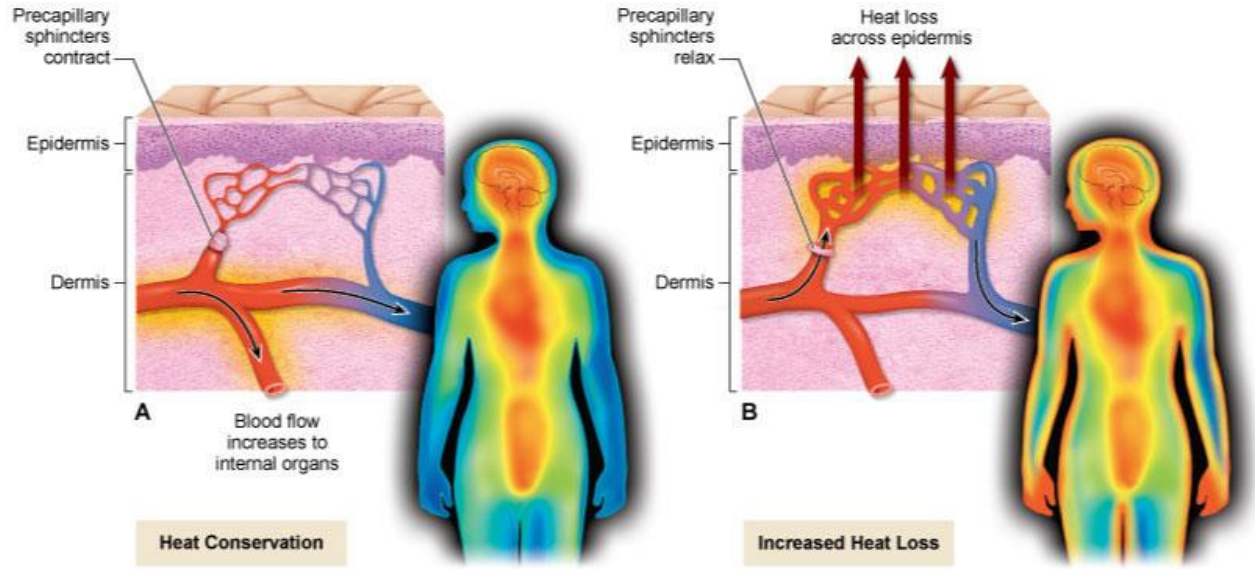
Skin and Temperature Control

"How does skin help maintain a stable body temperature?"

Model 1: The skin as thermoregulator



In thermal images, red/orange indicates higher heat levels and green/blue indicate lower heat levels.

Critical Thinking Questions

1. In 'heat conservation mode' what have the precapillary sphincter muscles done?

    a. What has that action done to the amount of blood in the epidermal capillary bed?

    b. According to the model, this action causes blood flow to increase where?

2. If blood is kept deeper in the body, will the heat stored in the blood's plasma be able to escape easily?

    a. Why might that be a good idea in 'heat conservation' mode?

3. Look at part 'B' of the model. What is different about blood flow in this part of the model compared to part 'A'?

4. What effect has this change in blood flow had on the distribution of heat in the body (look at the thermal image)?

a. If the left side of the model is 'heat conservation' what is the right side labeled?

b. When might we want to increase heat loss?

5. The mechanism of heat loss you just discovered is called **radiation heat loss**. As a group devise a simple description in everyday terms that explains how the skin controls **radiation heat loss**.

6. If the air surrounding the skin is still (no wind) and higher than 37°C (98.6°F), how much heat is likely to be radiated away from the skin (none, a little, or a lot)?

7. If you were to walk outside and the temperature is higher than 99°F, do you automatically die?

a. If you were to walk outside into 99°F temperatures, what is the first thing you would likely notice on your skin (particularly your head and underarms)?

b. What happens to liquids when they are exposed to heat (do they stay liquid)?

c. Besides increased blood flow to the skin, what other physical process aids in heat loss?

8. **Convection** is the movement of molecules within a fluid (liquid or gas). Which feels cooler, a 90°F room with a fan off or with a fan on?

a. Will convection increase or decrease the rate of evaporation?

9. In the space below, list the three main ways that the body sheds excess heat.

Application

10. Professor McSpeedy loves to run. Answer the following questions about heat generation and loss in runners.

a. What tissue type is going to be doing most of the work in <u>moving</u> Professor McSpeedy as he runs?

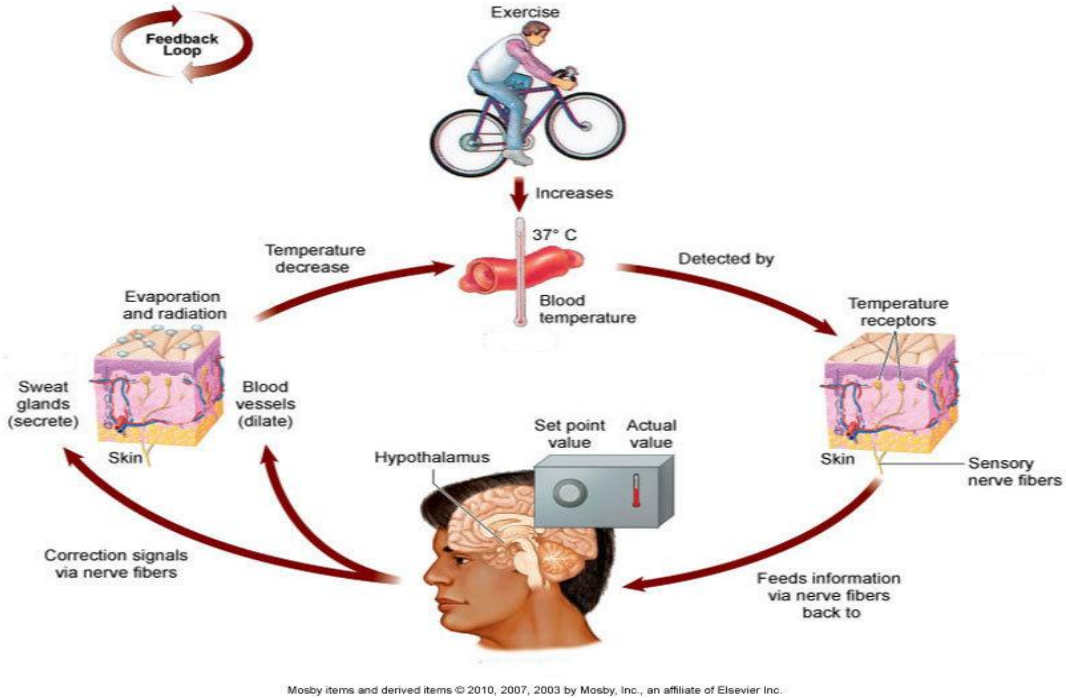
b. Based on your answer to 'a', what tissue is responsible for generating most the body heat generated during exercise?

c. When professor McSpeedy hits the three-mile mark he is really sweating. Besides evaporation, what are two other mechanisms by which his body is losing heat?

d. If Professor McSPeedy runs on a treadmill indoors, which of the three mechanisms will likely **not** play a factor in keeping him from overheating?

e. Is there some way to introduce this method while on a treadmill? How?

Model 2: Regulation of body temperature



Critical Thinking Questions

11. According to the model, what will cause an increase in body temperature?

a. What detects this change in temperature?

b. What is the body's response to this increase in temperature (what two actions will bring temperature down)?

c. What organ is **integrating** the information from the skin receptors and the body's normal set-point temperature?

12. Body temperature is regulated by a **negative feedback loop**. There are four components to a negative feedback loop, a **variable**, **sensor**, **integrator**, and one or more **effectors**. Label the variable, sensor, integrator, and effectors on model 2.

13. The temperature in this room is regulated by a negative feedback loop. In the space below, write the components of the room's heating/AC system that correspond to the variable, sensor, integrator, and effector.