An anatomical illustration of the human torso, showing the cardiovascular and lymphatic systems. The heart is centrally located, with a network of blood vessels (arteries and veins) and lymphatic vessels extending throughout the body. The vessels are depicted in shades of orange and red, contrasting with the blue-tinted background of the human figure. The text is overlaid on the central part of the illustration.

Understanding Vessel Diameter Changes in the Cardiovascular and Lymphatic Systems

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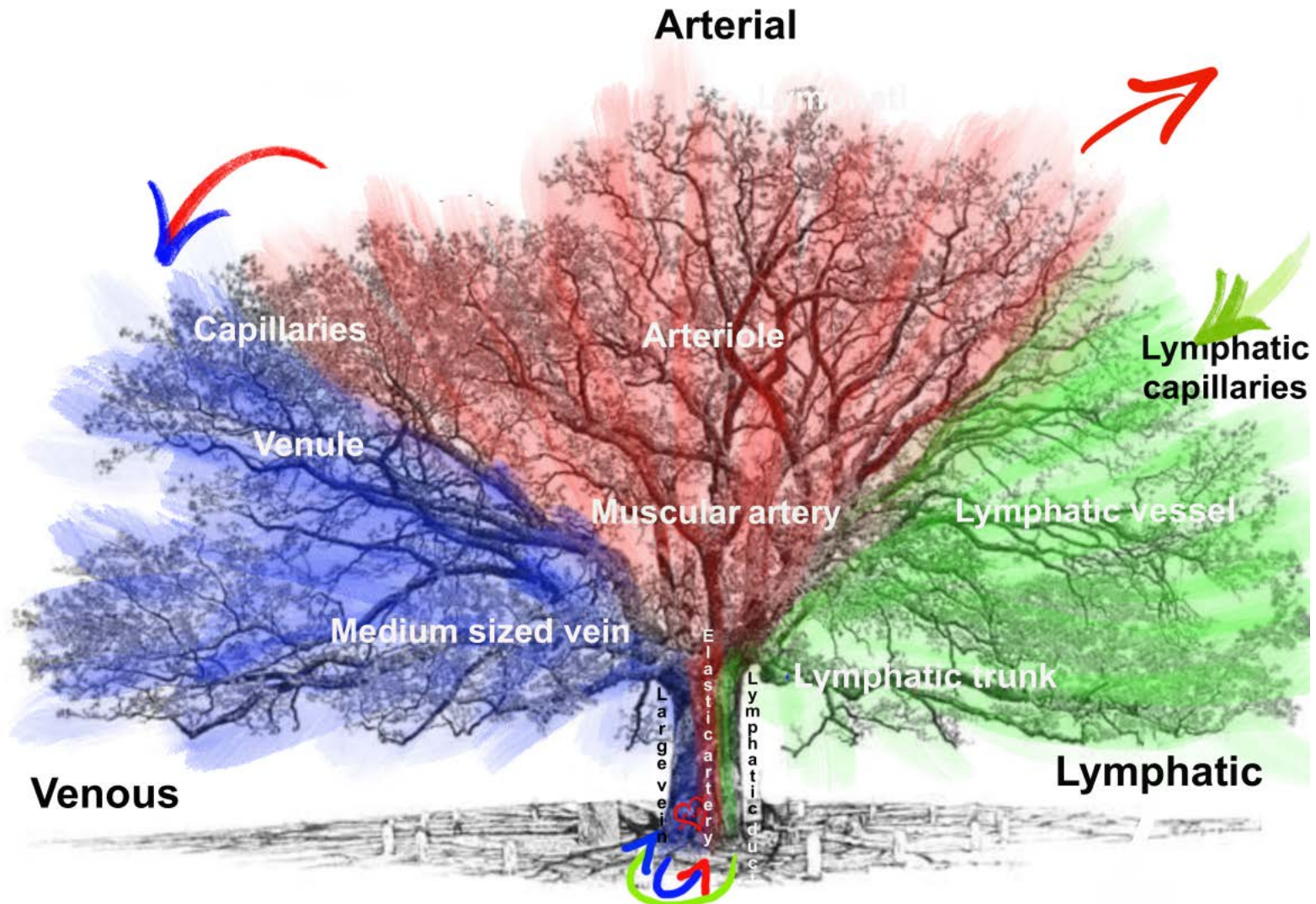
Problem:

When studying the cardiovascular and lymphatic systems, how can students efficiently learn and retain the anatomical structures associated with vessel diameter changes and understand the relationships between these closed body systems?

Solution:

By using the Anatomical Tree Tool!

Anatomical Tree of Vessel Changes in the Cardiovascular and Lymphatic Systems



Who Can Benefit From This Tutoring Tool?

Generally...

- Anatomy and physiology tutors
- Anatomy and physiology students
- Students in health fields
- Anyone interested in better understanding the amazing human body and how it works

How To Use?

The Anatomical Tree Tool...

- Serves as a basis for Socratic Questioning to determine the Proximal Zone of Development for most effective tutoring.
- Illustrates concepts of increasing or decreasing vessel diameter, direction of flow and relationships between systems.
- Elucidates similarities and differences between systems.
- Reinforces color conventions for systems.
- Facilitates connection between concept and real world.
- Functions as a memorable analogy for the branching structure of vessels.

Specifically...



Learners Who Prefer Concepts First and Details Later

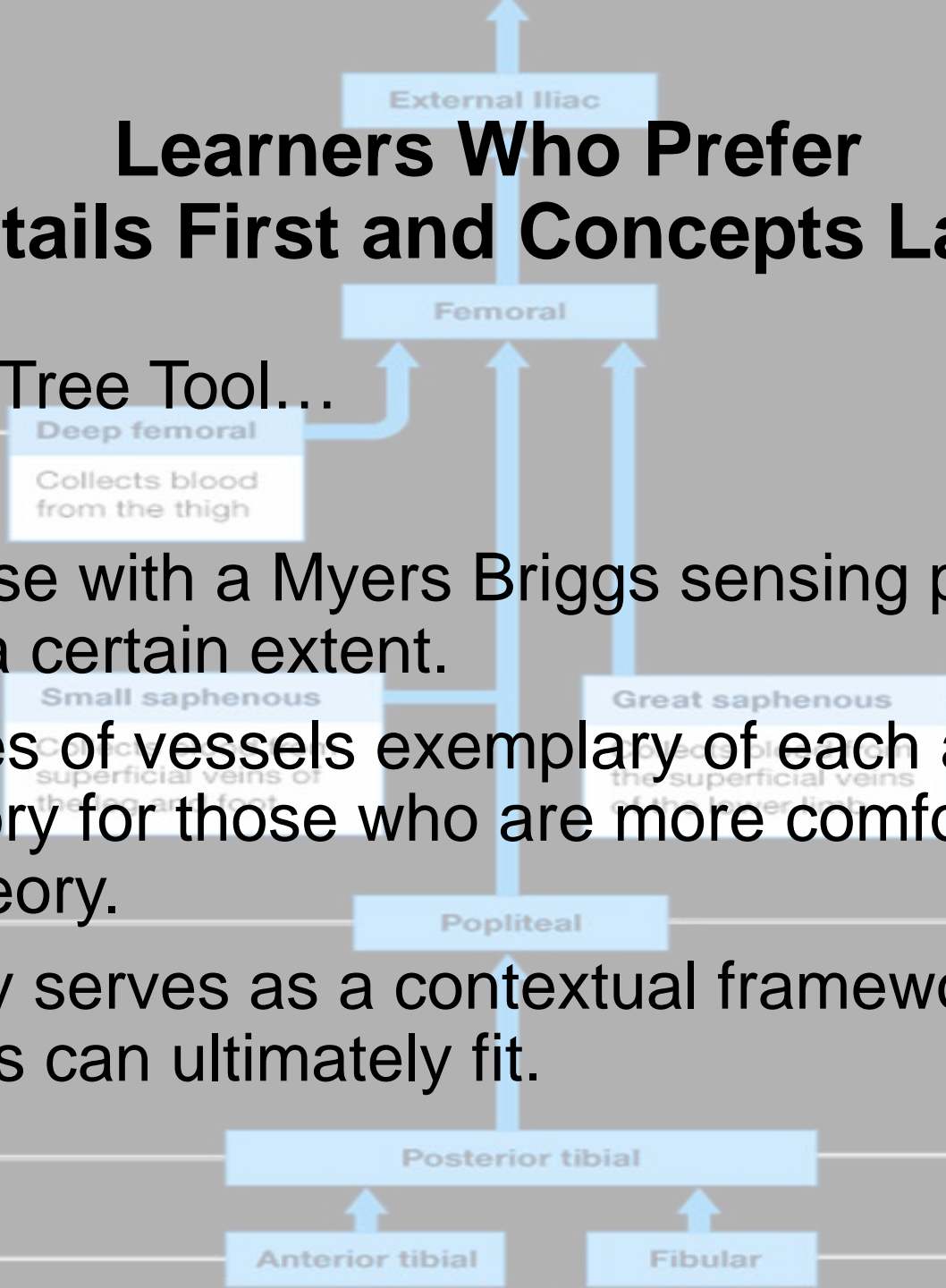
The Anatomical Tree Tool...

- Appeals to those with Myers Briggs intuitive personality preference.
- Presents the big picture necessary to mentally organize the details learned later appropriately.
- Enables specifics to be recalled as they are connected to a pattern.
- Concisely shows how the systems relate to one another.
- Illustrates the systems side-by-side so that similarities and differences between them may be easily identified.
- You might ask the tutee to consider the systems and:
 - Compare the direction of flow.
 - Identify which have valves.

Learners Who Prefer Details First and Concepts Later

The Anatomical Tree Tool...

- Appeals to those with a Myers Briggs sensing personality preference to a certain extent.
- Provides names of vessels exemplary of each applicable, general category for those who are more comfortable with details than theory.
- Simultaneously serves as a contextual framework into which specific vessels can ultimately fit.



Visual Learners

The Anatomical Tree Tool...

- May appeal to a visual learner's appreciation for art.
- Simplifies understanding by being diagrammatic.
- Differentiates the systems by being color coded.
- Aides in retention by being something a visual learner can later visualize in his / her mind.
- Satisfies a visual learner's keen sense of visual-spatial relationships as it illustrates how big vessels transition to smaller ones and vice versa.

Kinesthetic Learners

The Anatomical Tree Tool...

- May be used as a hands on activity allowing kinesthetic learners who appreciate a tactile approach to learning and like to solve problems by physically working through them to trace over the large trunk, medium sized branches and smaller twigs with a finger to simulate the flow of blood or lymph through vessels.
- May be used as a reference tool to keep track of vessel hierarchy. For example, you might ask the tutee to point to the relevant area of the tree as he / she explains how an erythrocyte might travel from the aortic arch to the inferior vena cava.

Auditory Learners

The Anatomical Tree Tool...

- Serves as a basis for discussion. It facilitates:
 - Socratic Questioning to determine the tutee's Zone of Proximal Development; range of understanding in which learning can expand with guidance. You might ask the tutee to explain...
 - How blood travels from the heart to the tissues and back.
 - The connection between the arterial and venous systems.
 - The connection between the lymphatic and cardiovascular systems
 - The physiological effect changing vessel diameter has and its clinical significance to health and well-being.
 - Metacognition in allowing the tutee to talk through his / her understanding which appeals to an auditory learner's preference for reading aloud, explaining and discussing with others.

Adult Learners Who Value Relevance

A background image showing a male doctor in a white lab coat and stethoscope examining a female patient's arm with a blood pressure cuff. The doctor is on the right, looking down at the patient's arm. The patient is on the left, looking towards the doctor. The image is slightly faded to allow text to be read over it.

The Anatomical Tree Tool...

- Illustrates the direction of flow and the connection between systems. You might ask the tutee to explain how...
 - Excess fluid in swollen feet might be redistributed.
 - Cancer might metastasize; spread from one area of the body to another.
- Offers an opportunity to connect to physics and see how Boyle's Law, $P_1V_1 = P_2V_2$, might be applied.
 - Volume and pressure are inversely related. A decrease in vessel diameter results in a decrease in volume resulting in an increase in pressure. This explains conditions such as hypertension and atherosclerosis.
- Contributes to student success, as suggested by andragogy, by allowing the student to recognize that this aspect of anatomy and physiology has real life value.

Have We Been Effective?

Success in understanding the material is evident if the tutee is able to explain to you verbally or graphically that...

- The cardiovascular system is comprised of two systems:
 - **Arterial** (color coded **red** by convention) which carries blood (oxygenated in the systemic circuit and deoxygenated in the pulmonary circuit) away from the heart to the tissues.
 - **Venous** (color coded **blue**) which carries blood (deoxygenated in the systemic circuit and oxygenated in the pulmonary circuit) toward the hear from the tissues.
- The **lymphatic** system (color coded **green**) carries lymph from tissues and returns it to the venous system.

- The **arterial** and **venous** systems flow in opposite directions.
- The **venous** and **lymphatic** systems flow in the same direction and both contain valves.
- Fluid connective tissue is carried in both the **cardiovascular** (blood) and **lymphatic** (lymph) systems.

- From the heart, **arterial** vessel diameter decreases from elastic artery to muscular artery to arterioles to capillaries.
- From the capillaries, **venous** vessel diameter increases from venules to medium sized vein to large vein.
- From the lymphatic capillaries, **lymphatic** vessel diameter increases from lymphatic vessel to lymphatic trunk to lymphatic duct.
- Name examples of specific elastic and muscular **arteries**, large and medium sized **veins** and **lymphatic** trunks and ducts.
- Vessel diameter and pressure are inversely related; as one increases, the other decreases and vice versa.

Since teaching others is a highly effective strategy for promoting information retention, hopefully you have ...

- Provided the tutee with many metacognitive opportunities throughout the tutoring session to demonstrate his / her understanding and receive both your feedback and encouragement.
- Scaffolded; lead less and listened more as the tutee's knowledge and confidence have grown.

Concluding Thoughts

By studying information in logical groups rather than in isolation, students are better able to manage the vast amount of information necessary to learn in anatomy and physiology courses.

Diagrams identifying how details fit into the contextual hierarchy and side-by-side comparisons highlighting similarities and differences are useful study tools.

The background of the slide is a microscopic image of tissue, likely showing cellular structures and blood vessels. Overlaid on this background are several thin, light green lines. One line is horizontal at the top, with a small circular dot at its left end. Another line is horizontal at the bottom right, with a small circular dot at its right end. A third line is diagonal, extending from the bottom right towards the center, with a small circular dot at its left end. A fourth line is diagonal, extending from the bottom right towards the center, with a small circular dot at its right end. These lines appear to be part of a larger diagram or tool being discussed in the text.

The Anatomical Tree Tool presented here summarizing the vessel diameter changes in the cardiovascular and lymphatic systems is but an example of this strategy.

Credits

All images except for the Anatomical Tree Tool and blood pressure assessment originated from...

Martini, Frederic H., et al. *Human Anatomy*, 9th edition.
Pearson Education, Inc., 2018.

Blood pressure assessment image originated from the internet via a Bing Image search through PowerPoint.