Renal Physiology

Background
Two of the main functions of the kidneys are to regulate the volume of fluid in the body, and to regulate the osmolarity (concentration) of bodily fluids at about 300 mM/L. This is done primarily by adjusting the amounts of water and salt in the body. Vasopressin (=ADH) increases reabsorption of water, aldosterone increases the reabsorption of salt, and atrial natriuretic hormone (ANH) decreases the reabsorption of salt. The sympathetic nerves to the kidney also play roles in controlling blood flow to the kidney, and the amount of renin in the blood.

In this lab, you will demonstrate this regulation by challenging the renal system with excess water and/or salt, and recording the kidney’s response in the osmolarity and volume of urine produced.

Procedure
1 Limit fluid intake on the day of lab.

2 Empty your bladder 2 hours before lab and note the time. Do not worry about saving this urine sample.

3 As soon as you enter lab, take a urine specimen cup to the restroom and void into the container, completely emptying the bladder. Note the time. This is your CONTROL specimen (t = 0 minutes).

4 Return to the lab and drink your assigned solution as quickly as possible.

FOUR TREATMENT GROUPS
Hypotonic: 800 ml water + 0g NaCl
Isotonic: 800 ml water + 7g NaCl
Hypertonic: 80ml water + 7g NaCl
Control: 0ml water + 0g NaCl

5 Every 30 minutes, empty your bladder into the container (t = 30, 60, 90, and 120 minute specimens. If you are unable to void, just wait until the next 30 minute period is up.

Specimen Analysis*

*Read this before the start of lab!!

1 For EVERY collection, you will analyze volume, specific gravity, and chloride concentration.

- **Volume** – use the side of the specimen jar to determine the volume excreted. NOTE: you need to determine total volume, so if more than the cup is voided, once the cup is full, dump that portion noting the exact volume and then proceed to finish completely voiding the bladder. Add the 2 volumes together to get total volume. Express URINE OUTPUT as ml/min.

- **Specific Gravity** – pour some of the sample into the urinometer to float the specific gravity meter. If you do not have enough urine, your instructor will assist you*. You will also need to note the temperature of the sample as soon as you determine the specific gravity.
  - Correct for temperature: Add 0.001 for each 3°C above 15°C or subtract 0.001 for each 3°C below 15°.

- **Chlorine concentration** – Transfer 10 drops of urine into a clean test tube. Add 1 drop of 20% potassium chromate. Then add 2.9% silver nitrate solution drop by drop while shaking the solution and counting the drops until the solution turns from yellow to brown. Express the number of drops as g/L (mg/ml) of sodium chloride in the urine.

2 For the CONTROL collection, you will also analyze your urine specimen with the labstix test for various parameters. This is a time sensitive test, so have a partner help you to read the results at the appropriate times.

3 Record your results on the class data sheet (excel file) at the designated computer in the lab.

* measured SG of 50:50 mixture = (X + 1.000) / 2