February 22, 6-7:30pm US Pacific
February 23, 10-11:30am Hong Kong
Supporting Students Beyond the Classroom
Eleanor Vandegrift, University of Oregon &
Catherine Zhou, Hong Kong University of Science and Technology

March 29, 6-7:30pm US Pacific
March 30, 9-10:30am Hong Kong
Creating an Active Learning Environment
Eleanor Vandegrift, University of Oregon
Maria Vassileva, Nagoya University

April 26, 6-7:30pm US Pacific
April 27, 9-10:30am Hong Kong
TBD
Eleanor Vandegrift, University of Oregon
TBD

USC | APRU Global Health | UNIVERSITY OF OREGON

More info or to register: apru.org/our-work/pacific-rim-challenges/global-health