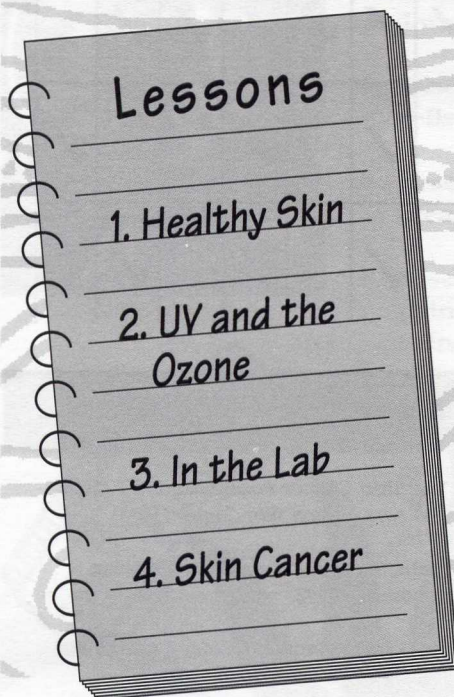


FOCUS: SUN AND SKIN



Why do a unit on skin?

It's current. Rising skin cancer rates have triggered a recent boom in skin research and related fields of science and medicine. More people are overexposing themselves to the sun. A declining ozone layer may be contributing to the problem.

Relevant. We all have skin; we all use laboratory-tested skin products every day. Four out of five students suffer from acne. Rapid advances in research have produced new treatments for many skin conditions.

Exciting. Expect more therapies and discoveries. Also expect that your students may be responsible for these advances. New career opportunities in skin research include a rising field called photobiology (the effects of light on living organisms)



CURE

Connecticut United for Research Excellence, Inc.
Connecticut's BioScience Cluster

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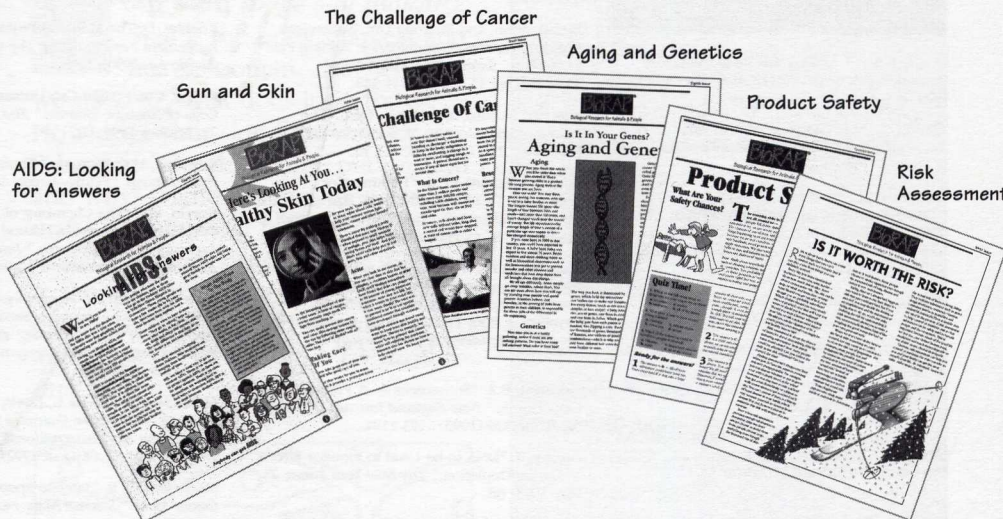
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Curriculum Chart: Sun And Skin

LESSON	scientific method	biology	chemistry	physics	earth	science health	environment	social studies	math	language arts	careers
1 HEALTHY SKIN		✓				✓		✓	✓		
2 UV RAYS AND THE OZONE LAYER		✓	✓	✓	✓	✓	✓	✓	✓	✓	
3 IN THE LAB	✓	✓	✓	✓		✓		✓			✓
4 SKIN CANCER		✓				✓		✓		✓	

Classroom Resources

American Academy of Dermatology, Schaumburg, IL. *Melanoma/Skin Cancer: You Can Recognize the Signs.* 1992.

American Cancer Society, Atlanta, GA. *Cancer Facts & Figures — 1993.*

National Cancer Institute. *What You Need to Know About Melanoma* (1993): NIH Publication No. 93-1563. *What You Need to Know About Skin Cancer* (1992): NIH Publication No. 92-1564. *Skin Cancers: Basal Cell and Squamous Cell Carcinomas Research Report* (1990): NIH Publication No. 91-2977.

The Skin Cancer Foundation. *It's Never Too Early to Stop Skin Cancer* (1985).

Stein, Sara, *The Body Book,* Workman Publishing; 1992.

Van Cleave, Janice. *Biology for Every Kid.* John Wiley & Sons; 1990.

For free information about preventing skin cancer, acne, and other skin diseases, contact: The American Academy of Dermatology, 930 N. Meacham Rd., P.O. Box 4014, Schaumburg, IL 60168-4014; (847) 330-0230.

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What's New In Skin Research

Increasingly, researchers are studying how skin acts to maintain our health and well-being. Their focus is health promotion and disease prevention:

- ▶ Discoveries by photobiologists (scientists who study the effects of light on cells) are leading to treatments for many skin diseases.
- ▶ Research is also aimed at developing better products to protect skin—acne creams and sunscreens, for example.
- ▶ Researchers are learning more about how nociceptors (NOH sis sep tors), pain processing cells in the skin, receive and transmit signals to the spinal cord and brain. This knowledge may lead to new therapies to reduce chronic pain.
- ▶ Researchers are trying to identify genes and proteins that regulate the growth of both healthy and abnormal melanocytes (cells that make the skin pigment melanin). This knowledge may lead to new therapies to prevent or stop melanoma, a type of skin cancer.



Read, Think, and Discuss

H **healthy Skin Today** (page 1 of BioRAP): Discuss the concept: skin is a mirror of your health. What messages does skin “reflect”? Can your skin tell you if a person is hot or cold (goose-bumps)? Tired (bags under eyes) or wide awake? Healthy or ill? Embarrassed? An outdoor or indoor person? What else?

What does “healthy” skin look like? Is a tan healthy or unhealthy? Why? How many students have had a sunburn? What does it feel like? (Note: Dark-skinned people burn, but not as easily or noticeably as light-skinned people.)

After reading the “Healthy Skin” article, discuss how and why skin can become unhealthy. Which people are more prone to skin cancer? (Un-protected sun bathers, light-skinned people, or those who

live where the ozone layer is thinning). Why is some skin darker than others? What makes people tan? What causes acne?

Y **our Skin** (page 4 of BioRAP): Skin is the body’s largest and heaviest organ. Ask: Why do we need it? What does it do for us? How does your skin fight infection? What products do people put on skin and why? (Hand lotions, sunscreens, make-up, ointment for wounds, etc.) Which products protect skin? What’s in them? Have students bring in skin products; research and discuss the ingredients. (See Lesson 2: UV Rays and Ozone.)



Learning Objectives

- ✓ Observe skin to understand its structure and function
- ✓ Identify health hazards and diseases of skin
- ✓ Discuss prevention and treatment of these diseases, including biological research that results in new skin care products

Investigate! Investigate! Investigate!

Skin Sleuth: Have students closely examine their skin with a magnifying glass to learn more about its structure and function. Identify and draw: wrinkles, lines, hair, mole, freckle, birthmark, blackheads, pimples (infected by bacteria), scar, callus, wart, rash, goosebumps, cut, scratch, burn, scab, bruise, and so on.

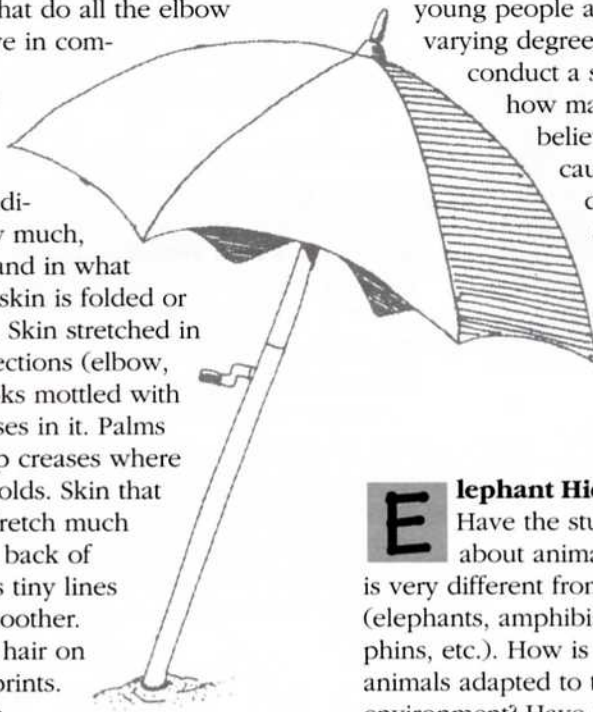
Ask: Where is skin thicker? (Back, soles of feet, palm of hand.) Soft and flexible? (Eyelids, between fingers.) Students can check for oil (a substance called sebum) by wiping tissues on the forehead, forearm, etc. or dropping water on skin to see if oil keeps it from penetrating. Why is skin oily? (To form a waterproof seal.)

Skin Prints: Making fingerprint-like rubbings of skin parts can reveal a lot about how we use our skin. Assign students to work in teams of two. Distribute clear tape, pencils, and paper towels for clean-up. (You may substitute an ink pad for pencil rubbings, but it takes a little practice to get un-smudged prints.)

Discuss the "Think About It" questions. (See below.) Have students make various skin prints. First, com-

pare differences in prints by group. Do any two palm prints look alike? (Each person's skin pattern is unique.) Then discuss common elements. What do all the elbow prints have in common, for example?

The skin pattern indicates how much, how far, and in what direction skin is folded or stretched. Skin stretched in many directions (elbow, knee) looks mottled with little crosses in it. Palms have deep creases where the skin folds. Skin that doesn't stretch much (forearm, back of hand) has tiny lines and is smoother. Compare hair on the skin prints. Does hair grow everywhere? (The palm has no hair; the forearm has plenty, for example). Which prints show large pores (the nose, for example)? Why are knuckles so wrinkled? Why are elbows rough? Based on their observations, would students be able to identify the origin of a skin print just by looking at it? How?



Acne Everywhere: Students may be embarrassed by acne, but as the Healthy Skin article in *BioRAP* points out, 80% of young people are afflicted to varying degrees. Have students conduct a survey to find out how many students believe certain foods cause acne (they don't). How could students debunk this myth scientifically? (For more on acne treatments, see Lesson 3: *In the Lab.*)

Elephant Hide/Rabbit Pelt: Have the students brainstorm about animals with skin that is very different from human skin (elephants, amphibians, sharks, dolphins, etc.). How is the skin of animals adapted to their particular environment? Have students design a make-believe animal. It may have scales, plates, fur, feathers, coarse and thick skin, etc. Where does the make-believe animal live, and how do its skin adaptations allow it to live there? (For example, armor protects from predators, fur protects from cold, color can camouflage.)

Making Skin Prints

Skin prints are like fingerprints. They show the pattern of skin on your wrist, elbow, and other body parts. In this experiment, you'll make and compare skin prints from different parts of your body. Then you'll compare your skin prints to those of your classmates.

ROUND IT UP

blank paper pencil
clear tape soap and water

THINK ABOUT IT

Does all of your skin look alike? If not, how and why does it differ?

DO IT

- 1 Rub a pencil back and forth on paper. The pencil smudge should be about the size of your palm.
- 2 Rub the inside of your wrist in the smudge until it's black.
- 3 Lay a piece of tape over your wrist. Then gently lift the tape; it will have a print of your skin.
- 4 Tape your skin print onto a piece of paper and label it "wrist."
- 5 Make prints of your elbow or knee, top of your forearm, knuckles, and nose. Then clean your skin with soap and water.

REVIEW IT

On a separate paper, describe each print in detail. Pretend you're talking over the phone to someone who can't see the print. Identify pores, hairs, moles, or other skin features. What else makes each skin print unique?

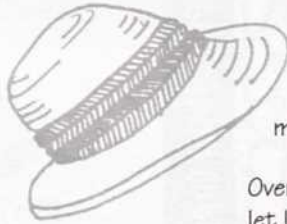
Form a hypothesis to explain why different parts of the skin have different patterns of lines and wrinkles.



FACT SHEET

More than Skin-Deep

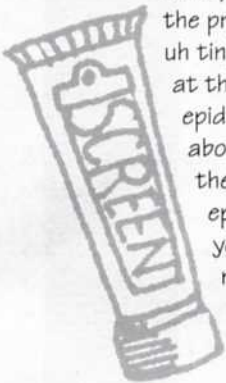
"It's only skin-deep" is a saying that belies a wealth of scientific truth. Human skin, only a few millimeters thick, contains a universe of highly specialized cells—about 20 million per square inch of skin. These cells act to maintain the health and well-being of the entire body. The story of human skin is told in two layers: **epidermis** (the upper layer that's as thin as a sheet of paper) and the **dermis** (the underlying layer that ranges from 15 to 40 sheets thick).



Ask students to name things that are inside skin. Hair is easy; you can see it from the outside. What else is there and how do you know? What evidence of skin parts can you see, feel, smell, or infer? Have students draw a cross section of the dermis and label the parts. Make an overhead transparency of the "Parts of the Skin" reproducible on page 4. Discuss the parts and have students revise their drawings.

The Epidermis

The epidermis consists primarily of cells called **keratinocytes** (care uh TIN oh sites) because they contain the protein keratin (CARE uh tin). Keratinocytes form at the bottom layer of the epidermis. Over a period of about 30 days, they push their way to the outer epidermal layer. As young keratinocytes migrate to the skin's surface, they displace their older, dying counterparts,



which flake off or are brushed or washed away. In this way, humans literally shed their skin. Most people lose a layer of keratinocytes every month or so.

The skin's pigment-forming cells, the **melanocytes** (mel AN OH sites), are at the base of the epidermis. They contain melanin, the protein that determines skin color. In general, the more melanin, the darker the skin. But whether a person's skin is light or dark depends on various factors, in particular inherited genes that direct the quantity and quality of melanin production.

Overexposure to both types of ultraviolet light (UVA and UVB) stimulates melanocytes to produce extra melanin, creating a tan. Scientists believe excessive sun exposure, along with genetics, may play a role in the type of skin cancer known as melanoma, where the melanocytes become cancerous and produce a tumor. If the melanoma tumor spreads to vital organs, such as the heart, lung, brain, or liver, death can result. (See Lesson 4: Skin Diseases for more on skin cancer.)

The Dermis

The dermis lies beneath the epidermis. In addition to connective tissue, the dermis contains blood vessels and nerve cells that penetrate the **subcutaneous** tissue. (Subcutaneous tissue exists beneath the skin and connects to underlying muscles, bones, and tissue.) The dermis also contains **hair follicles**, **sweat glands**, and **sebaceous glands**, which produce the oily substance called sebum.

Sweat glands are found in almost every part of the body, especially the palms of the hands and the soles of the feet. These glands contain spiraling ducts that ascend through the dermis and epidermis and end as skin pores: openings through which sweat evaporates. By

perspiring, the body rids itself of nitrogen-containing waste and sodium chloride, or salt. Perspiration also helps the body eliminate excess heat.

Functions of the Skin

A basic purpose of skin is to provide a waterproof, protective covering for the body's complex internal environment. The skin also plays key roles in helping to maintain the circulatory and nervous systems.

Because it contains thousands of small blood vessels, or capillaries, the skin helps transport blood throughout the body. In addition to providing oxygen and nutrients to cells within skin layers, the skin's blood vessels aid in regulating body temperature. By expanding on a hot day, skin capillaries help the body to shed internal heat. On a cold day, constricting capillaries help the body to retain heat.

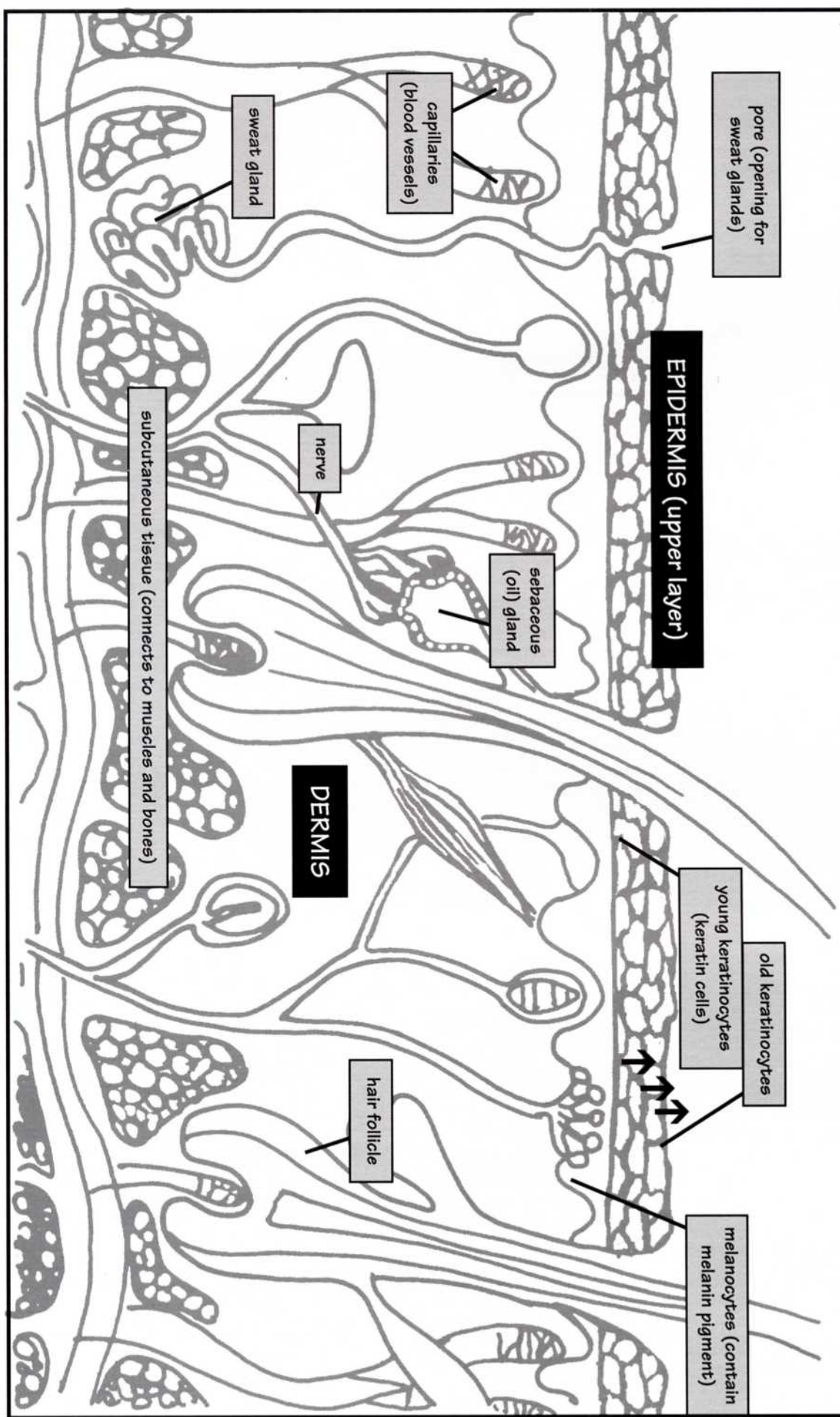
Nerve cells in the skin form the body's first contact with the outer world. At the moment of birth, an infant's first experiences of the physical world are perceived through the sense of touch. Through nerve cells, the skin receives and transmits signals for touch, pain, and change of temperature.



UV rays from the sun stimulate a biochemical process that converts a body chemical in the skin to vitamin D. Vitamin D helps the body absorb calcium.

The skin is also a major contributor to the body's immune system. In addition to being the first line of defense in keeping out bacteria, viruses, and other organisms that invade the body, the skin is home to enormous quantities of T-lymphocytes, or T-cells. T-cells attack and destroy bacteria, fungi, viruses, parasites, toxins, and cancerous cells that can cause disease.

PARTS OF THE SKIN



pore (opening for sweat glands)

EPIDERMIS (upper layer)

capillaries (blood vessels)

sweat gland

sebaceous (oil) gland

nerve

subcutaneous tissue (connects to muscles and bones)

DERMIS

young keratinocytes (keratin cells)

old keratinocytes

melanocytes (contain melanin pigment)

hair follicle

