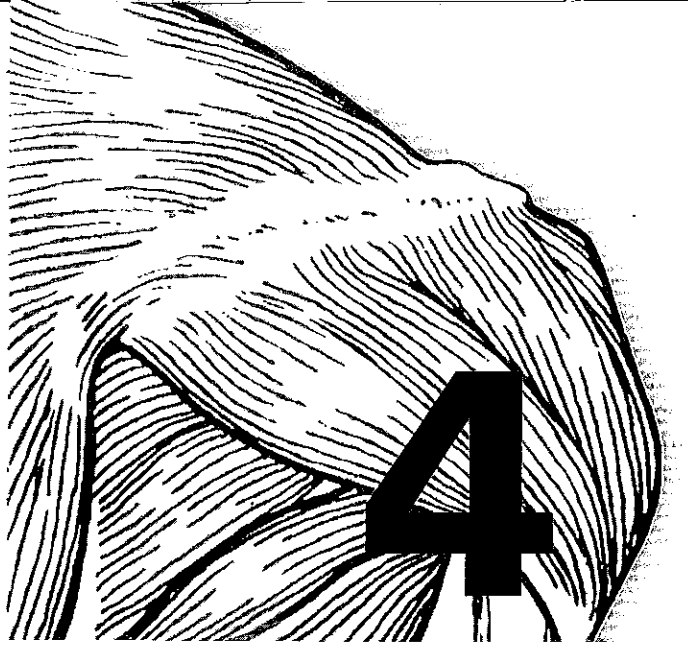

4 SKIN AND BODY MEMBRANES

Body membranes, which cover body surfaces, line its cavities, and form protective sheets around organs, fall into two major categories. These are epithelial membranes (skin epidermis, mucosae, and serosae) and the connective tissue synovial membranes.

Topics for review in this chapter include a comparison of structure and function of various membranes, anatomical characteristics of the skin (composed of the connective tissue dermis and the epidermis) and its derivatives, and the manner in which the skin responds to both internal and external stimuli to protect the body.

CLASSIFICATION OF BODY MEMBRANES

1. Complete the following table relating to body membranes. Enter your responses in the areas left blank.

Membrane	Tissue type (epithelial/connective)	Common locations	Functions
Mucous			
Serous			
Cutaneous			
Synovial			

2. Four simplified diagrams are shown in Figure 4–1. Select different colors for the membranes listed below, and use them to color the coding circles and the corresponding structures.

- ◯ Cutaneous membrane
- ◯ Mucosae
- ◯ Visceral pleura (serosa)
- ◯ Parietal pleura (serosa)
- ◯ Visceral pericardium (serosa)
- ◯ Parietal pericardium (serosa)
- ◯ Synovial membrane

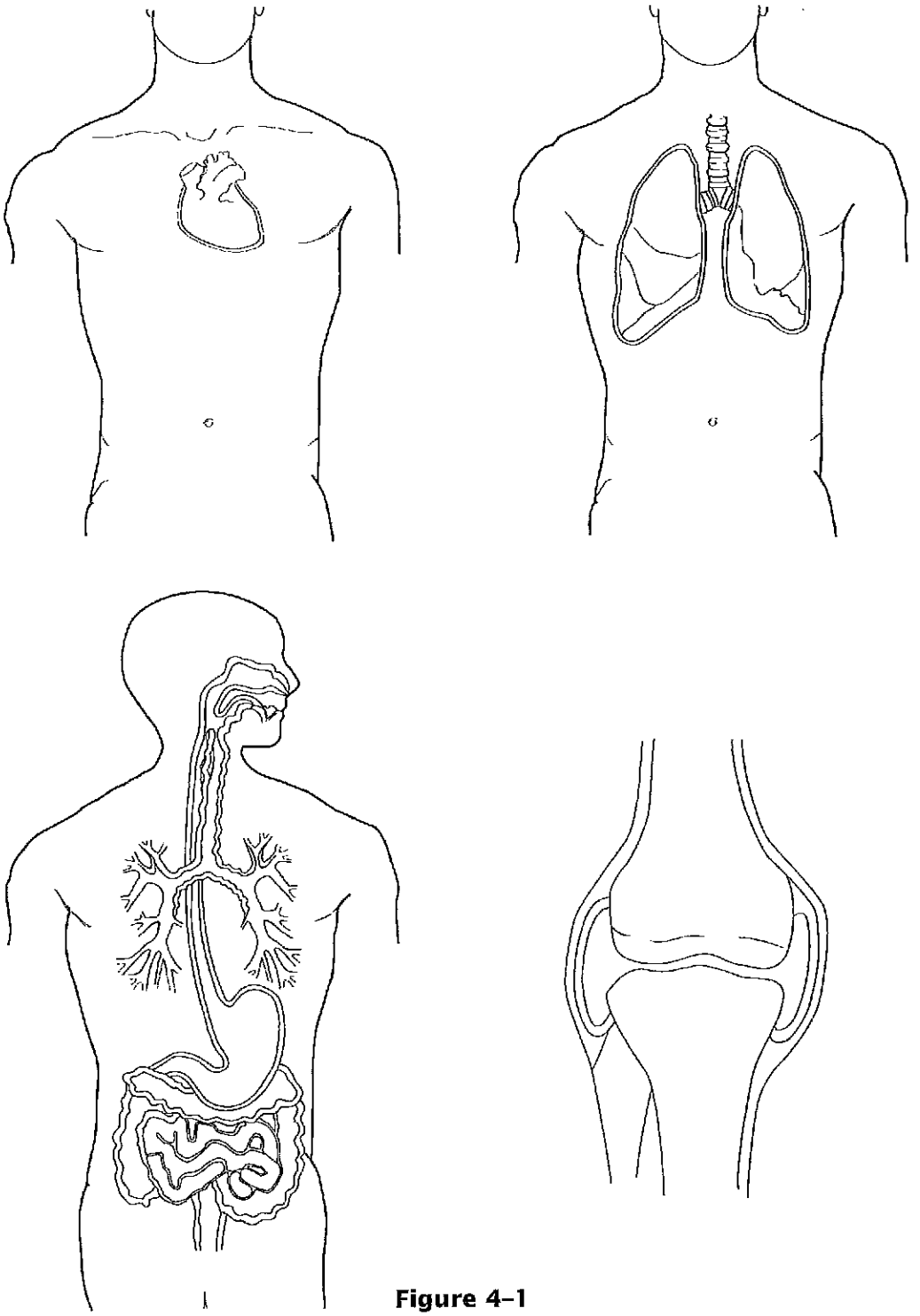

Figure 4–1

INTEGUMENTARY SYSTEM (SKIN)

Basic Functions of the Skin

3. The skin protects the body by providing three types of barriers. Classify each of the protective factors listed below as an example of a chemical barrier (C), a biological barrier (B), or a mechanical (physical) barrier (M).

_____ 1. Langerhans' cells and macrophages

_____ 2. Intact epidermis

_____ 3. Bactericidal secretions

_____ 4. Keratin

_____ 5. Melanin

_____ 6. Acid mantle

4. In what way does a sunburn impair the body's ability to defend itself?

(Assume the sunburn is mild.) _____

_____

5. Explain the role of sweat glands in maintaining body temperature homeostasis.

In your explanation, indicate how their activity is regulated. _____

_____

_____

_____

6. Complete the following statements. Insert your responses in the answer blanks.

_____ 1.
_____ 2.
_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.

The cutaneous sensory receptors that reside in the skin are actually part of the __(1)__ system. Four types of stimuli that can be detected by certain of the cutaneous receptors are __(2)__, __(3)__, __(4)__, and __(5)__.

Vitamin D is synthesized when modified __(6)__ molecules in the skin are irradiated by __(7)__ light. Vitamin D is important in the absorption and metabolism of __(8)__ ions.

Basic Structure of the Skin

7. Figure 4–2 depicts a longitudinal section of the skin. Label the skin structures and areas indicated by leader lines and brackets on the figure. Select different colors for the structures below and color the coding circles and the corresponding structures on the figure.

- ◯ Arrector pili muscle
- ◯ Adipose tissue
- ◯ Hair follicle
- ◯ Nerve fibers
- ◯ Sweat (sudoriferous) gland
- ◯ Sebaceous gland

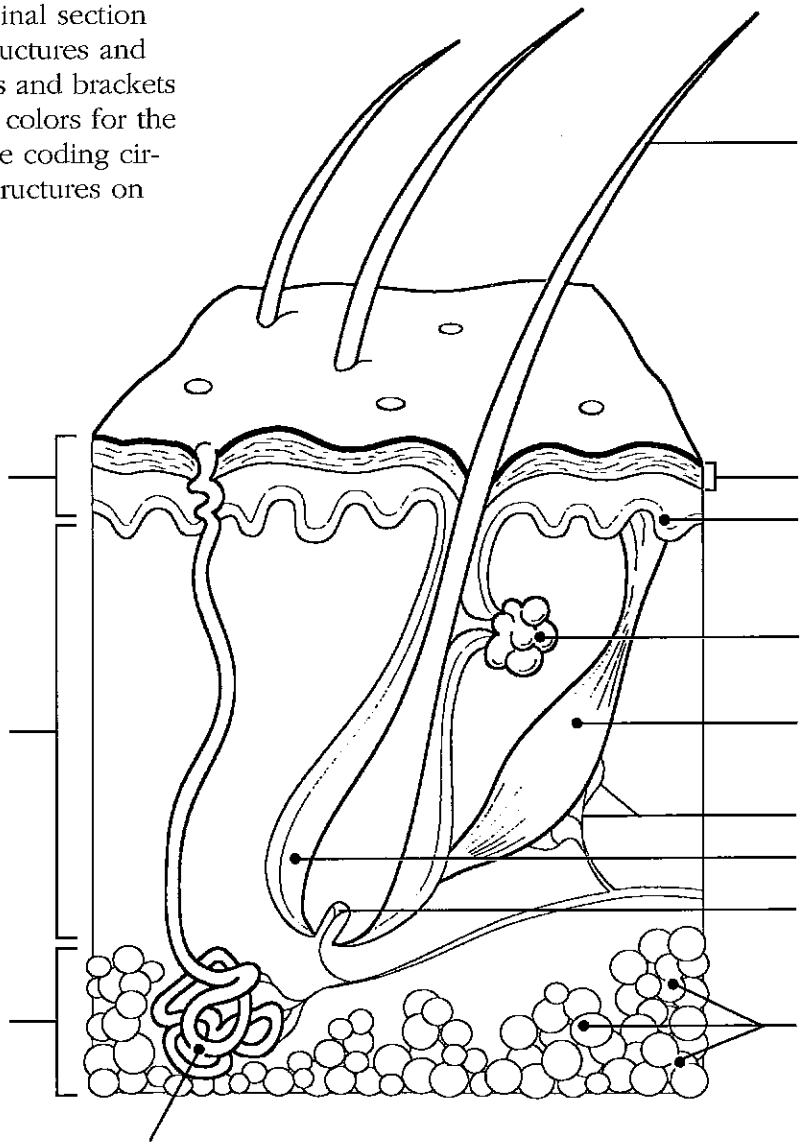

Figure 4–2

8. The more superficial cells of the epidermis become less viable and ultimately die. What two factors account for this natural demise of the epidermal cells?

1. _____

2. _____

_____

9. Using the key choices, choose all responses that apply to the following descriptions. Enter the appropriate letter(s) or term(s) in the answer blanks.

Key Choices

A. Stratum basale	D. Stratum lucidum	G. Reticular layer
B. Stratum corneum	E. Stratum spinosum	H. Epidermis as a whole
C. Stratum granulosum	F. Papillary layer	I. Dermis as a whole

_____ 1. Translucent cells, containing keratin

_____ 2. Strata containing all or mostly dead cells

_____ 3. Dermis layer responsible for fingerprints

_____ 4. Vascular region

_____ 5. Epidermal region involved in rapid cell division; most inferior epidermal layer

_____ 6. Scalelike cells full of keratin that constantly flake off

_____ 7. Site of elastic and collagen fibers

_____ 8. Site of melanin formation

_____ 9. Major skin area from which the derivatives (hair, nails) arise

_____ 10. Epidermal layer containing the oldest cells

_____ 11. When tanned becomes leather

10. Circle the term that does not belong in each of the following groupings.

1. Reticular layer Keratin Dermal papillae Meissner's corpuscles
2. Melanin Freckle Wart Malignant melanoma
3. Prickle cells Stratum basale Stratum spinosum Cell shrinkage
4. Langerhans' cells Epidermal dendritic cells Keratinocytes Immune cells
5. Meissner's corpuscles Pacinian corpuscles Merkel cells Arrector pili
6. Waterproof substance Elastin Lamellated granules Produced by keratinocytes
7. Intermediate filaments Keratin fibrils Keratohyaline Lamellated granules

11. This exercise examines the relative importance of three pigments in determining skin color. Indicate which pigment is identified by the following descriptions by inserting the appropriate answer from the key choices in the answer blanks.

Key Choices

A. Carotene B. Hemoglobin C. Melanin

_____ 1. Most responsible for the skin color of dark-skinned people

_____ 2. Provides an orange cast to the skin

_____ 3. Provides a natural sunscreen

_____ 4. Most responsible for the skin color of Caucasians

_____ 5. Phagocytized by keratinocytes

_____ 6. Found predominantly in the stratum corneum

_____ 7. Found within red blood cells in the blood vessels

12. Complete the following statements in the blanks provided.

_____ 1. Radiation from the skin surface and evaporation of sweat are two ways in which the skin helps to get rid of body __(1)__.

_____ 2. Fat in the __(2)__ tissue layer beneath the dermis helps to insulate the body.

_____ 3. A vitamin that is manufactured in the skin is __(3)__.

_____ 4. Wrinkling of the skin is caused by loss of the __(4)__ of the skin.

_____ 5. A decubitus ulcer results when skin cells are deprived of __(5)__.

_____ 6. __(6)__ is a bluish cast of the skin resulting from inadequate oxygenation of the blood.

Appendages of the Skin

13. For each true statement, write *T*. For each false statement, correct the underlined word(s) and insert your correction in the answer blank.

_____ 1. A saltwater solution is secreted by sebaceous glands.

_____ 2. The most abundant protein in dead epidermal structures such as hair and nails is melanin.

_____ 3. Sebum is an oily mixture of lipids, cholesterol, and cell fragments.

_____ 4. The externally observable part of a hair is called the root.

_____ 5. The epidermis provides mechanical strength to the skin.

14. Figure 4–3 is a diagram of a cross-sectional view of a hair in its follicle. Complete this figure by following the directions in steps 1–3.

1. Identify the two portions of the follicle wall by placing the correct name of the sheath at the end of the appropriate leader line.
2. Use different colors to color these regions.
3. Label, color-code, and color the three following regions of the hair.

◯ Cortex ◯ Cuticle ◯ Medulla

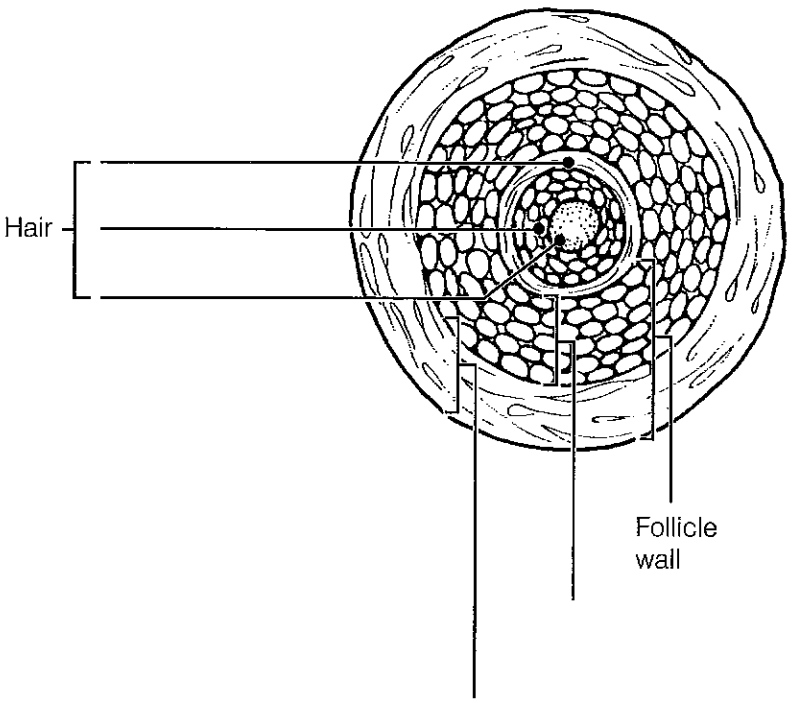

Figure 4–3

15. Circle the term that does not belong in each of the following groupings.

1. Luxuriant hair growth Testosterone Poor nutrition Good blood supply
2. Vitamin D Cholesterol UV radiation Keratin
3. Stratum corneum Nail matrix Hair bulb Stratum basale
4. Scent glands Eccrine glands Apocrine glands Axilla
5. Terminal hair Vellus hair Dark, coarse hair Eyebrow hair

16. What is the scientific term for baldness? _____

17. Using the key choices, complete the following statements. Insert the appropriate letter(s) or term(s) in the answer blanks.

Key Choices

A. Arrector pili
B. Cutaneous receptors
C. Hair
D. Hair follicle(s)
E. Sebaceous glands
F. Sweat gland (apocrine)
G. Sweat gland (eccrine)

_____ 1. A blackhead is an accumulation of oily material produced by __(1)__.

_____ 2. Tiny muscles attached to hair follicles that pull the hair upright during fright or cold are called __(2)__.

_____ 3. The most numerous variety of perspiration gland is the __(3)__.

_____ 4. A sheath formed of both epithelial and connective tissues is the __(4)__.

_____ 5. A less numerous variety of perspiration gland is the __(5)__. Its secretion (often milky in appearance) contains proteins and other substances that favor bacterial growth.

_____ 6. __(6)__ is found everywhere on the body except the palms of the hands, soles of the feet, and lips, and it primarily consists of dead keratinized cells.

_____ 7. __(7)__ are specialized nerve endings that respond to temperature and touch, for example.

_____ 8. __(8)__ become more active at puberty.

_____ 9. Part of the heat-liberating apparatus of the body is the __(9)__.

_____ 10. Secretin contains bacteria–killing substances.

18. Circle the term that does not belong in each of the following groupings.

1. Sebaceous gland Hair Arrector pili Epidermis
2. Radiation Absorption Conduction Evaporation
3. Stratum corneum Nails Hair Stratum basale
4. Scent glands Eccrine glands Apocrine glands Axilla
5. Cyanosis Erythema Wrinkles Pallor

Homeostatic Imbalances of the Skin

19. Overwhelming infection is one of the most important causes of death in burn patients. What is the other major problem they face, and what are its possible consequences?

_____

_____

20. This section reviews the severity of burns. Using the key choices, select the correct burn type for each of the following descriptions. Enter the correct answers in the answer blanks.

Key Choices

A. First-degree burn B. Second-degree burn C. Third-degree burn

_____ 1. Full-thickness burn; epidermal and dermal layers destroyed; skin is blanched

_____ 2. Blisters form

_____ 3. Epidermal damage, redness, and some pain (usually brief)

_____ 4. Epidermal and some dermal damage; pain; regeneration is possible

_____ 5. Regeneration impossible; requires grafting

_____ 6. Pain is absent because nerve endings in the area are destroyed

21. What is the importance of the "rule of nines" in treatment of burn patients?

_____

22. Fill in the type of skin cancer that matches each of the following descriptions:

_____ 1. Epithelial cells, not in contact with the basement membrane, develop lesions; metastasize

_____ 2. Cells of the lowest level of the epidermis invade the dermis and hypodermis; exposed areas develop ulcer; slow to metastasize

_____ 3. Rare but often deadly cancer of pigment-producing cells

23. What does ABCD mean in reference to examination of pigmented areas? _____

_____

_____

DEVELOPMENTAL ASPECTS OF THE SKIN AND BODY MEMBRANES

24. Match the choices (letters or terms) in Column B with the appropriate descriptions in Column A.

Column A	Column B
_____ 1. Skin inflammations that increase in frequency with age	A. Acne
_____ 2. Cause of graying hair	B. Cold intolerance
_____ 3. Small white bumps on the skin of newborn babies, resulting from accumulations of sebaceous gland material	C. Dermatitis
_____ 4. Reflects the loss of insulating subcutaneous tissue with age	D. Delayed-action gene
_____ 5. A common consequence of accelerated sebaceous gland activity during adolescence	E. Lanugo
_____ 6. Oily substance produced by the fetus's sebaceous glands	F. Milia
_____ 7. The hairy "cloak" of the fetus	G. Vernix caseosa

INCREDIBLE JOURNEY

A Visualization Exercise for the Skin

Your immediate surroundings resemble huge grotesquely twisted vines . . . you begin to climb upward.

25. Where necessary, complete statements by inserting the missing words in the answer blanks.

_____ 1.
_____ 2.

For this trip, you are miniaturized for injection into your host's skin. Your journey begins when you are deposited in a soft gel-like substance. Your immediate surroundings resemble huge grotesquely twisted vines. But when you peer carefully at the closest "vine," you realize you are actually seeing connective tissue fibers. Although tangled together, most of the fibers are fairly straight and look like strong cables. You identify these as the __(1)__ fibers. Here and there are fibers that resemble coiled springs. These must be the __(2)__ fibers that help give skin its springiness. At this point,

_____ 3.
_____ 4.
_____ 5.
_____ 6.
_____ 7.
_____ 8.
_____ 9.
_____ 10.

there is little question that you are in the __(3)__ region of the skin, particularly considering that you can also see blood vessels and nerve fibers around you.

Carefully, using the fibers as steps, you begin to climb upward. After climbing for some time and finding that you still haven't reached the upper regions of the skin, you stop for a rest. As you sit, a strange-looking cell approaches, moving slowly with parts alternately flowing forward and then receding. Suddenly you realize that this must be a __(4)__ that is about to dispose of an intruder (you) unless you move in a hurry! You scramble to your feet and resume your upward climb. On your right is a large fibrous structure that looks like a tree trunk anchored in place by muscle fibers. By scurrying up this __(5)__ sheath, you are able to escape from the cell. Once safely out of harm's way, you again scan your surroundings. Directly overhead are tall cubelike cells, forming a continuous sheet. In your rush to escape you have reached the __(6)__ layer of the skin. As you watch the activity of the cells in this layer, you notice that many of the cells are pinching in two, and the daughter cells are being forced upward. Obviously, this is the layer that continually replaces cells that rub off the skin surface, and these cells are the __(7)__ cells.

Looking through the transparent cell membrane of one of the basal cells, you see a dark mass hanging over its nucleus. You wonder if this cell could have a tumor; but then, looking through the membranes of the neighboring cells, you find that they also have dark umbrella-like masses hanging over their nuclei. As you consider this matter, a black cell with long tentacles begins to pick its way carefully between the other cells. As you watch with interest, one of the transparent cells engulfs the tip of one of the black cell's tentacles. Within seconds a black substance appears above the transparent cell's nucleus. Suddenly, you remember that one of the skin's functions is to protect the deeper layers from sun damage; the black substance must be the protective pigment, __(8)__.

Once again you begin your upward climb and notice that the cells are becoming shorter and harder and are full of a waxy-looking substance. This substance has to be __(9)__, which would account for the increasing hardness of the cells. Climbing still higher, the cells become flattened like huge shingles. The only material apparent in the cells is the waxy substance—there is no nucleus, and there appears to be no activity in these cells. Considering the clues—shingle-like cells, no nuclei, full of the waxy substance, no activity—these cells are obviously __(10)__ and therefore very close to the skin surface.

Suddenly, you feel a strong agitation in your immediate area. The pressure is tremendous. Looking upward through the transparent cell layers, you see your host's fingertips vigorously scratching the area directly overhead. You wonder if you are causing his skin to sting or tickle. Then, within seconds, the cells around you begin to separate and fall apart, and you are catapulted out into the sunlight. Since the scratching fingers might descend once again, you quickly advise your host of your whereabouts.

AT THE CLINIC

26. Mrs. Ibañez volunteered to help at a hospital for children with cancer. When she first entered the cancer ward, she was upset by the fact that most of the children had no hair. What is the explanation for their baldness?

27. A new mother brings her infant to the clinic, worried about a yellowish, scummy deposit that has built up on the baby's scalp. What is this condition called, and is it serious?

28. Patients in hospital beds are rotated every 2 hours to prevent bedsores. Exactly why is this effective?

29. Eric and his wife are of northern European descent. Eric is a proud new father who was in the delivery room during his daughter's birth. He tells you that when she was born, her skin was purple and covered with a cream–cheese-like substance. Shortly after birth, her skin turned pink. Can you explain his observations?

30. Would you expect to find the highest rate of skin cancer among the Blacks of tropical Africa, research scientists in the Arctic, Norwegians in the Southern United States, or Blacks in the United States? Explain your choice.