Case Study Conclusion

Skin cancer begins in the outer layer of skin, the epidermis. There are three common types of skin cancer: basal cell carcinoma, squamous cell carcinoma, and melanoma.
Basal Cell Carcinoma

**Basal cell carcinoma** occurs in basal cells of the epidermis. Basal cells are stem cells in the stratum basale layer that divide to form all the keratinocytes of the epidermis. Basal cell carcinoma is the most common form of skin cancer. More than four million cases occur in the United States each year. A basal cell carcinoma may appear as a pearly or waxy bump, like the one shown in Figure \(\PageIndex{2}\). Basal cell carcinomas rarely spread (or undergo metastasis), so they can generally be cured with a biopsy, in which the lesion is cut out of the skin and analyzed in a medical lab.

Squamous Cell Carcinoma

**Squamous cell carcinoma** occurs in squamous cells of the epidermis. Squamous cells are flattened, keratin-filled cells in the upper layers of the epidermis. Squamous cell carcinoma is the second most common form of skin cancer. More than two million cases occur in the United States each year. A squamous cell carcinoma may appear as a firm, red nodule, or as a flat lesion with a scaly or crusty surface, like the one pictured in Figure \(\PageIndex{3}\). Squamous cell carcinomas are generally localized and unlikely to metastasize, so they are usually curable surgically.

Melanoma

**Melanoma** occurs in the melanocytes of the epidermis. Melanocytes are the melanin-producing cells in the stratum.
basale of the epidermis. Melanoma is the rarest type of skin cancer, accounting for less than one percent of all skin cancer cases. Melanoma, however, is the most deadly type of skin cancer. It causes the vast majority of skin cancer deaths because melanoma is malignant. If not treated, it will metastasize and spread to other parts of the body. If melanoma is detected early and while it is still localized in the skin, most patients survive for at least five years. If melanoma is discovered only after it has already metastasized to distant organs, there is only a 17 percent chance of patients surviving for five years. You can see an example of melanoma in Figure \(\PageIndex{4}\).

Figure \(\PageIndex{2}\): Basal cell carcinoma

Figure \(\PageIndex{3}\): Squamous cell carcinoma

Figure \(\PageIndex{4}\): Melanoma

Melanoma can develop anywhere on the body. It may develop in otherwise normal skin, or an existing mole may become cancerous. Signs of melanoma may include a:

- mole that changes in size, feel, or color
- mole that bleeds
- large brown spot on the skin sprinkled with darker specks
• small lesion with an irregular border and parts that appear red, white, blue, or blue-black
• dark lesion on the palms, soles, fingertips, toes, or mucous membranes

As with most types of cancer, skin cancer is the easiest to treat and most likely to be cured the earlier it is detected. The skin is one of the few organs that you can monitor for cancer yourself, as long as you know what to look for. A brown spot on the skin is likely to be a harmless mole, but it could be a sign of skin cancer. As shown in Figure 13.1, unlike moles, skin cancers may be asymmetrical, have irregular borders, be very dark in color, and may have a relatively great diameter. These characteristics can be remembered with the mnemonic ABCD.

Figure 13.1: ABCDs of skin cancer

With the help of mirrors, you should check all of your skin regularly. Look for new skin growths or changes in any existing moles, freckles, bumps, or birthmarks. Report anything suspicious or different to your doctor.

If you have risk factors for skin cancer, it's a good idea to have an annual skin check by a dermatologist. This helps ensure that cancerous or precancerous lesions will be detected before they grow too large and become difficult to cure—or, in the case of melanoma, before they metastasize.

Chapter Review

In this chapter, you learned about the structures and functions of the organs of the integumentary system. Specifically, you learned that:

• The integumentary system consists of the skin, hair, and nails. Functions of the integumentary system include providing a protective covering for the body, sensing the environment, and helping the body maintain homeostasis.
• The skin’s main functions include preventing water loss from the body, serving as a barrier to the entry of microorganisms, synthesizing vitamin D, blocking UV light, and helping to regulate body temperature.
• The skin consists of two distinct layers: a thinner outer layer called the epidermis and a thicker inner layer called the dermis.
  ◦ The epidermis consists mainly of epithelial cells called keratinocytes, which produce keratin. New keratinocytes form at the bottom of the epidermis. They become filled with keratin and die as they move upward toward the surface of the skin, where they form a protective, waterproof layer.
  ◦ The dermis consists mainly of tough connective tissues that provide strength and stretch; and almost all skin structures, including blood vessels, sensory receptors, hair follicles, and oil and sweat glands.
• Cell types in the epidermis include keratinocytes which make up 90 percent of epidermal cells; melanocytes that produce melanin; Langerhans cells that fight pathogens in the skin; and Merkel cells that respond to light touch.
• The epidermis in most parts of the body consists of four distinct layers. A fifth layer occurs only in the epidermis of the palms of the hands and soles of the feet.
  ◦ The innermost layer of the epidermis is the stratum basale, which contains stem cells that divide to form new

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keratinocytes. The next layer is the stratum spinosum, which is the thickest layer and contains Langerhans cells and spiny keratinocytes. This is followed by the stratum granulosum, in which keratinocytes are filling with keratin and starting to die. The stratum lucidum is next, but only on the palms and soles. It consists of translucent dead keratinocytes. The outermost layer is the stratum corneum, which consists of flat, dead, tightly packed keratinocytes that form a tough, waterproof barrier for the rest of the epidermis.

- Functions of the epidermis include protecting underlying tissues from physical damage and pathogens. Melanin in the epidermis absorbs and protects underlying tissues from UV light. The epidermis also prevents the loss of water from the body and synthesizes vitamin D.
  - Melanin is the main pigment that determines the color of human skin. However, the pigments of carotene and hemoglobin also contribute to skin color, especially in the skin with low levels of melanin.
  - The surface of healthy skin normally is covered by vast numbers of bacteria representing about 1,000 species from 19 phyla. Different areas of the body provide diverse habitats for skin microorganisms. Usually, microorganisms on the skin keep each other in check unless their balance is disturbed.

- The thicker inner layer of the skin, the dermis, has two layers. The upper papillary layer has papillae extending upward into the epidermis and loose connective tissues. The lower reticular layer has denser connective tissues and structures such as glands and hair follicles. Glands in the dermis include eccrine and apocrine sweat glands and sebaceous glands. Hair follicles are structures where hairs originate.

- Functions of the dermis include cushioning subcutaneous tissues, regulating body temperature, sensing the environment, and excreting wastes. The dense connective tissues of the dermis provide cushioning. The dermis regulates body temperature mainly by sweating and by vasodilation or vasoconstriction. The many tactile sensory receptors in the dermis make it the main organ for the sense of touch. Wastes excreted in sweat include excess water, electrolytes, and certain metabolic wastes.

- Hair is a filament that grows from a hair follicle in the dermis of the skin. It consists mainly of tightly packed, dead keratinocytes that are filled with keratin. The human body is almost completely covered with hair follicles.

- Hair helps prevent heat loss from the head and protects its skin from UV light. Hair in the nose filters the incoming air, and the eyelashes and eyebrows keep harmful substances out of the eyes. Hair all over the body provides tactile sensory input. The eyebrows also play a role in nonverbal communication.

- The part of the hair that is within the follicle is the hair root. This is the only living part of a hair. The part of the hair that is visible above the skin surface is the hair shaft. It consists of dead cells.
  - Hair growth begins inside a follicle when stem cells within the follicle divide to produce new keratinocytes.
  - A hair shaft has three zones: the outermost zone called the cuticle; the middle zone called the cortex, and the innermost zone called the medulla.

- Genetically controlled, visible characteristics of hair include hair color, hair texture, and the extent of balding in adult males. Melanin (eumelanin and/or pheomelanin) is the pigment that gives hair its color. Aspects of hair texture include curl pattern, thickness, and consistency.

- Among mammals, humans are nearly unique in having undergone a significant loss of body hair during their evolution, probably because sweat evaporates more quickly from the less hairy skin. Curly hair also is thought to have evolved at some point during human evolution, perhaps because it provided better protection from UV light.

- Hair has social significance for human beings, being an indicator of biological sex, age, and ethnic ancestry. Human hair also has cultural significance. For example, hairstyle may be an indicator of a social group membership.

- Nails consist of sheets of dead, keratin-filled keratinocytes. The keratin in nails makes them hard but flexible. They help protect the ends of the fingers and toes, enhance the sense of touch in the fingertips, and may be used as tools.

- A nail has three main parts: the nail root, which is under the epidermis; the nail plate, which is the visible part of the nail; and the free margin, which is the distal edge of the nail. Other structures under or around a nail include the nail bed, cuticle, and nail fold.

- A nail grows from a deep layer of living epidermal tissues, called the nail matrix, at the proximal end of the nail. Stem cells in the nail matrix keep dividing to allow nail growth, forming first the nail root and then the nail plate as the nail
continues to grow longer and emerges from the epidermis.

- Fingernails grow faster than toenails. Actual rates of growth depend on many factors, such as age, sex, and season.
- The color of the nail bed can be used to quickly assess oxygen and blood flow in a patient. How the nail plate grows out can reflect recent health problems, such as illness or nutrient deficiency. Nails — and especially toenails — are prone to fungus infections. Nails are more permeable than skin and can absorb several harmful substances such as herbicides.
- Skin cancer is a disease in which skin cells grow out of control. It is caused mainly by excessive exposure to UV light, which damages DNA. Skin cancer affects more Americans than all other cancers combined.
- There are three common types of skin cancer: basal cell carcinoma, squamous cell carcinoma, and melanoma. Carcinomas are more common and unlikely to metastasize. Melanoma is rare and likely to metastasize. It causes the most skin cancer deaths.
- Besides exposure to UV light, risk factors for skin cancer include having light-colored skin, many moles, and a family history of skin cancer, among several others.

Now that you have learned about the organs on the surface of the body, read the next chapter to travel inside and learn about the skeletal system, which protects and supports us internally, among other functions.

Chapter Summary Review

1. What is skin cancer?
2. How common is skin cancer?
3. Compare and contrast the three common types of skin cancer.
4. Identify factors that increase the risk of skin cancer.
5. How does exposure to UV light cause skin cancer?
6. In which layer of the skin does skin cancer normally start?
7. Which two skin cancers described in this section start in the same sublayer? Include the name of the sublayer and the cells affected in each of these cancers in your answer.
8. If a type of skin cancer spreads to other organs, which type is it most likely to be? Explain your answer.
9. True or False. A mole is a form of cancer.
10. True or False. Exposure to UV light can contribute to wrinkles.
11. True or False. Skin cancers are always dark in color.
12. Which form of skin cancer is the most deadly?
13. What are some ways people can reduce their risk of getting skin cancer? Explain your answer.
14. True or False. UV radiation causes more cancers than tobacco use.
15. Describe one way in which the integumentary system works with another organ system to carry out a particular function.
16. Put the following layers of skin in order, from the deepest layer to the layer closest to the surface:
   A. papillary layer
   B. stratum basale
   C. reticular layer
   D. stratum spinosum

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17. The basement membrane is between the:
   A. Dermis and epidermis
   B. Dermis and the subcutaneous tissues beneath it
   C. Dermis and the hair in the follicle
   D. Nail matrix and the nail bed

18. For each of the descriptions below (A-D), match it to the protein that is best described by it (protein choices: keratin, collagen, melanin, elastin).
   A. Helping provide strength and elasticity in the lower layer of the dermis
   B. Makes up the loosely arranged fibers in the upper layer of the dermis
   C. The predominant protein in hair, skin, and nails
   D. Protects against damage from UV light.

19. Keratinocytes are found in:
   A. Skin
   B. Hair
   C. Nails
   D. All of the above

20. Papillae extend from the:
   A. Sebaceous glands to the surface of the skin
   B. Sweat glands to the surface of the skin
   C. Epidermis down into the dermis
   D. Dermal up into the epidermis

21. Describe two types of waterproofing used in the integumentary system. Include the types of molecules and where they are located in your answer.

22. Explain why nails enhance touch sensations.

23. Why do you think light-colored skin is a risk factor for skin cancer?

24. Which vitamin is synthesized by the skin?
   A. Vitamin A
   B. Vitamin D
   C. Vitamin B9
   D. Vitamin E

25. Describe the similarities between how the epidermis, hair, and nails all grow.

26. True or False. The inside of the mouth is considered to be epidermal tissue.

27. True or False. Epidermal cells are filled with an increasing amount of keratin as they go from the lowest layer to the outermost layer.

28. True or False. Cells in the stratum corneum of the skin do not have a nucleus or organelles.

29. What does the whitish crescent-shaped area at the base of your nails (towards your hands) represent? What is its function?

30. What is one difference between human hair and the hair of non-human primates?

31. True or False. Blood vessels extend through the entire thickness of the skin.
32. **True or False.** Cells that produce melanin are located in the dermis of the skin.

33. Describe the relationship between skin and hair.

34. **What kind of skin cancer is a cancer of a type of stem cell?**

35. For the skin and hair, describe one way in which they each protect the body against pathogens.

36. **If sweat glands are in the dermis, how is sweat released to the surface of the body?**

37. Explain why you think that physicians usually insist that patients remove any nail polish before having surgery.

38. **True or False.** Langerhans cells are immune cells located in the epidermis.

39. **True or False.** Fingerprints are due to structures on the surface of the epidermis.

40. Describe generally how the brain gets touch information from the skin.

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Check out this video to learn more about vulvar cancer, a type of skin cancer not typically caused by sun exposure.

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