Kidneys

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Kidneys EN_1
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Introduction:

In this experiment, you will investigate how the kidneys handle fluid loads. These include water alone, and isosmotic salt and monosaccharide solutions, as well as a hyperosmotic monosaccharide solution.

Claude Bernard (1813 - 1867) - the first to express the concept of the constancy of the internal environment.

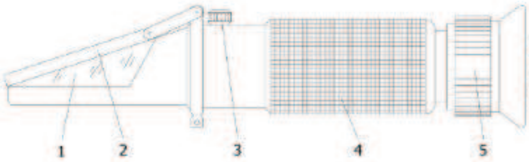
Carl Ludwig (1816 - 1895) - a pioneer of renal physiology.

Learning Objectives

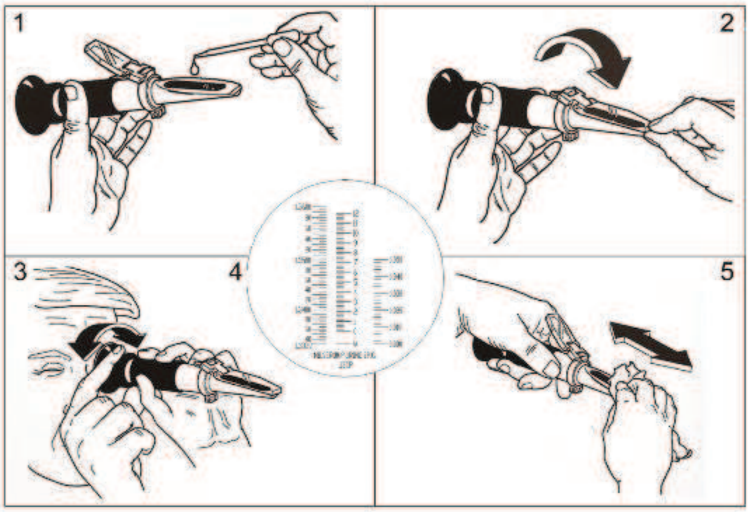
By the end of today's laboratory you will be able to:

- Describe how the kidneys handle a water load
- Distinguish between the handling of water and isosmotic salt loads
- Explain the pattern of fluid excretion following isosmotic and hyperosmotic monosaccharide loads
- Discuss the relationship between urine osmolarity and specific gravity and how osmolarity is affected by changes in urine flow rates

Refractometer RUR2-ATC

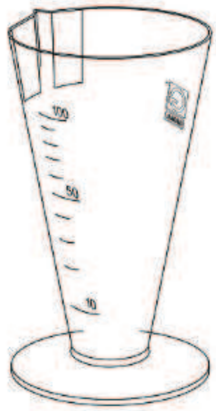


1. Optical prism
2. Translucent cup
3. Calibration screw
4. Rubber handle
5. Eyepiece with focus



Equipment:

Refractometer, urine collection container, urine transfer pipette to refractometer, test strips, measuring container and paper napkins.



Urine collection container

Test strips

Pipete

Urine measuring container

1. Applying a drop of urine to the prism of the refractometer.
2. Covering the prism with a transparent cup.
3. Reading the measured value from the scale.
4. Cleaning the prism (be careful not to scratch the prism).

Procedure:

This laboratory involves the collection of urine at various time intervals and measurement of its volume and specific gravity (an indication of osmolarity). There are four different protocols, each requiring a different volunteer.

Volunteer preparation

The establishment of the diuresis depends upon fairly rapid absorption of the water so it is important not to start with a full stomach. Just eat a light meal and drink normally in the 3 to 4 hours before the laboratory starts. In addition, avoid fluids containing caffeine (coffee, tea, cola drinks) for at least 3 hours prior to the laboratory.

Be sure to note the time at which you last urinated prior to coming to the laboratory.

Refractometer measurement

1. Preparation for measurement (handle the device with care and do not touch optical lens).
Set direction of the refractometer transparent cup against the light, look into the eyepiece and sharpen the image to improve readability.
You will see a circular space with a measuring scale .

2. Refractometer calibration.
Open the transparent cup, put **1 to 2 drops** of the calibration solution (distilled water) on the optical prism, close the cup and press it slightly for the solution to spread perfectly over the surface of the optical prism (without air bubbles and dry spots). Look into the eyepiece, the top of the visor should be blue, the bottom white, and the boundary should go through a calibration value of **1.3300** (left scale of the RI) If not, turn the calibration screw until the desired condition is reached.

3. Measurement.
Open the transparent cup, clean the optical prism with the **included cloth**, then put **1 to 2 drops** of the test liquid (urine) on it, close the cup and slightly press it so that the liquid can spread perfectly over the surface of the optical prism (without air bubbles and dry spots) The measured value will be represented by the intersection of the blue-white boundary on the **right measuring scale** (specific gravity).

4. Cleaning after measurement
Clean the prism and the transparent cup with a damp cloth and carefully place the device in to the case.
To wet the cloth, use **Desident CaviCide** spray.

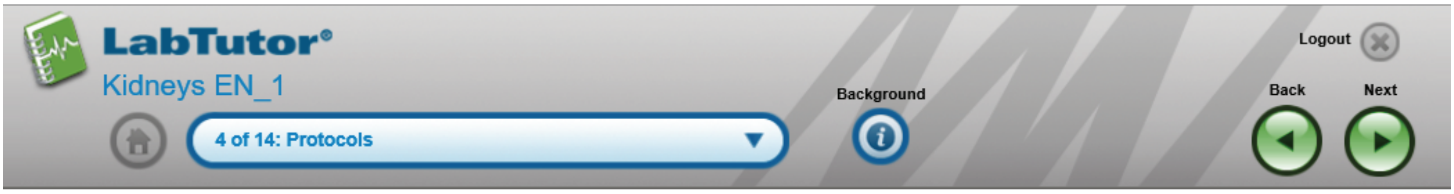
General procedures during the experiments for all volunteers

1. At the commencement of the experiment, note the time, collect your urine and measure its volume. Keep a small sample for measurement of specific gravity.
2. Immediately after the collection of the first sample, drink the required solution (except control). Once you have drunk this solution, do not drink anything else during the laboratory.
3. Continue to collect urine approximately every 20 minutes, noting the time at which the bladder is emptied to the nearest minute.
4. It will be found most convenient for each subject to be his or her own timekeeper; there is no necessity for the subjects to keep in step with each other. The essential thing is that the intervals between urination are accurately recorded.

Cautions

⚠ Do not volunteer to be a subject in this laboratory class if you are suffering from kidney or circulatory problems, have any other medical problem or are on any medications.

⚠ Urine is a potentially infectious body fluid. Therefore, students are directly responsible for all measurements of the volume and specific gravity of their own urine, and are required to clean up any spilt urine themselves.



Experimental protocols:

There are four different protocols.

Protocol 1: Control - no fluid intake during experiment.

1. Drink nothing during this laboratory and collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.

Protocol 2: To illustrate a normal water diuresis.

1. Drink 800 mL of Solution 2, then collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.

Protocol 3: To illustrate effects of drinking the equivalent of an isosmotic sodium chloride solution.

1. Drink 800 mL of Solution 3, then collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.

Protocol 4: To illustrate effects of drinking a hyperosmotic glucose solution.

1. Drink 800 mL of Solution 4, then collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.