

Honors Biology

Unit 6

Rat Dissection

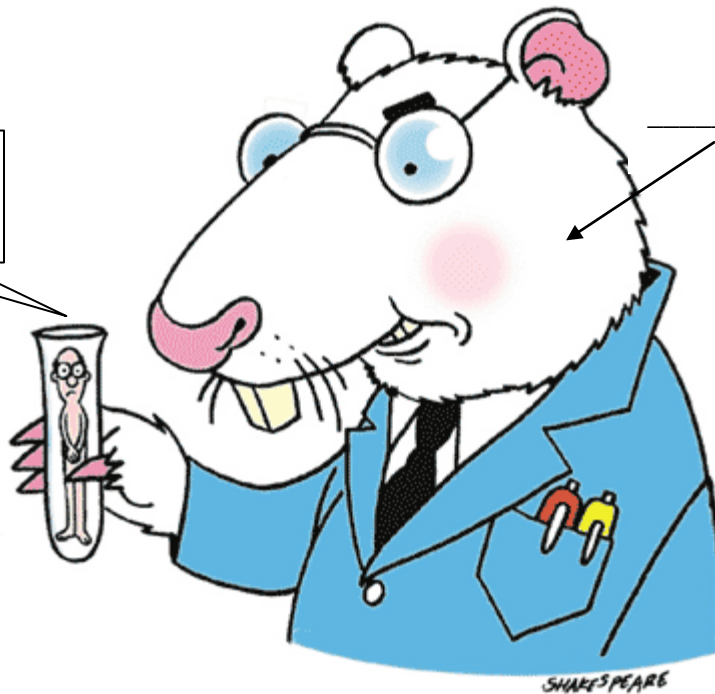
Name _____

Teacher _____ Hr _____

www.johnshakespeare.com.au

The name of my rat friend is:

Thanks for helping
me learn more
about myself!



Introduction

✓ Rattus norvegicus albinos

The rat that you will be dissecting is (what is referred to as) a common 'lab rat'. These white (albino) rats are the result of interbreeding of two wild rat species: brown and black rats. This type of breeding has produced a rat that is much smaller and far less aggressive than its ancestors, so they can easily be used by humans in a lab setting. These rats are raised for the function of vertebrate anatomical study.

✓ Ethical Expectations

These rats were, at one time, living animals. Although they are raised as a tool for your learning, they, like any other organism, deserve to be treated with respect (both in life and in death).

Dissections of specimens can sometimes be exciting, scary, or even a little bit unsettling. However, this organism is an animal, just as you and I are. As such, we expect that all students during this unit will behave in a fashion that displays acknowledgement of the rats' integrity as a specimen, and as a learning tool.

The following behaviors will not be tolerated:

- Mutilation (inappropriate damage or destruction) of the rat or any of its parts
- Horseplay or harassment of others
- Inappropriate use of sexual slang, drawings or references
- Misuse of tools

If any students or groups are found to be doing any of the above actions, the following consequences could be imposed:

- After-school detention
- Cleaning of dissection tools and trays
- Written letter of apology to rat for mistreatment.



✓ During Lab

Students are expected to use their time efficiently and effectively in lab. There are three essential tasks that students should be completing for each section of the rat dissection:

- Procedure:
 - Follow the specific dissection directions provided for each section.
- Identification and Labeling:
 - Use your packets to determine what structures need to be identified. Use your *Rat Dissection Guide* to help you. Remember, you will be responsible for these parts on the lab practical.
- Questions:
 - Answer ALL questions for a section before moving onto the next section. These questions are designed to test your ability to locate specific structures and determine the important purposes, functions, or relationships between these structures. Use your *Rat Dissection Guide* to help you. Remember, you will be responsible for these parts on the lab practical.

✓ Assessment

The end-of-unit assessment will be in the form of a lab practical (50pts KS). Specimens will be displayed on dissection trays where students will need to do one or more of the following tasks:

- Identify a structure
- Describe the function, purpose, or importance of a structure
- Relate an already identified structure or function to an important idea or concept that was studied during the unit.

✓ Comfort Level Questionnaire

Each student will be given a short set of questions to help determine his/her comfort with the dissection process. It is important to be honest when answering the questions so that each student can be properly matched with a partner for the dissection.

✓ Optional Gloves

Gloves may be worn during dissection, but are the sole responsibility of the student(s) using them. Gloves will not be provided or stored for any students during the dissection. Often, students will share the cost of purchasing a pack of gloves for the dissection unit. Students can plan on needed gloves for at least three days of dissection.

Why Do We Dissect?

- ✓ We have chosen rats for our dissection experience for a variety of reasons. Rats are mammals, just like humans! Therefore, they share many of the same internal and external structures that humans do, and perform many of the same functions. This dissection will provide you with an opportunity to apply your knowledge and understanding of human anatomy and physiology to another organism with similar characteristics. Some of these traits include:

- Vertebrates (have backbones)
- Hair-covered bodies
- Mammary glands for nursing young
- Young are nourished in mother's uterus
- Breathe with lungs (throughout lifetime)
- Diaphragm separating thoracic and digestive cavities
- Four-chambered heart
- Warm-blooded
- Two pairs of limbs



<http://img32.photobucket.com/albums/v97/MasterSplinter/Splinter.jpg>

1. Write a response to the question, "Why are we dissecting in science class?"

2. Why dissect a rat and not a different thing?

Location Terms

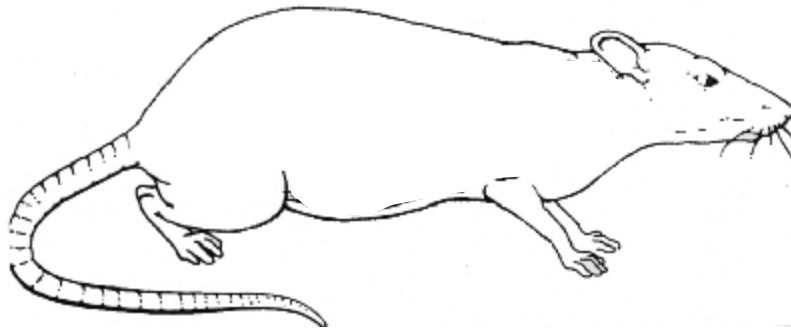
- **Procedure:**

- 1) Obtain a rat from your teacher and remove it from the original storage bag and throw away the original storage bag.
- 2) Place the rat on the dissecting tray so it looks like the diagram below.

- **Identification and Diagram Labeling:**

You are responsible for knowing the location of the following terms. Locate each term using your *Dissection Guide*. Label them on the diagram below and/or describe their location in the notes section of the table.

| Terms: | Notes: |
|-----------|--------|
| Anterior | |
| Posterior | |
| Dorsal | |
| Ventral | |



http://www.williams.edu/Biology/Faculty_Staff/sswoap/site/images/implant-rat.gif

- **Questions:**

3. What would be an easy for you to remember these 4 terms? Write this idea here:

External Structures

- **Procedure:**

- 1) Lay your rat on its dorsal surface.
- 2) This next step may require some force. Lay the rat as flat as possible on its dorsal surface so its ventral surface is clearly visible.
- 3) Be sure to view rats of BOTH sexes during this section.

- **Identification and Diagram Labeling:**

You are responsible for knowing the location of the following terms. Locate each term using your *Dissection Guide*. Label them on the diagram below and/or describe their location in the notes section of the table.

♀ **Female Rat:**

| Terms: | Notes: |
|------------------------------------------------|--------|
| Nipples (Mammary papillae) | |
| Opening of the urinary system (urethra) | |
| Opening of the digestive (anus) | |
| Opening of the reproductive system (vagina) | |

♂ **Male Rat:**

| Terms: | Notes: |
|-------------------------------------------------|--------|
| Scrotum | |
| Opening of the urinary system (urethra) | |
| Opening of the digestive (anus) | |
| Opening of the reproductive system (urethra) | |

♀ **Female Rat:**



♂ **Male Rat:**



http://www.carolina.com/text/teacherresources/workshop_presentations/pdfs/ratdissect.pdf

- **Questions:** If you do not already know the answers to these questions, reference your *Dissection Guide*.

4. How can you differentiate between a male and female rat from the external features? _____

5. What external clue is there for the approximate number of “babies” that a female rat could produce?

Respiratory System

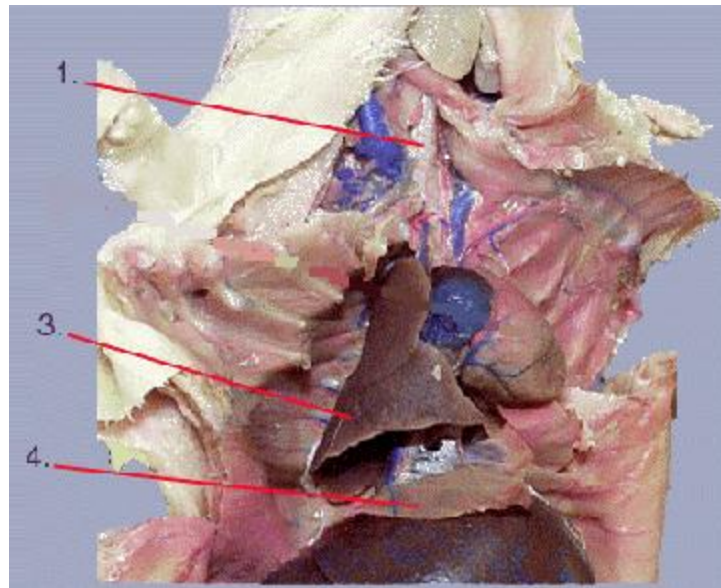
- **Procedure:**

- 1) Begin dissection by inserting the dissecting scissors into the urethra and penetrating the body cavity just below the surface. ***Caution:** Do not cut too deep; this may damage tissues.
- 2) Following the diagram of cut lines in your *Dissection Guide*, proceed to cut open the rat just inside the body cavity, through the ribcage, toward the head and then down each limb. This will expose internal organs. Don't forget the neck area as well.
- 3) Split open the cavity and open the flaps of tissue. Attempt to pin down the tissue if necessary.

- **Identification and Diagram Labeling:**

You are responsible for knowing the location of the following terms. Locate each term using your Dissection Guide. Label them on the diagram below and/or describe their location in the notes section of the table.

| Terms: | Notes: |
|-----------|--------|
| Trachea | |
| Lungs | |
| Diaphragm | |



<http://www.utm.edu/departments/cens/biology/rirwin/RatThorQuestions.htm>

- **Questions:**

If you do not already know the answers to these questions, reference your *Dissection Guide*.

6. Locate the trachea and the esophagus. Describe several ways in which you could tell them apart.

7. Cut the trachea about halfway down its length. Now insert the glass pipette with attached bulb into the part of the trachea still leading to the lungs. What things do you observe when you squeeze the bulb?

8. Although the alveoli of the lungs are too small to be seen with a microscope, what is their function?

9. Locate the diaphragm. What is its function?

Circulatory System

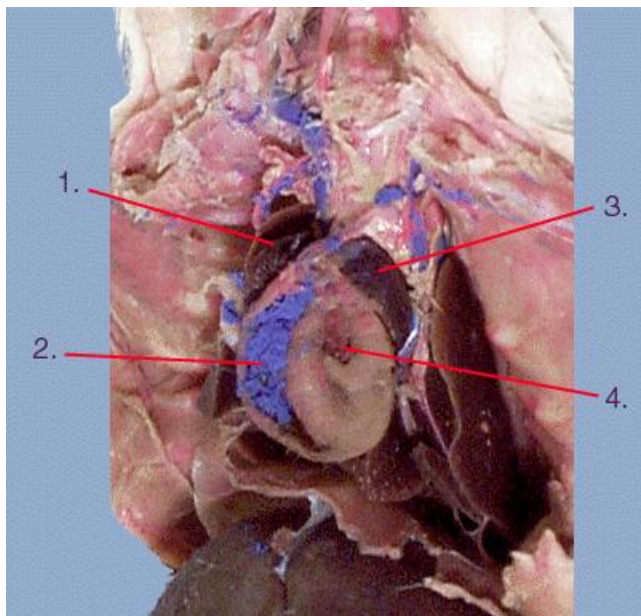
- **Procedure:**

- 1) Since the chest cavity has already been opened and the rib cage opened, the heart should be in plain view. Locate and examine the structures below externally before proceeding.
- 2) After locating the parts externally, obtain a scalpel from your teacher.
- 3) Carefully hold the heart between your fingers and make an incision with the scalpel at the tip of the heart toward the anterior end.
- 4) Hinge open to view the chambers of the heart

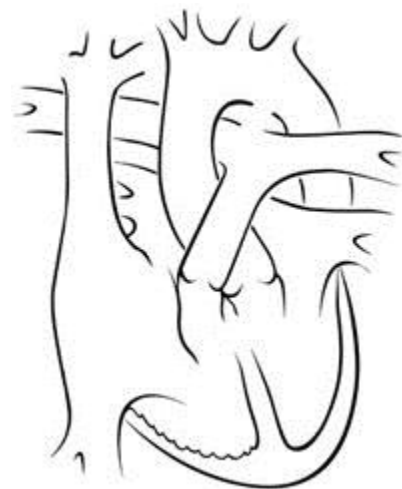
- **Identification and Diagram Labeling:**

You are responsible for knowing the location of the following terms. Locate each term using your *Dissection Guide*. Label them on the diagram below and/or describe their location in the notes section of the table.

| Terms: | Notes: |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heart | |
| Right Atrium | |
| Left Atrium | |
| Right Ventricle | |
| Left Ventricle | |
| Spleen | *note: This is very difficult to identify and is not located in the pictures below. It is a half moon shaped dark tissue under the liver. It is the same color as the liver. |



<http://www.utm.edu/departments/cens/biology/rirwin/RatHeartQuestions.htm>



http://www.chp.edu/images/heart_diag3.jpg

- **Questions:**

If you do not already know the answers to these questions, reference your *Dissection Guide*.

10. How many chambers are there in the rat's heart? Name them:

Digestive System

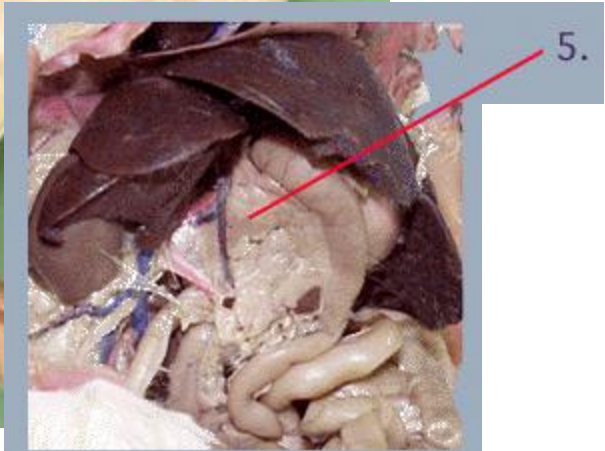
- **Procedure:**

- 1) The digestive system is a hollow tube that extends from the mouth to anus. Locate and examine the structures below externally before proceeding.
- 2) Dissect the membrane surrounding the salivary glands by referencing your Dissection Guide.
- 3) Dissect the esophagus from behind the trachea. Use the probe to release it from its membrane.
- 4) Cut along the side of the stomach and hinge it open to view contents and structure.
- 5) Carefully dissect the membrane (mesentery) that keeps the small intestines together so you can stretch the intestines out to its full length. ***Caution:** Use care as to keep the digestive tract attached.
- 6) Cut along the caecum and large intestine to view the contents as they have broken down throughout the system.

- **Identification and Diagram Labeling:**

You are responsible for knowing the location of the following terms. Locate each term using your *Dissection Guide*. Label them on the diagram below and/or describe their location in the notes section of the table.

| Terms: | Notes: |
|-----------------|--------|
| Incisors | |
| Salivary Glands | |
| Esophagus | |
| Stomach | |
| Pancreas | |
| Liver | |
| Small Intestine | |
| Caecum | |
| Large Intestine | |
| Rectum | |



http://www.carolina.com/text/teacherresources/workshop_presentations/pdfs/ratdissect.pdf

<http://www.utm.edu/departments/cens/biology/rirwin/RatCircAbdQuestions.htm>

- **Questions:**

If you do not already know the answers to these questions, reference your *Dissection Guide*.

11. Locate one or more of the parotid, mandibular, and sublingual glands. By their location and the fact that they are part of the digestive system, what must their function be?

12. Locate the trachea and the esophagus. Describe several ways in which you could tell them apart.

13. Where in the digestive system does mechanical digestion occur? _____

14. Describe the interior of the stomach.

15. What are the general functions of the cardiac and pyloric sphincters of the stomach?

16. If your rat does not have stomach contents see if you can see another groups and describe it here:

17. Besides the glands in the walls of the duodenum, what accessory organ releases numerous digestive enzymes in to the digestive system at that site? _____

18. What does the liver secrete to aid in the process of digestion and what is the function of that secretion?

19. What sac in humans stores the liver's secretion? _____

20. Why must the rat be able to get along without that sac?

21. Determine the approximate length of the small intestine, which ends at the caecum. _____

22. Why is the small intestine soooooo long? _____

23. What is the function of the caecum? _____

24. Chemical digestion occurs at three points along the digestive track. Name those three points and what type(s) of foods are being chemically digested at each one.

25. What is the function(s) of the large intestine (colon)?

Urinary System

- Procedure:**

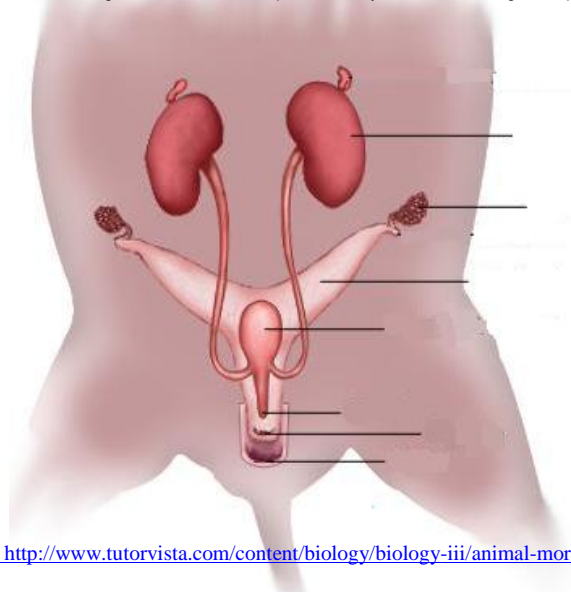
- 1) Place the intestines off to the side outside of the body cavity so you can view the inside dorsal surface of the rat.
- 2) Once you have located all the urinary parts, dissect the membrane around the kidney and lift it out of the cavity without detaching it from the ureter.
- 3) Slice along the side of the kidney with the scalpel and hinge open to view the inside.

- Identification and Diagram Labeling:**

You are responsible for knowing the location of the following terms. Locate each term using your *Dissection Guide*. Label them on the diagram below and/or describe their location in the notes section of the table.

| Terms: | Notes: |
|-----------------|--------|
| Kidneys | |
| Ureters | |
| Urinary Bladder | |
| Urethra | |

*Note: the diagram to the right is also a diagram for the female reproductive system. After doing the reproductive system, come back label these parts here as well.



<http://www.tutorvista.com/content/biology/biology-iii/animal-morphology/respiratory-excretory->

- Questions:**

If you do not already know the answers to these questions, reference your *Dissection Guide*.

26. Locate a kidney. Trace the pathway of the urine through the following structures of the excretory system. Describe the function of each:

- A. Kidneys: _____
- B. Ureters: _____
- C. Urinary bladder: _____
- D. Urethra: _____

Reproductive System

- **Procedure:**
 - **Female Procedure**
 - 1) Carefully look for the ovaries, and dissect at least one.
 - 2) Locate the uterus. Follow this structure to the posterior of the rat (where it becomes the vagina)
 - 3) If your rat has a bumpy uterus, your rat is pregnant. See your teacher to dissect out some fetuses.
 - **Male Procedure**
 - 4) If necessary, cut additional tissue near the pelvis so that the pelvic bones can separate and the legs can lay out flat.
 - 5) Remember that some of the male parts lie outside of the abdominal cavity!
 - 6) Make an incision along the edge of the scrotum, and hinge open the flap of skin.
 - 7) Use a probe to remove the testes from the scrotum (so that they sit outside of the scrotal sac).
 - 8) Locate the epididymis (directly atop <anterior> to the testes).
 - 9) Look back into the abdominal cavity to find the seminal vesicles.

♀ **Female Rat:**

| Terms: | Notes: |
|---------|--------|
| Ovaries | |
| Uterus | |
| Vagina | |

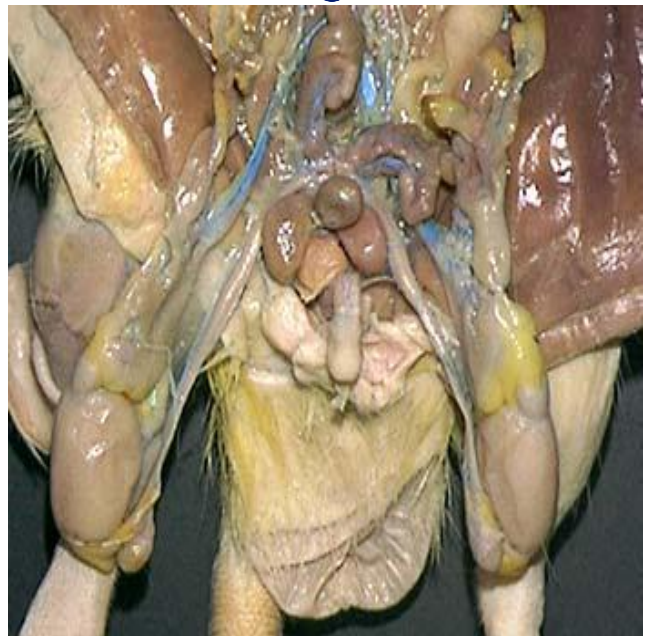
♂ **Male Rat:**

| Terms: | Notes: |
|------------------|--------|
| Scrotum | |
| Testes | |
| Epididymis | |
| Seminal Vesicles | |

Female ♀



Male ♂



• **Questions:**

If you do not already know the answers to these questions, reference your *Dissection Guide*.

27. **Male:** Cut open one of the scrotal sacs so that you can see the testis and epididymis. What is the function(s) of each of those two structures?

28. **Female:** Locate the uterus and the two ovaries attached to it. Cut open the uterus to check for embryos. Notice its large “V” shape. Why is the rat’s uterus such a different shape than a human’s pear-shaped uterus? (Hint: Think about your answer to #5.)

Nervous System

• **Procedure:**

This is one of the most difficult areas to dissect in the rat! You are not required to attempt this part of the dissection, BUT you are required to view these parts of the central nervous system on someone’s specimen in class, if not your own.

PATIENCE is required for this part of the dissection. Please see your teacher for assistance before starting!

- 1) Place the specimen on the dissecting tray so that you are looking down at its dorsal side.
- 2) Find the base of the neck, where the bottom dorsal part of the cranium meets the backbone.
- 3) Use a scalpel or dissecting scissors to remove as much of the skin and muscle tissue as possible from the cranium.
- 4) Carefully use the tip of the dissecting instrument to slowly chip away small portions of the bone.
Caution: The skull sits directly on top of the brain tissue! It is important to not ‘dig’ at the bone. This may damage the brain tissue.
- 5) Continue until most of the dorsal and posterior portions of the brain can be seen.

• **Identification and Diagram Labeling:**

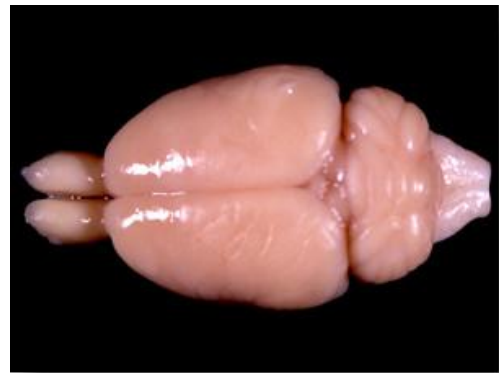
You are responsible for knowing the location of the following terms. Locate each term using your *Dissection Guide*. Label them on the diagram below and/or describe their location in the notes section of the table.

| Terms: | Notes: |
|----------------------------------------------|--------|
| Cerebrum | |
| Cerebellum | |
| Brain Stem (locate the medulla oblongata) | |



dorsal view

<http://media.wiley.com/CurrentProtocols/TX/tx1114/tx1114-fig-0002-1-full.jpg>



http://www.apuche.org/OIA/Anatomical%20Images/WB01_Puche_300x225.jpg

• **Questions:**

If you do not already know the answers to these questions, reference your *Dissection Guide*.

29. What is the function of the cerebrum'?

30. What is the function of the cerebellum'?

31. Where is the medulla oblongata located, and what is its function?



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<http://www.crystalandcookie.com/gallery/blogpics/rizzo20the20rat>

Review Websites

- Use the following websites to help you study for your lab practical. Remember, you are responsible for knowing **all** of the structures that you identified during the dissection. Any questions that you answered are also fair game!

1. <http://www.utm.edu/departments/cens/biology/rirwin/RatAnat.htm>
2. http://www.carolina.com/text/teacherresources/workshop_presentations/pdfs/ratdissect.pdf
3. <http://biology.kenyon.edu/courses/biol09/Rat/welcome.htm>
4. http://www.k-state.edu/organismic/rat_dissection.htm

