

Integumentary System

1. Describe the purpose and function of the integumentary system.
2. Create a model of, or label on a diagram, the major layers of the skin and explain their functions.
3. Identify and draw the following:
 - a. Thermoreceptor
 - b. Tactile (Meissner's) corpuscle
 - c. Nociceptor
 - d. Pacinian Corpuscle
 - e. Sweat glands
 - f. Sebaceous gland
 - g. Arrector pili muscles
4. What is melanin? Discuss the role that it plays in the body and why it is important.
5. Answer the following questions:
 - a. Explain the cause of skin moles. Describe the differences between a cancerous mole and a non-cancerous mole.
 - b. How are freckles different than moles? What causes them?
 - c. What are birthmarks? Explain the difference between pigmented and vascular birthmarks.
6. Explain the benefits and dangers of sunlight, and why it is important to protect the skin from excessive sunshine. Describe the process by which the integumentary system creates vitamin D, and the role that vitamin D plays in the body.
7. Explain the role of hair on the human body, and describe the way that hair grows. What can you do to keep your hair healthy?
8. Describe how nails grow, and the importance of caring for them. Demonstrate or label the following parts of the nail on a diagram:
 - a. Nail root
 - b. Cuticle
 - c. Nail bed
 - d. Body
 - e. Free edge
9. Describe the following types of skin traumas and their basic treatment:
 - a. Abrasion
 - b. Blister
 - c. Burn
 - d. Contusion
 - e. Laceration
 - f. Puncture
 - g. Ulcer
10. Why are burns dangerous? Explain the difference between first, second, and third-degree burns, and how to estimate the percentage of the body that has been burned.
11. Explain the process that the skin goes through to heal a wound. How do sutures help in the healing process? What are scars, and why are they important to the healing process?
12. Choose three common skin disorders or illnesses, and answer the following:
 - a. What causes it?
 - b. What are its early signs?
 - c. In what ways does it affect a person?

Integumentary System

- d. How can it be treated?
- 13. What can the skin tell us about a person? List five ways that a person's skin may tell you something about that person.
- 14. Describe five ways that you can keep your skin healthy. Put these into practice.
- 15. Find at least three references from the Bible that refer to your skin. Create a spiritual application about something that you have learned in this honor and share it with your instructor or group.

The Integumentary System

Upper Columbia Conference Honor Pilot

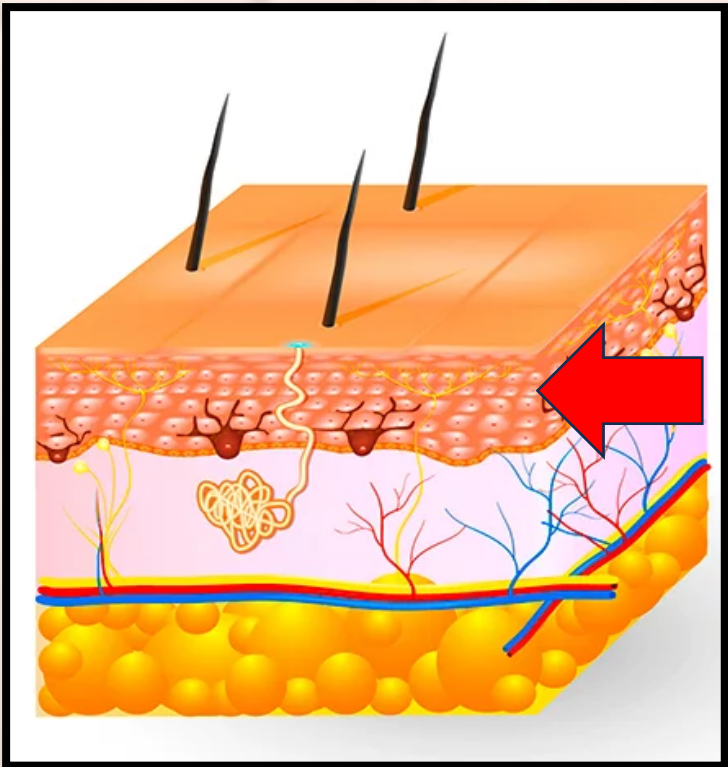
When someone is asked to name a system in the human body, usually they will name the heart and circulatory system, the lungs and respiratory system, or the digestive system. Rarely will they name the integumentary system, even though it is usually the only bodily system that is visible. The integumentary system is a complex and unique system of organs which protect our bodies and help us function, yet is often taken for granted. Without it, not one of the other body systems would work!



The skin is the largest organ in the integumentary system.¹

The integumentary system consists of the skin and all its parts including sensory receptors, hair, nails, and glands. It not only serves to cover all our inner organs, but it also protects them from all types of damage, both from physical trauma, and from germs and other problematic stuff! It keeps us from losing precious water and drying out, helps to get rid of waste in the form of sweat and secretions, and allows us to sense our world through touch and other sensory capabilities!

Layers of the Skin – The Epidermis



The Epidermis is made up of primarily dying or dead skin cells.¹

The skin, the largest organ in the integumentary system can be divided into three major layers. The outermost layer, the Epidermis, consists primarily of dead skin cells. As skin cells, known as keratinocytes, are created in

the lower layers of the skin, they are pushed outward, eventually losing contact with the nourishing blood vessels, and dying. They slowly get flattened out, and shed off when they reach the outer layers.

A few other specialized skin cells exist in this layer, right on the border between the epidermis and the middle layer of the skin, the dermis. One of these types of cells is the melanocyte (which we will talk about later), which provides the skins natural color and is responsible for tanning and other roles. The other specialized skin cell type is the outermost layer of the skin is the Merkel cell, which processes light touch senses, and are most common in the fingertips and face.

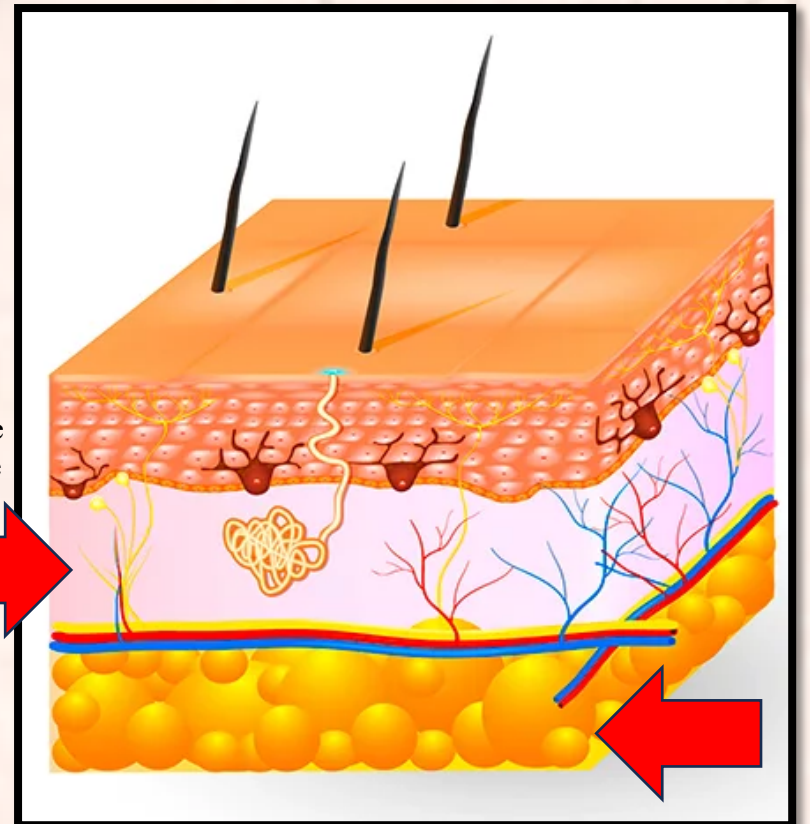
(1) https://www.oncobeta.com/fileadmin/user_upload/nmsc-info/skin_structure.jpg

Layers of the Skin – The Dermis

The Dermis is the middle layer of the skin, and is the most diverse in the functions that the layer plays. It is the location of a number of different structures, known as “appendages,” that each play a special role in the skin. For example, many of our sensory receptors can be found in this layer, including all of the ones discussed in the next question. It contains the blood vessels and capillaries that nourish the skin, helps to cushion the inner parts of the body from bumps and scrapes, and is the location of hair follicles and sweat glands.

The third and lowest layer of the skin is the Subcutaneous layer, which plays a vital role in the skin’s function. It is mostly made up of fatty tissue, and its role is to provide a cushion, insulation, and to connect the skin to the rest of the body. It also helps to keep the water that is inside the body from escaping!

The Dermis is where most of the skin’s sensors are located.¹



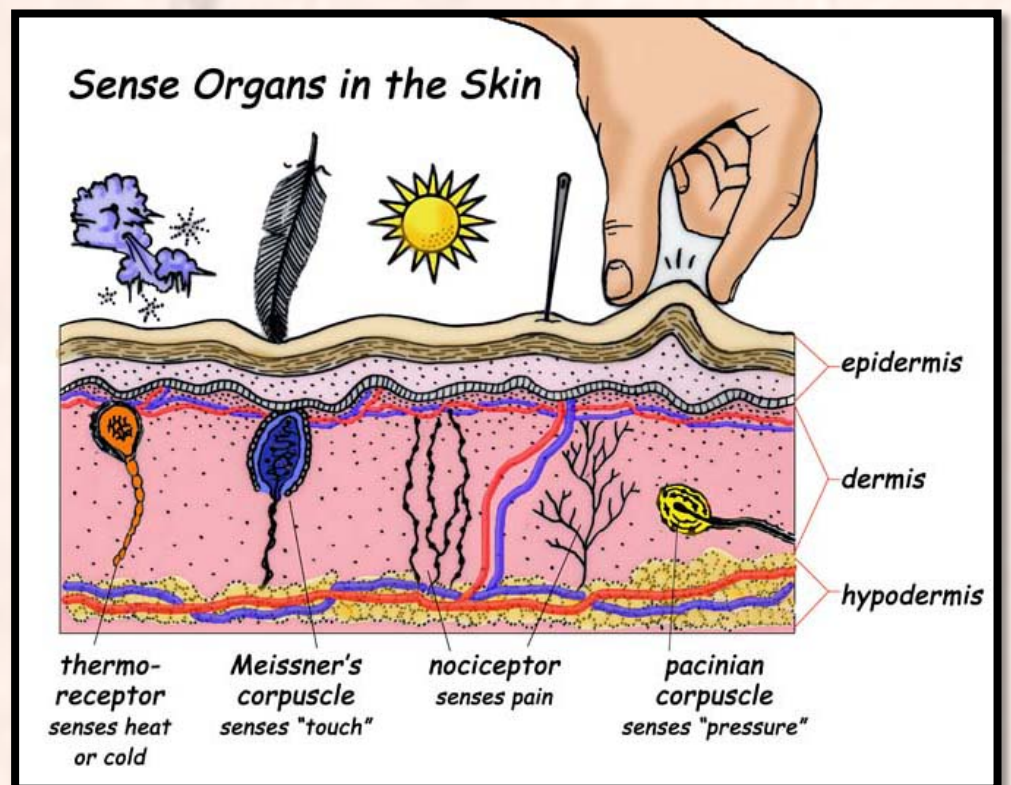
Under the Dermis, the Subcutaneous layer acts as a cushion and connects the skin to the rest of the body.¹

(1) https://www.oncobeta.com/fileadmin/user_upload/nmsc-info/skin_structure.jpg

Senses and Structures in the Skin

Imbedded in the skin are several small structures and sensory receptors, that allow the body to feel.

- Thermoreceptors sense heat.
- Tactile (Meissner's) corpuscles sense touch, but they are not very receptive to light touch.



The four major sensors in the skin are located in the Dermis, the middle layer of the skin.¹

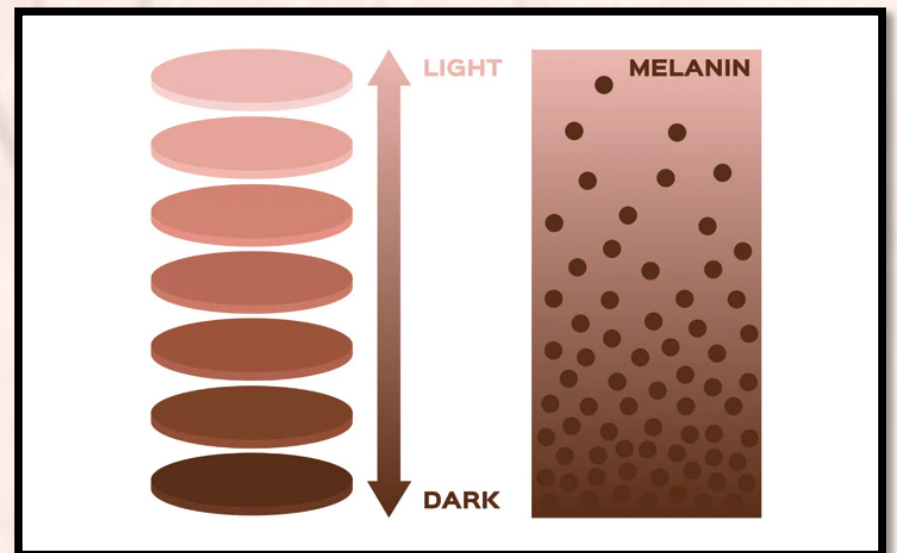
- Nociceptors sense pain.
- Pacinian Corpuscles sense pressure.

Several other interesting structures help to keep the integumentary system healthy and working properly. Sweat glands help to control body temperature and gets rid of waste. Sebaceous glands are oil glands that keep the skin smooth and elastic. There are also tiny muscles called arrector pili muscles that attach to hair follicles. They are responsible for moving the hair, and when they contract, they cause goosebumps!

(1) https://www.exploringnature.org/graphics/biology/sensory_organisms_in_skin.jpg

Melanin and Skin Color

Melanin is a pigment that is created by special cells called melanocytes. It is responsible for the color of our skin, hair and even eye color. The more we



Melanin concentrations are what colors our skin and helps protect us from harmful UV rays.¹

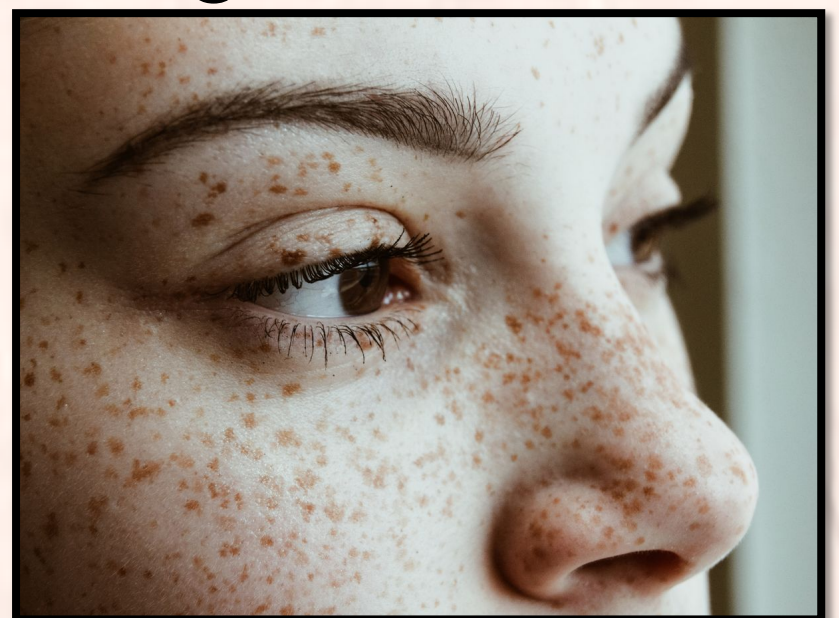
have, the darker our skin, hair, or eye color is, and vice versa! It is also responsible for making sunlight into vitamin D and may also protect from the ultraviolet rays of the sun! Without melanin, our bodies would be more susceptible to damage, especially in the form of skin cancers.



The more melanin that our melanocytes naturally make, the darker our natural skin tone is.²

Occasionally, melanocytes that are evenly spread out overproduce melanin causing freckles.

Freckles may be genetic, but they are often caused by sudden or excessive exposure to the sun. They often fade after a while of less sun exposure.



Freckles can be caused by sun exposure.³

(1) <https://cdn.shopify.com/s/files/1/2028/2057/files/More-Melanin-Mean-Darker-Skin.jpg?v=1580460315>

(2) https://www.communitypsychology.com/wp-content/uploads/2018/02/hand-1917895_1920-resized1-e1519691967883.jpg

(3) <https://hips.hearstapps.com/hmg-prod/images/close-up-of-thoughtful-woman-with-freckles-on-face-royalty-free-image-1589835056.jpg?crop=0.88847xw:1xh:center,top&resize=1200:>

Moles – (The Skin Kind!)

Moles are clusters of melanocytes in the skin. They can have several shapes, but usually they are mostly symmetrical and don't change much. Moles might be present at birth or may appear later in life. The vast majority of them aren't dangerous, but sometimes these can be the sites of the aggressive skin cancer melanoma. There are several ways to tell if a mole may be cancerous. You can use the ABCDE guide to help you know if the mole is something that you should be concerned about:

- A - Asymmetrical (irregular) shape
- B – Border is irregular or notched
- C – Color has changed, or is multiple colors
- D – Diameter is growing
- E – Evolving or changing in some way.

Normal, non-cancerous moles.¹



A mole that has become cancerous.²

(1) <https://eternaldermatology.com/wp-content/uploads/2021/04/->

What_percentage_of_moles_removed_are_cancerous_637544370745968998.png

(2) [https://www.verywellhealth.com/thmb/lvnm0wvm_P6E6QjurFCHHfhqcdI=/1500x0/filters:no_upscale\(\):max_bytes\(150000\):strip_icc\(\)/melanoma-photo4-56a880845f9b58b7d0f2e997-de11bf539dde4156941667d9e1d37a15.jpg](https://www.verywellhealth.com/thmb/lvnm0wvm_P6E6QjurFCHHfhqcdI=/1500x0/filters:no_upscale():max_bytes(150000):strip_icc()/melanoma-photo4-56a880845f9b58b7d0f2e997-de11bf539dde4156941667d9e1d37a15.jpg)

Birthmarks

Birthmarks are marks on the skin that some people are born with. There are several different types of birthmarks, but they can be broken down into two broad categories: pigmented and vascular birthmarks.

Pigmented birthmarks are a larger group of melanocytes than a typical mole. While it may actually look like a very large mole or spot, there are a variety of types of this birthmark. The one thing that is consistent about this type is that this form of birthmark is caused by a pigment in the skin. This is different than a vascular



A pigmented birthmark.¹



A vascular birthmark.²

birthmark, which is a mark created by a bundle of blood vessels near the skin. Neither of these types are usually harmful, but they may be embarrassing to the person with the birthmark if they are visible, and they may be more likely to be the site of skin diseases in the future.

(1) <https://dermskinhealth.com/wp-content/uploads/2022/05/Birthmark-hero.jpeg>

(2) <https://www.sknclinics.co.uk/wp-content/uploads/2018/07/infantile-haemangiomas-scaled-e1613134943140-1024x376.jpg>

Sunshine – Harmful or Helpful?

There is a lot of discussion about the benefits and harms of sunlight. While it is true that sunshine can help to cause skin cancer and other problems because of UV radiation, it is also the natural way we create vitamin D in our bodies. This is created when sunshine hits a special chemical compound in the skin, which is converted to a type of vitamin D. However, the body can't use that version yet, so it is moved to the liver, which changes it into the type that it can use. Vitamin D is important for the creation of healthy bones, proper digestion, and maintaining the balance of the body's chemicals and minerals. Since sunshine helps us make Vitamin D, it is very important! Sunshine can also help to improve our moods, improve sleep, and may actually help to prevent some skin problems like acne!



Sunshine is important for healthy growth.¹

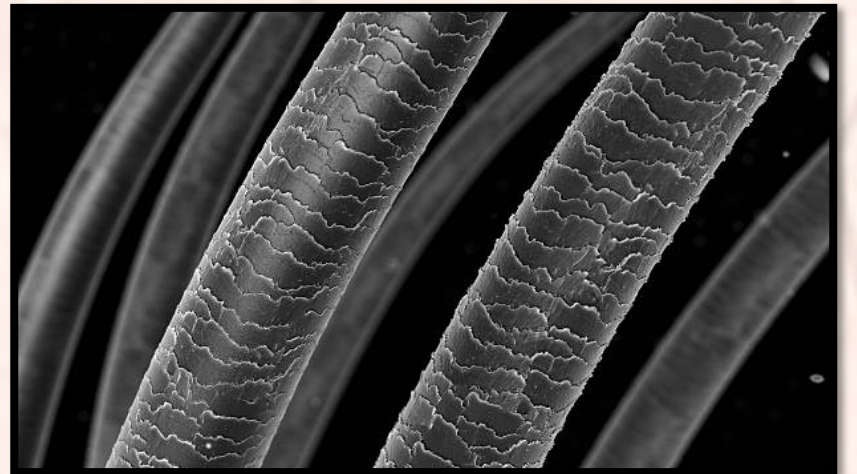
(1) https://media.baamboozle.com/uploads/images/476073/1632074484_446429.jpeg

Hair

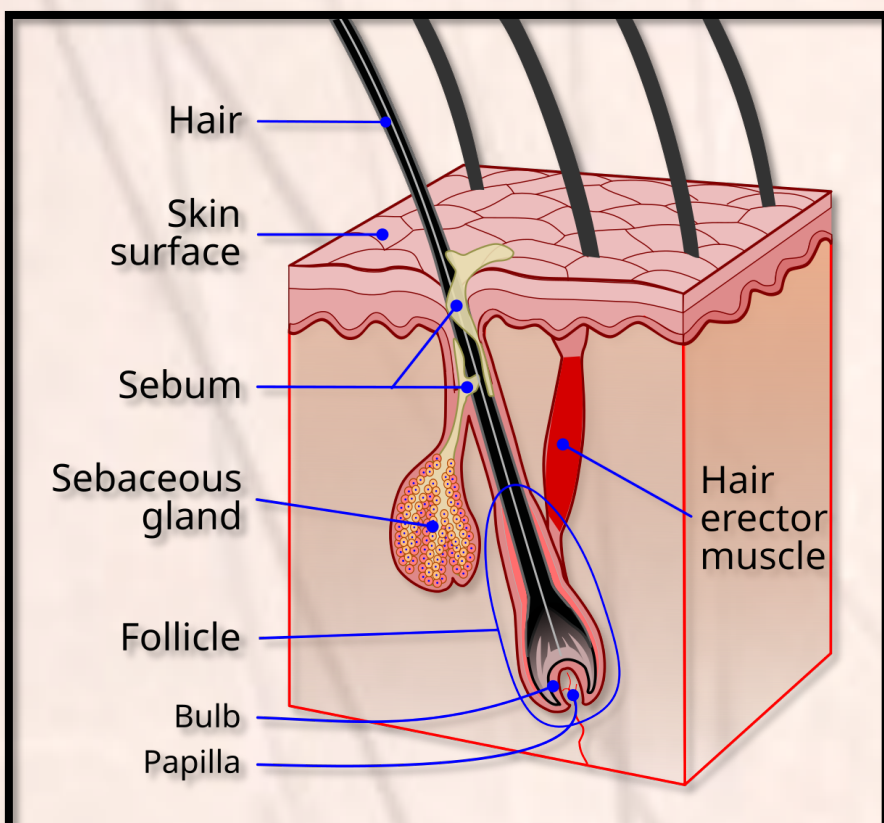
One of the most visible parts of the skin is the hair. Hair has several functions, helping to insulate and cool our bodies, as well as protect our heads from excess radiation. It also can help with touch senses. It even helps to define our appearance! Hair grows out of a hair follicle, a pocket that has a special root, designed to make the cells which the hair consists of. As this hair root makes cells, they are pushed, one on top of the other, away from the root, dying and flattening out.

Healthy hair is important, since it protects the skin under it. Hair that is not

cared for can easily become a problem, causing ingrown hairs, hiding skin problems or lice, covering dandruff, ringworm, and other problems, and looking terrible! Hair that is not properly cared for may become dry, brittle, or may even fall out! Hair care is very important!



Hair under a microscope. Notice the flattened cells stacked one on top of another!¹



A diagram of a hair follicle.²

(1) <https://media.istockphoto.com/id/497686734/photo/hair-under-microscope.jpg?s=612x612&w=0&k=20&c=6WufiikRYQfQPv4aCxGKcseqVfQLefljwEqbdawLk5M=>

(2) https://upload.wikimedia.org/wikipedia/commons/thumb/4/4d/Hair_follicle-en.svg/1200px-Hair_follicle-en.svg.png

Finger and Toe Nails

Finger and toe nails play a special role in protecting the finger's skin, as well as helping pick up objects. Improper care of the nails can lead to ingrown nails, split and broken nails (all which can lead to infection!), odd colors or shapes, and even nail loss.

- Nail roots are where nail growth happens. Special cells similar to the ones that are used in growing of hair push nail cells outward.



A normal fingernail. Can you identify all the parts?¹

- The cuticle is the flap of skin that protects the place where the nail meets the overlying skin.
- Nail bed is the skin underneath the nail, which the nail slides over as it grows.
- The nail's body or nail plate is the biggest part of the visible nail itself. This is the part that protects the fingers and toes.
- The edge of the nail body farthest from the nail bed is called the free edge, and is the part that gets regularly trimmed.

(1) <https://www.disabled-world.com/pics/1/healthy-fingernail.jpg>

Skin Injuries

Abrasions and Blisters



Covering an abrasion helps to keep it clean.¹

Abrasion is another name for a scrape. It occurs when the skin is rubbed over a rough surface, such as the

concrete, scraping off the outer layer of skin, sometimes damaging the lower layers too.

Skinned knees and elbows are great examples of this. For a minor abrasion, wash the wound to fight infection, and cover it with an antibacterial ointment and a Band-Aid. For more serious abrasions, seek medical help.

A laceration is another name for a cut such as a papercut or cut from a knife. Lacerations may cut through all the layers of the skin, making them very serious, but usually, they only affect one or two layers. To treat small lacerations, gently wash out the cut, apply antibacterial ointment, and cover with a Band-Aid. For deeper or longer lacerations, get medical help.



Lacerations can get infected easily and need to be cleaned well.²

(1) https://draxe.com/wp-content/uploads/2019/01/Abrasion_Header.jpg

(2) <https://dan.org/wp-content/uploads/2021/07/Purple-gloved-hand-rubs-a-wound-with-a-white-cloth-to-clean-it.jpg>

Skin Injuries

Blisters and Contusions



Blisters cushion the lower layers of skin from being injured further.¹

Blisters are caused when the skin is rubbed hard or burned in a way that separates the layers of skin. The space between these layers fills with liquid, protecting the

skin below and allowing it to heal. It is typically best not to pop them. If the blister pops or is in a place that makes it necessary to pop, clean the area well, pop the blister carefully, and drain the fluid out. Wash it, and cover it with antibacterial ointment and a Band-Aid.

Contusion is the official name for a bruise. When something hits the body hard enough to damage blood vessels under the skin, the blood pools under the skin if it can't escape, causing the dark blueish-purple patches that we all know. It usually disappears after a few days. To treat a contusion, apply pressure and ice when possible.



Bruises happen because the blood from an injury doesn't have a place to go and pools outside of the vessels.²

(1) <https://npr.brightspotedn.com/legacy/sites/kufm/files/202103/blister-iStock.jpg>

(2) <https://us.123rf.com/450wm/andriano/andriano1711/andriano171100216/90191003-large-bruise-on-human-arm-injection-bruises.jpg?ver=6>

Skin Injuries

Punctures



Stepping on a nail is a common cause of puncture wounds.¹

A puncture is similar to a laceration except that instead of a long cut, it creates a deep hole, often all the way through the skin. Common puncture wounds are some

splinters, stab wounds, and stepping on a nail. While they might not bleed much because the wound is relatively small and fewer blood vessels were damaged, they can be very serious because of their depth. Puncture wounds can be difficult to clean out because they are deep, and infection from whatever made the puncture might easily set in! Also, if the skin around the puncture seals over the hole, the infection can be trapped inside. For minor puncture wounds, remove whatever made the puncture, wash it carefully, apply antibacterial ointment, and cover with a Band-Aid. For more serious or deep punctures, get professional help. You might be told to leave whatever made the puncture inside until the professionals are able to check it over.

(1) <https://media.istockphoto.com/id/1446402302/photo/concept-of-risk-of-nail-injury-and-tetanus.jpg?s=612x612&w=0&k=20&c=jL7iGmT2xMX8caDcKVtyvhh87htKZqQSxLSqbNHPgyI=>

Skin Injuries

Ulcers

Ulcers are sores or wounds that develop by themselves and can happen for a variety of reasons including infections, long-term illness, or immobility. The top layers of skin often fall off, resulting in raw infected areas that are quite painful and might fester. They can be very uncomfortable and may require medical treatment depending on their cause and their seriousness. For a minor ulcer, gently wash out the affected area, apply antibacterial ointment, and cover with a Band-Aid. For more serious or infected ulcers, get medical help.



Certain diseases can make getting an ulcer easier.¹

(1) <https://www.evidentlycochrane.net/wp-content/uploads/2017/10/venous-leg-ulcers-e1508833041133.jpg>

Skin Injuries

Burns

Burns happen when the skin is exposed to excessive heat. There are three levels of burns, 1st degree burns which only burn the Epidermis, 2nd degree burns, which burn through the Epidermis and into the Dermis, and 3rd degree burns, which burn all the way into the Subcutaneous layer.

Burns are serious, because they can cause a loss of fluids, swelling, and the lack of blood pressure, known as shock. Some burns aren't serious, so they are easy to treat. For minor burns, cool the burn, wash it gently, leaving blisters intact, and cover it with a Band-Aid. Make sure to keep the burn area moist! However, any burn that covers more than 10% of the body, or any burn that is on the hands, face, or private areas is a serious burn and should be treated at a hospital.

A sunburn is a common 1st degree burn.¹



2nd degree burns burn into the Dermis.²



3rd degree burns destroy the nerve endings and usually hurt only along the edges.³



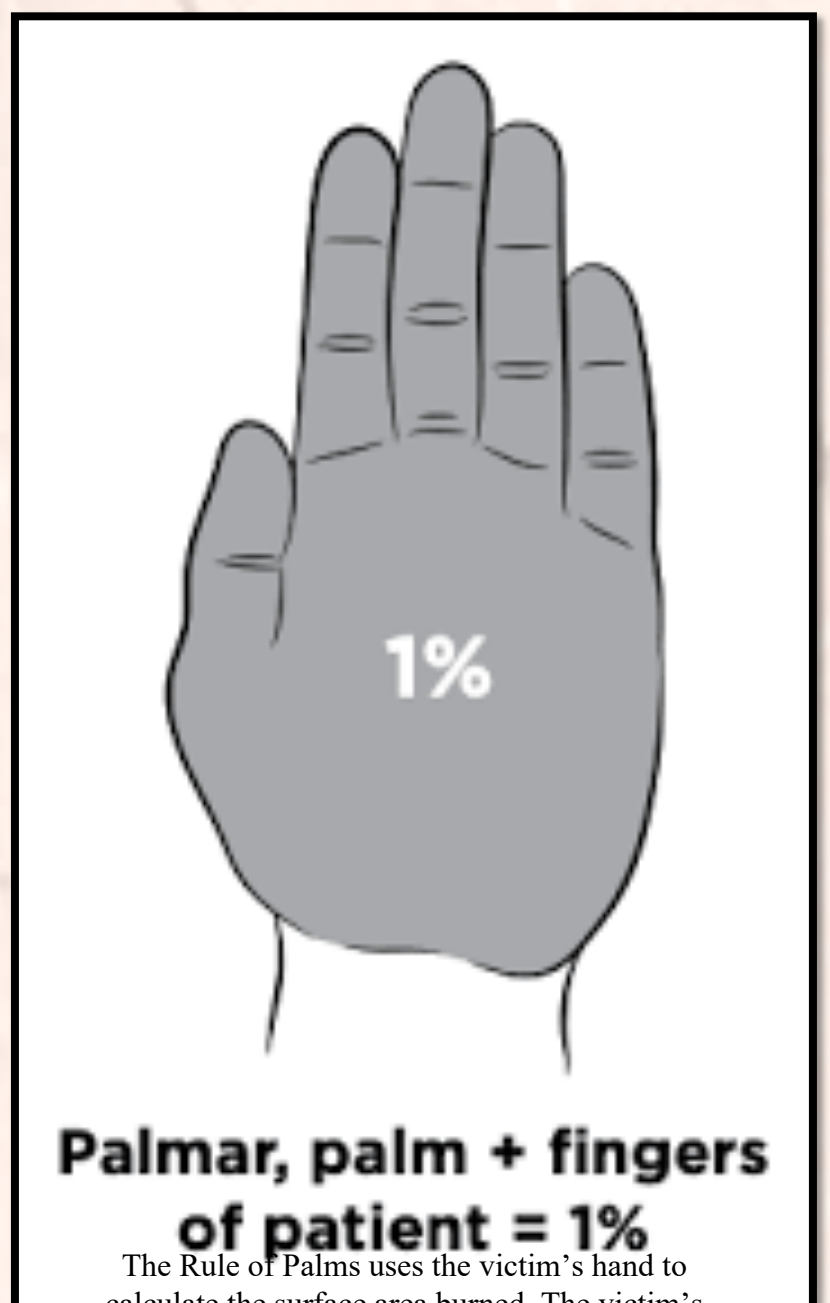
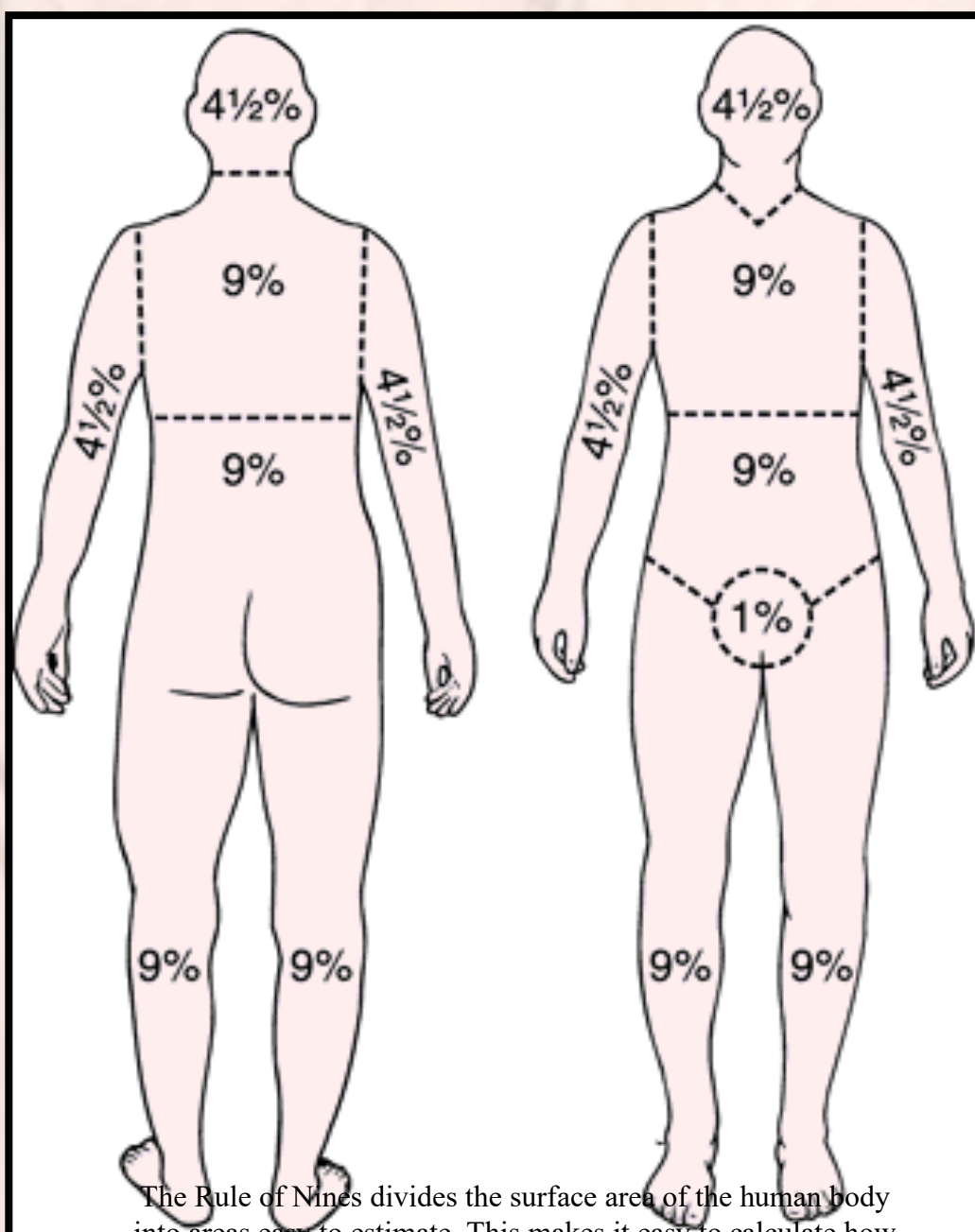
(1) <https://cdn.britannica.com/12/144412-050-68832E22/Sunburn.jpg>

(2) [https://www.verywellhealth.com/thmb/Rdb0_dJ9o5T55HRbhjvGANPmyIo=/3264x2448/filters:no_upscale\(\):max_bytes\(150000\):strip_icc\(\)/image-56a2f5615f9b58b7d0cfd44.jpg](https://www.verywellhealth.com/thmb/Rdb0_dJ9o5T55HRbhjvGANPmyIo=/3264x2448/filters:no_upscale():max_bytes(150000):strip_icc()/image-56a2f5615f9b58b7d0cfd44.jpg)

(3) https://as1.ftcdn.net/v2/jpg/01/22/63/30/1000_F_122633015_ut5Yv4vk6QF1g6vyVqGLqoypyUJcKxJ4.jpg

Calculating Burn Area

When someone is seriously burned, it is important to be able to estimate how much of their body has been burned so that the 911 operators can have an idea of the extent of the burn before EMS arrives. Easy tools to use are the “Rule of Nines” or the “Rule of Palms.”



Knowing how much surface area has been burned can tell first responders how urgent and what tools are needed to best care for the burn victim.

(1) <https://img.tfd.com/mk/R/X2604-R-27.png>

(2) <https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcRqoiLKUt7gTQ0b6c706C7du8Qb8dAJIuMYyy6L5G5-7W5pfJa2f-J5TFNG5Jq7Puj61U4&usqp=CAU>

The Skin's Healing Process



When the skin is damaged, the body prioritizes stopping the bleeding by tightening the blood vessels around the injury, cutting off their blood flow. Then, a part of the blood, the platelets, seals off the leak, attaching to the edges of the injury and to each other, forming a net that other blood-clotting agents and blood cells get caught in.

Then the area around the injury becomes inflamed, helping to prevent further blood loss, as well as providing a place for white blood cells to take up a defense, and for the repair of the skin to take place. Finally, the body begins a rapid repair, new skin growing from the outside edges inward.

Sutures, also known as stitches, can help the healing process by holding the edges of the wound together and making it easier for the body to close the wound.

Sutures help the body heal by holding the edges of the injury together.²



(1) <https://www.firstaidproadelaide.com.au/wp-content/uploads/2022/01/Untitled-design-70-1024x577.png>

(2) https://bewellic.com/wp-content/uploads/2020/07/Suture-Staple-Removal_.jpg

What the Skin Tells Us

The integumentary system tells a lot about a person. When meeting someone for the first time, we don't have much time to make a good first impression and our skin, hair, and appearance plays a major role in how people see us. Not only does it help to display emotions, but it can also show our health and wellbeing, our history through scars, and even our self-expression! This is why it is so important to keep our integumentary system in good health. Some ways we can do this is by:

- Eating a healthy diet
- No smoking
- Exercise
- Get good rest
- Manage stress
- Minimize makeup use
- Do not pick off scabs
- Keep it clean and moist
- Limit time in the shower
- Take care of wounds immediately
- Avoid excess sun exposure or wear sunscreen
- Avoid exposure to harsh chemicals or soaps



Healthy skin tells a lot about us!¹

(1) https://hips.hearstapps.com/hmg-prod/images/skincare-1588698347.png?crop=0.668xw:1.00xh;0.191xw,0&resize=1200:*

The Bible and Our Skin

The Bible talks a lot about the skin. One of the most common references to the skin involves instructions for those who suffered from chronic skin diseases such as leprosy. Other references include many times in the books of Job and Psalms, where descriptions of poor skin are used to demonstrate extreme need. The Bible also uses the skin as a demonstration of healing and forgiveness, both physically and spiritually.

The integumentary system acts as the body's primary defense, acting as a barrier against those things that would hurt us. The Bible is like that, a defense for our spiritual lives and protection against things that may harm us spiritually!



What other spiritual lessons can you learn from our integumentary system?

(1) <https://dailytrust.com/wp-content/uploads/2021/08/jesus-and-the-leper.jpg?w=640>



Name(s): _____

Date: _____

The Integumentary System

1. Fill in the blanks from the word bank to complete the statement:

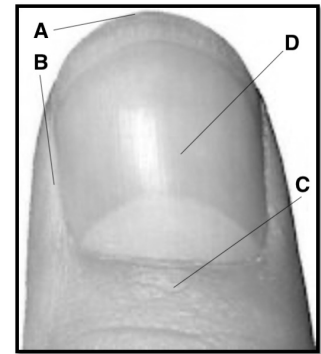
- The skin creates _____ using sunshine.
- The color of our skin is due to _____, special pigment cells.
- The bottom layer of skin is called the _____ layer.
- Most sensory receptors can be found in the _____.

Word Bank:

Subcutaneous Melanocyte
Dermis Mole Freckle
Vitamin D Epidermis

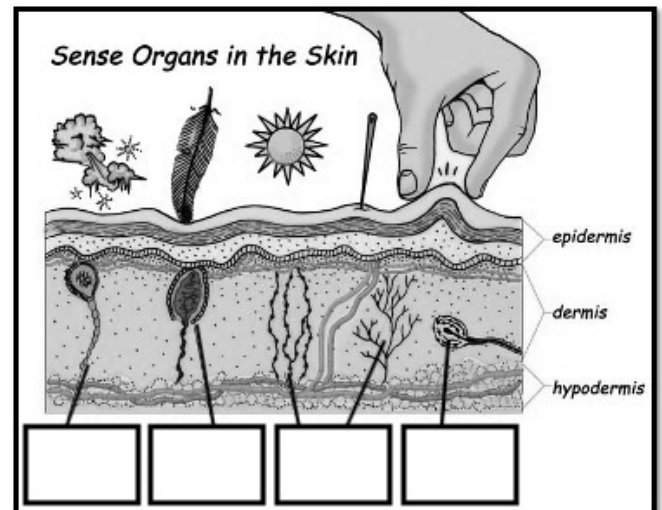
2. Label the following parts of a fingernail with the corresponding letter from the diagram:

_____ Nail Bed _____ Free Edge
_____ Nail Body/Nail Plate _____ Cuticle



3. Match the following injuries to their descriptions or examples:

- | | |
|------------------|-----------------------------------|
| _____ Contusion | a. A scraped knee |
| _____ Laceration | b. Stepping on a nail |
| _____ Blister | c. A very painful suntan |
| _____ Puncture | d. A bruise |
| _____ Abrasion | e. A papercut |
| _____ Burn | f. Pocket of fluid under the skin |



4. Label the image to the right with the letter of the corresponding sensory receptor:

- a. Nociceptor b. Thermoreceptor c. Pacinian Corpuscle d. Meissner's corpuscle

5. Create your own Biblical parallel or object lesson from what you know about the integumentary system:

