

**ACTIVITY 3D: HEALTHY BONE REMODELING –
THE OSTEO BLASTER/CLASTER WHEEL**

TEACHER PAGE

HEALTHY BONE REMODELING

Healthy bone remodeling occurs at many simultaneous sites throughout the body where bone is experiencing growth, mechanical stress, microfractures, or breaks. About 20% of all bone tissue is replaced annually by the remodeling process. There are five phases in the bone remodeling process: **ACTIVATION, RESORPTION, REVERSAL, FORMATION, and QUIESCENCE**. The total process takes about 4 to 8 months, and occurs continually throughout our lives.

Provide each student with their own copy of *The Osteo Blaster/Cluster Wheel*. The numbers on the wheel match those of the chart below, as well as, the questions on *The Osteo Blaster/Cluster Worksheet*. This page forms the base for the “wheel.” The cover for the wheel needs to be carefully cut out along the dark lines. Line up the center of the cover with the base and secure it with a brad. After the students have constructed their “wheels,” have them place their wheels with the “window” open on section one.

The information on the chart below describes some of the events that occur during *normal* bone remodeling, maintenance, and repair. Use this information to describe to the students the events that they see on their wheel. Have the students place their “window” on number one, then they should listen as you describe the events depicted in section one. Have students then turn their wheels to section two, you describe the events, and so move through all eleven windows. After the information for all eleven sections are discussed, hand out *The Osteo Blaster/Cluster Worksheet*. Have students complete the statements on the worksheet as they refer back to their “wheels.” Use their responses to evaluate their understanding of bone remodeling events.

<p>Normal Bone Remodeling-Normal Maintenance and Repair “Ordered Coupling” <i>Osteoblasts and Osteoclasts, “blast/clast,” activity is in balance</i></p>

- PHASE -

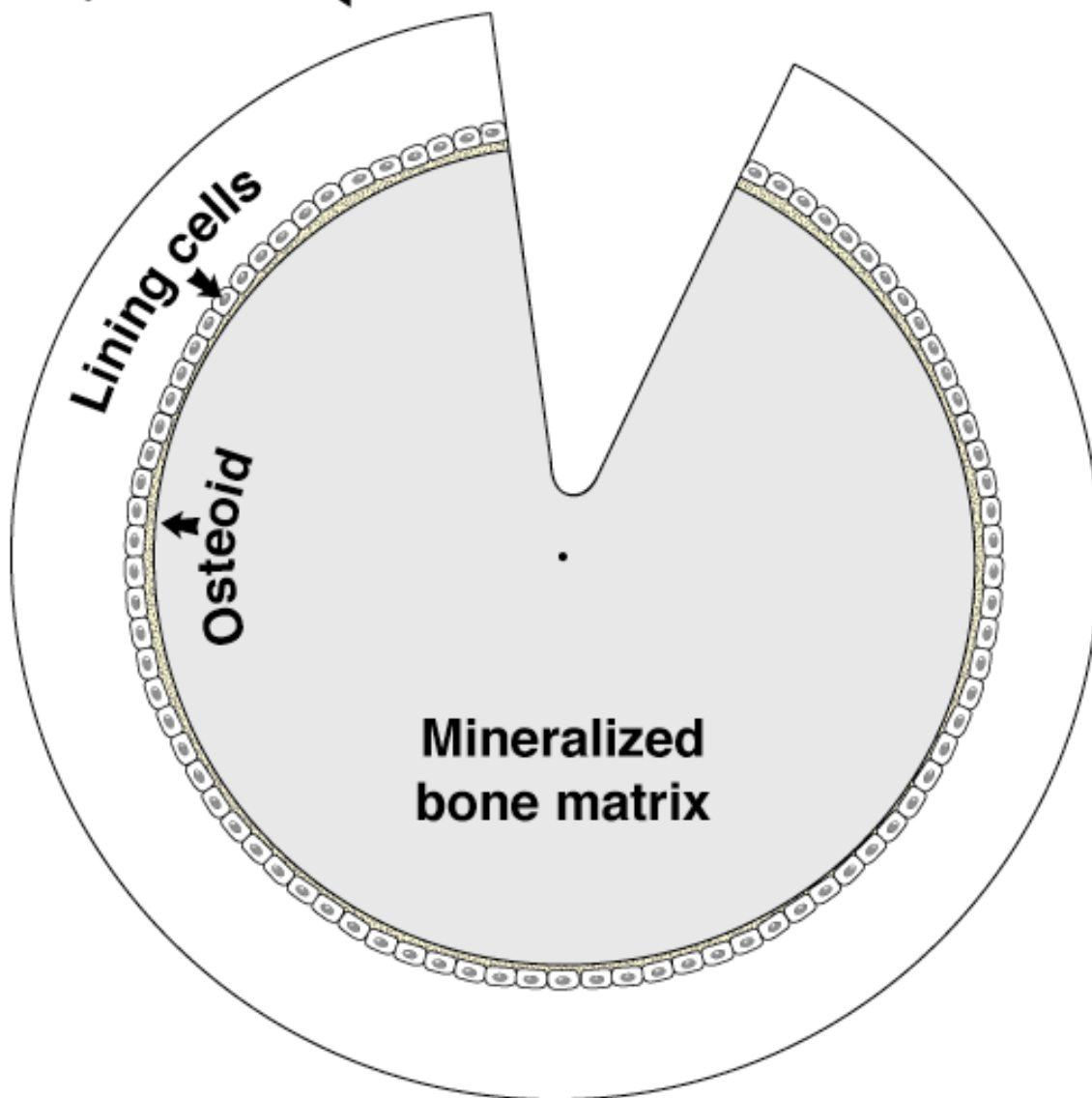
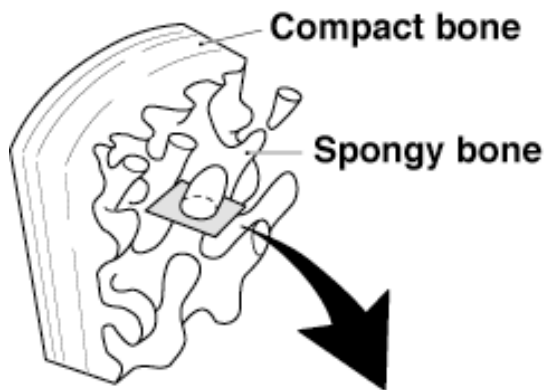
- PHASE EVENTS –

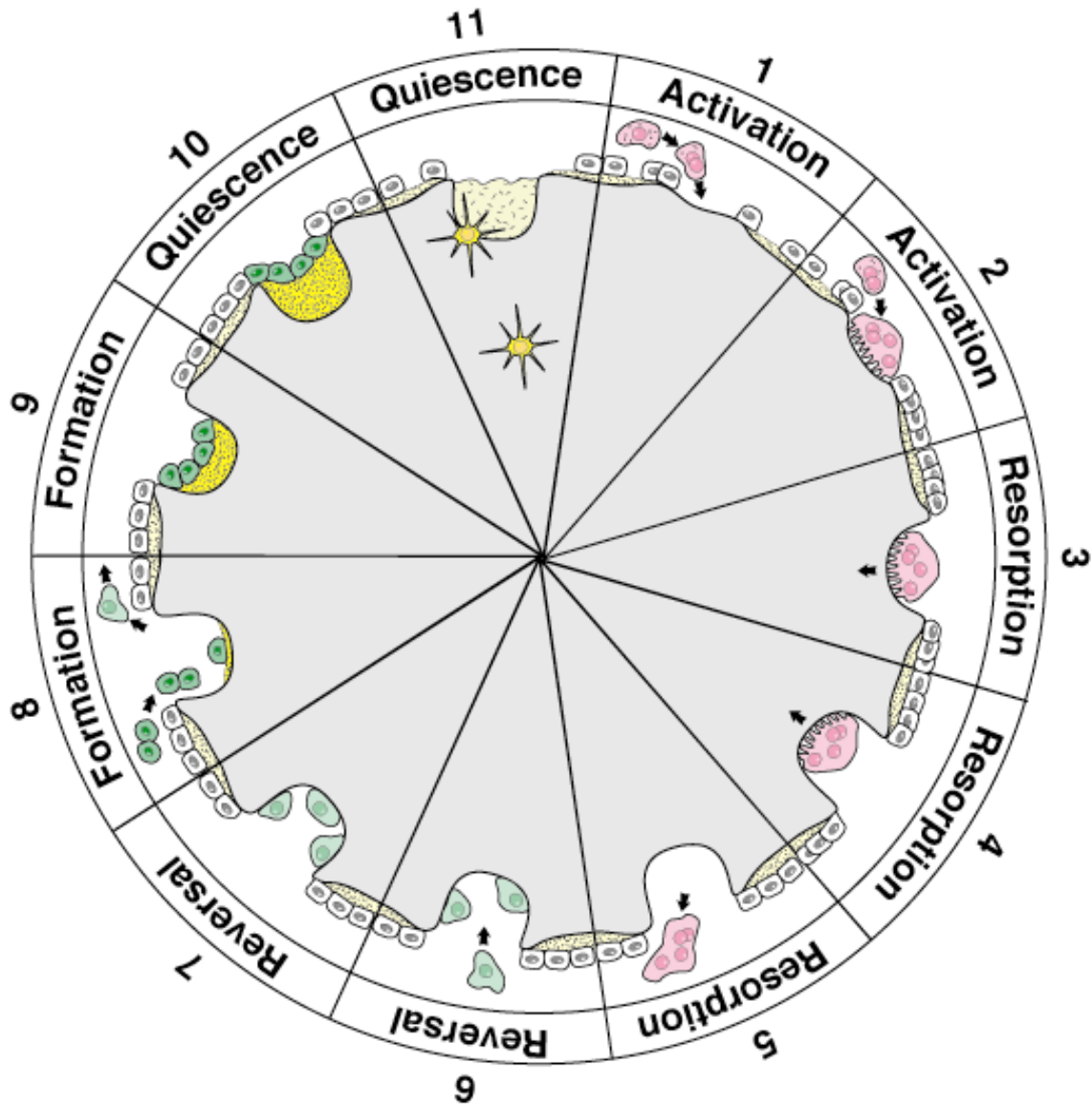
ACTIVATION	1. Pre-osteoclasts are attracted to the remodeling sites.
	2. Pre-osteoclasts fuse to form multinucleated osteoclasts.
RESPORPTION	3. Osteoclasts dig out a cavity, called a resorption pit, in spongy bone or burrow a tunnel in compact bone.
	4. Calcium can be released into the blood for use in various body functions.
	5. Osteoclasts disappear.
REVERSAL	6. Mesenchymal stem cells, <i>pre-cursors</i> to osteoblasts, appear along the burrow or pit where they...
	7. <i>proliferate</i> (increase in numbers) and <i>differentiate</i> (change) into pre-osteoblasts, then ...
FORMATION	8. <i>mature</i> into osteoblasts at the surface of the burrow or pit and ...
	9. release <i>osteoid</i> at the site, forming a new soft nonmineralized <i>matrix</i> .
	10. The new matrix is mineralized with calcium and phosphorous.
QUIESCENCE	11. Site, with resting lining cells, remains <i>dormant</i> until the next cycle.

ACTIVITY 3D: HEALTHY BONE REMODELING THE OSTEO BLASTER/CLASTER WHEEL


STUDENT HANDOUT


Carefully cut out the cover for the Osteo Blaster/Claster Wheel that is provided below. Push a two-prong brad through the dot in the center of the cover and then attach the cover to the base page. The “wheel” you have constructed will be used to learn about the events that occur during normal bone remodeling, maintenance, and repair. Set the “window” over section one and prepare for the activity that follows.







Key:


 Lining cells (epithelial cells)


 Pre-osteoclasts


 Osteoclasts

 Mononuclear cells

 Osteoblasts

 Non-mineralized bone matrix (osteoid)

 New-mineralized bone matrix

 Osteocytes

ACTIVITY 3D: HEALTHY BONE REMODELING — THE OSTEO BLASTER/CLUSTER WHEEL - STUDENT WORKSHEET

HEALTHY BONE REMODELING

After listening carefully to the description of healthy bone remodeling, complete the following statements as you review the events depicted in *The Osteo Blaster/Cluster Wheel* that you have constructed. Refer to the key for help with terms.

1. During the Activation Phase, the _____ are attracted to the remodeling sites.
2. The pre-osteoclasts become fused and form _____ osteoclasts.
3. During the Resorption Phase, the osteoclasts dig out a cavity called a _____ pit.
4. As the pit is being dug out, an important mineral, _____, is absorbed into the blood for use by the body.
5. After the pit is completed, the _____ disappear.
6. In the Reversal Phase, _____ cells appear along the burrow or pit.
7. The cells along the pit prepare the surface for new bone _____.
8. During the Formation Phase, the osteoblasts are _____ to the surface of the pit or burrow.
9. The osteoblasts busy themselves with replacing the removed bone tissue with a new soft matrix, or _____.
10. This phase must be called the _____ Phase because the new matrix becomes mineralized with calcium and phosphorus thus creating new bone.
11. The remodeling site (now new bone tissue) remains _____ until the next bone remodeling cycle begins.

Now, use your wheel to try to teach someone else about normal bone remodeling and the balance between the work of the osteoclasts and osteoblasts in bone tissue.

***ACTIVITY 3D: HEALTHY BONE REMODELING —
TEACHER ANSWER KEY—HEALTHY BONE REMODELING***

1. pre-osteoclasts
2. multinucleated
3. resorption
4. calcium
5. osteoclasts
6. mononuclear
7. formation
8. attracted
9. osteoid
10. formation
11. dormant

ACTIVITY 3D: HEALTHY BONE REMODELING

Normal bone is always undergoing remodeling. This remodeling removes old bone tissue and replaces it with new bone tissue. The remodeling cycle, removing and building tissue, continues throughout life and is typically “in balance” to maintain healthy bone.

This remodeling cycle involves bone “resorption” by the osteoclasts. The osteoclasts remove the old stressed or worn-out mineralized bone. This recreates a “resorption pit.”

The “resorption” process causes osteoblasts to become attracted to the “resorption pit.” Osteoblasts rebuild new bone tissue by laying down an unmineralized matrix, called osteoid, which will eventually form new mineralized bone.

When this rebuilding is complete, the area of bone remodeling rests until the next remodeling cycle begins.

