

See Lecture Question #'s 2, 16, and 18

\_\_\_\_\_ Teacher initials for procedures \_\_\_\_\_ Teacher initials for data collection

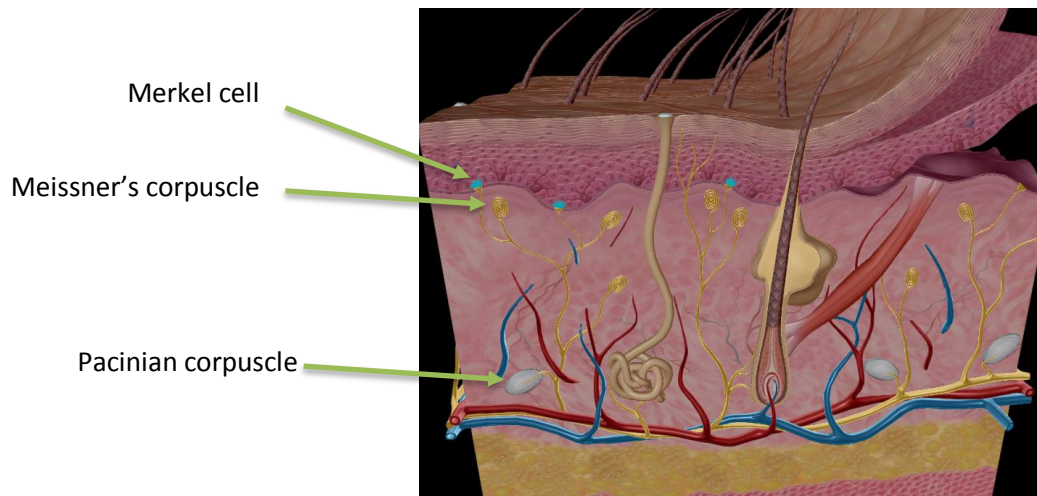
## How are touch receptors distributed in the integumentary system?

Annotate text and answer questions 1-9

Annotating Text	
<input type="checkbox"/>	<b>UNDERLINE</b> concepts you think might be useful for understanding or solving the problem
<input type="checkbox"/>	<b>Box</b> information you think might be helpful for designing your investigation
<input type="checkbox"/>	← Write <b>notes</b> in the left margin
<input type="checkbox"/>	→ Write <b>questions and answers</b> in the right margin
Each paragraph (including each step of the procedures) must have something underlined or boxed, <b>AND</b> have something written in the margins (a question and/or note).	

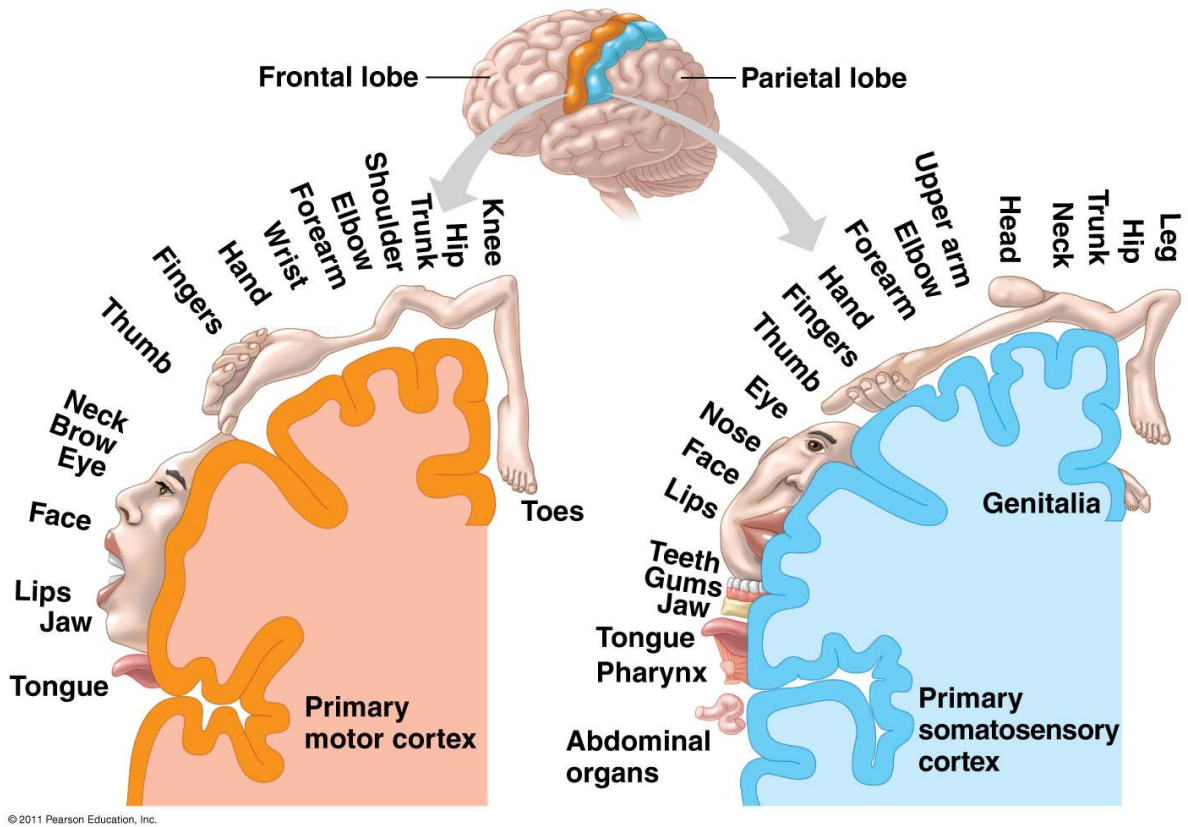
### Introduction:

One of the many functions of the integumentary system is to help the nervous system monitor and respond to the external environment. It contains Merkel cells located at the basal layers of the epidermis, which sense extremely small pressure changes in superficial layers of the epidermis (see question #18 lecture). These mechanoreceptor cells relay pressure information to sensory neurons, but are not directly linked to muscle activation. In addition to Merkel cells, the integumentary system has Meissner's corpuscles and Pacinian corpuscles. Meissner's corpuscles are sensory neurons with a mechanosensitive end embedded in the superficial layers of the dermis, and Pacinian corpuscles are sensory neurons with mechanosensitive ends embedded in deep layers of the dermis. As a result, Pacinian corpuscles respond to deep pressure changes and Meissner's corpuscles respond to superficial pressure changes, and both are directly linked to muscle movement.



The smallest distance at which two points of contact can be felt is **the two-point threshold**. **Tactile localization** is the ability to determine which portion of the skin has been touched. Sensory neurons bring information to the sensory cortex of the brain. The sensory cortex is located within the frontal lobe of the cerebral cortex. Each body region maps onto a portion of the sensory cortex. The human homunculus below illustrates where within the sensory cortex and how much of the sensory cortex is dedicated to each body region

The motor cortex is located within the parietal lobe of the cerebral cortex. It sends motor information to body regions based on the interpretation of sensory information.



### Your Task

To design and carry out an experiment to determine how touch receptors are distributed within the integumentary system.

**Procedure:**

Determining the Two-Point Threshold

- 1) Have your partner close their eyes
- 2) Touch your partner with the caliper arms and ask them if they feel one or two points
- 3) Continue with this testing procedure until the subject reports that 2 points of contact can be felt

Testing tactile localization

- 1) Have your partner close their eyes
- 2) Touch the subject with a black dry erase marker
- 3) Now allow the subject to try to touch the exact point with a red dry eraser marker
- 4) Measure the error of localization

To determine *what type of data you will need to collect*, answer the following questions:

1. What will serve as your dependent variable?
2. What body regions will you need to measure during your investigation? **Use appropriate anatomical language.** See question #2 notes.

To determine *how you will collect your data*, think about the following questions:

3. What types of body regions will you need to test and how will you do it?
4. How many trials will you need?
5. How will you make sure that your data are of high quality (i.e., how will you reduce error)?

6. How will you keep track of the data you collect and how will you organize the data?

To determine *how you will analyze your data*, think about the following questions:

7. How will you determine if there is a difference between body regions?

8. What type of calculations will you need to make?

9. What type of chart could you create to help make sense of your data?

### **\*Your data must include mean and range bars**

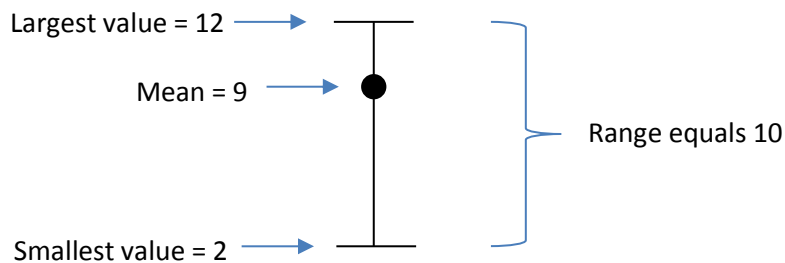


Figure 1

### **Crosscutting concepts**

Keep the crosscutting concepts in mind as you complete your investigation

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
- Empirical evidence is needed to identify patterns.
- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
- The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

Be able to answer the following questions

- How did you collect your data? Why did you use that method? Why did you collect those data?
- What did you do to make sure the data you collected are reliable? What did you do to decrease measurement error?
- What did you do to analyze your data? Why did you decide to do it that way? Did you check your calculations?
- Is that the only way to interpret the results of your analysis? How do you know that your interpretation of your analysis is appropriate?
- Why did your group decide to present your evidence in that manner?
- What other claims did your group discuss before you decided on that one? Why did your group abandon those alternative ideas?
- How confident are you that your claim is valid? What could you do to increase your confidence?

Investigation Proposal TGB Version

Guiding Question:

Claim:

Alternative claims:

Method:

What data will you collect?

How will this data help you answer the guiding question?

Data table(s) and chart(s)

Guiding Question:

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Our Claim:

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**Our Evidence:**

Analysis: break it down (Illustrate and describe your data)

**Our Justification of the Evidence:**

Use your scientific knowledge and analysis to support your interpretation

Interpretation: What does the analysis mean?



## Check out questions

1. Was there a difference in the distribution of Merkel cells, Pacinian corpuscles, and Meissner's corpuscles? Explain why or why not.
2. The investigation that you just completed is an example of an experiment. True or False Explain your answer, using information from your investigation.
3. Scientists often try to explain the underlying cause for their observations. Explain why this is important, using an example from your investigation.
4. Structure and function are related in living things. Explain how, using an example from your investigation.