Skin Under the Microscope: NYSSLS Alignment

Teacher guide for the student worksheet at mrsajdak.com/skin-layers (two pages, 20 questions; Day 1 on the front, Day 2 on the back; a low-write version has the same numbers). Anatomy & Physiology, Hole's Essentials 6.2: Layers of the Skin. Day 1: Layers of the Skin (AP.3.6.2), tabs 1 and 2. Day 2: Layers of the Epidermis and Dermis (AP.3.6.3), tabs 3 and 4. © 2026 Ryan Sajdak. Free to use, share and change under CC BY-NC-SA 4.0 (creativecommons.org/licenses/by-nc-sa/4.0): give credit, do not sell it, share your version the same way.

Objectives

The same four statements are printed on the worksheet, two at the top of each day, each with a box to tick. They are the lessons' own statements. Day 1 matches AP.3.6.2: identify the layers of the integument and describe the role of each. Day 2 matches AP.3.6.3: identify and describe each layer of the epidermis and dermis. Q20 pulls both Day 2 statements together.

Day	I can	Questions
1	identify the epidermis, dermis and subcutaneous layer on a slide and describe the role of each.	1, 4, 6
1	measure skin layers with a microscope scale and explain why skin is thicker in some places.	2, 3, 5, 7 to 10
2	identify the five strata of the epidermis and what happens to a cell in each.	11 to 15
2	tell the papillary from the reticular layer and explain how each one's build fits its job.	16 to 19

Performance expectations: building toward

The lab and worksheet give students evidence for these performance expectations. They are one step on the way, not a full assessment of any one of them.

> **HS-LS1-2**
> *"Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms."* Worksheet link: students work down the levels of one organ: the skin's layers (Q1), the strata inside the epidermis and the two layers of the dermis (Q11, Q16), and the cells in them (Q12, Q13), tying each level to the job it does (Q6, Q10, Q19).

> **HS-LS1-3**
> (the plan book's tag) *"Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis."* Worksheet link, partial: students choose the right objective to measure each layer (Q3, Q5) and see the epidermis held at a steady thickness while cells are lost from the top and replaced from the bottom (Q12, Q15). The lab does not model a feedback loop itself.

> **HS-LS1-1**
> (the plan book's tag) *"Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells."* Touched only: keratinocytes are specialized cells whose job ends in one protein, keratin, which fills the cell as it dies (Q13). DNA is not modeled.

DCI LS1.A: *"Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level." "Systems of specialized cells within organisms help them perform the essential functions of life."*

Part by part

Part	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	What students do
Day 1 · 1. Virtual	SEP 3 Planning and carrying out investigations SEP 4 Analyzing and	LS1.A structure and function;	Scale, Proportion, and Quantity;	Focus the slide, identify the three layers on thin (forearm) and thick (palm) skin, and measure the epidermis and dermis

microscope Q1 to 6	interpreting data SEP 5 Using mathematics and computational thinking	hierarchical organization	Structure and Function	with a 50-division eyepiece scale (50, 20, 5 µm per division at 4×, 10×, 40×), choosing the objective that fits each layer and converting divisions to µm and mm. Then send a scrape, a cut and a deep cut into each slide: the same 0.3 mm cut bleeds on the forearm and stays in the bloodless epidermis on the palm.
Day 1 · 2. Body map Q7 to 10	SEP 4 Analyzing and interpreting data SEP 5 Using mathematics and computational thinking	LS1.A structure and function	Patterns; Structure and Function	Compare epidermis and dermis at six sites drawn to the same scale, then re-sort by each layer. The epidermis is thickest where skin is rubbed (palm, fingertip, sole: thick skin); the dermis is thickest on the back, which is pulled but not rubbed.
Day 2 · 3. Inside the epidermis Q11 to 15	SEP 2 Developing and using models SEP 4 Analyzing and interpreting data	LS1.A specialized cells	Stability and Change; Structure and Function	Identify the five strata (lucidum in thick skin only), then follow one keratinocyte from the stratum basale to the day it flakes off (about 4 weeks in thin skin): it flattens, fills with keratin and dies in the granulosum. Overlays show melanocytes in the basale and food and oxygen diffusing up from dermal capillaries into the avascular epidermis.
Day 2 · 4. Inside the dermis Q16 to 19	SEP 3 Planning and carrying out investigations SEP 4 Analyzing and interpreting data	LS1.A structure and function	Structure and Function	Find seven structures (papillary layer, dermal papilla, capillary loop, tactile corpuscle, reticular layer, sweat gland, lamellated corpuscle), with an elastic-fiber stain to switch on. Pull strips of papillary dermis, reticular dermis and tendon along and across: dense irregular tissue is strong both ways, dense regular tissue only one way. Count friction ridges in a 5 mm box.
Wrap it up Q20	SEP 6 Constructing explanations SEP 7 Engaging in argument from evidence	LS1.A	Stability and Change	Claim, evidence and reasoning: tattoo ink lasts because it sits in the dermis, which stays, rather than the epidermis, which renews every few weeks.

Using it with the lessons

- **Day 1 (Layers of the Skin):** tab 1 is the Explore (find, measure, injure); tab 2 is the Elaborate. Front of the worksheet only. The Day 1 lesson's follow-along sheet records the same measurements, so a class can use either sheet.
- **Day 2 (Layers of the Epidermis and Dermis):** tabs 3 and 4, back of the worksheet. Q20 closes the tattoo question the Day 1 lesson opens.
- **Not here on purpose:** hair, nails, glands and pigment are seen on the slides and named, but each has its own later lesson.

Also in play

- **Explore, then explain, then apply:** each part starts with data questions (Q1 to 4, Q7 and 8, Q11 to 13, Q16 to 18). A READ FIRST line on the sheet then sends students to the **Learn It** box on that tab of the lab, which opens once they have the data, before the questions that use the ideas (Q5 and 6, Q9 and 10, Q14 and 15, Q19 and 20). The slideshow has a matching Learn It slide at each of those points. Taught there: the job of each layer and that only the dermis has

blood vessels, why a stronger lens gives a better count; thick and thin skin, the epidermis taking wear and the dermis taking pull; diffusion, keratinization, and cells made as fast as they are lost; fibers strong along their length, dense regular against dense irregular tissue, papillae setting the ridges, and the dermis not being shed.

- **Key terms:** epidermis, dermis, subcutaneous layer (hypodermis), thick skin, thin skin, stratum basale, spinosum, granulosum, lucidum, corneum, keratinocyte, keratin, keratinization, melanocyte, avascular, papillary layer, reticular layer, dermal papilla, friction ridge, collagen, elastic fiber.
- **Real numbers, rounded:** epidermis about 0.05 mm (eyelid), 0.07 (forearm), 0.08 (back), 0.4 (palm), 0.5 (fingertip), 1.0 (heel); dermis about 0.4, 1.2, 3.0, 1.5, 1.2, 2.0 mm. Sources: Kolarsick et al. 2011 (epidermis 0.05 mm eyelid to 1.5 mm palm and sole), Lintzeri et al. 2022 meta-analysis (periorbital 53 µm, palm 183 µm, fingertip 520 µm, plantar foot 597 µm), and 50 MHz ultrasound in 74 adults (dermis: forearm 1.6 mm, back 2.9 mm). Keratinocyte trip: about 4 weeks (OpenStax A&P 2e: the stratum corneum is replaced in about 4 weeks; published estimates run to about 8 weeks and slow with age). Friction ridges about 0.5 mm apart.
- **Simplified on purpose:** 50-division eyepiece scale; thicknesses fixed at the scale line; one injury depth per button; pull-test forces are model values for a 10 mm by 0.5 mm strip that keep the real contrasts (reticular much stronger than papillary; dense irregular strong both ways, tendon one way). The page says so.

Standards text quoted from the New York State P-12 Science Learning Standards, High School Life Science (NYSED). The answer key is a separate file, kept off the public site.