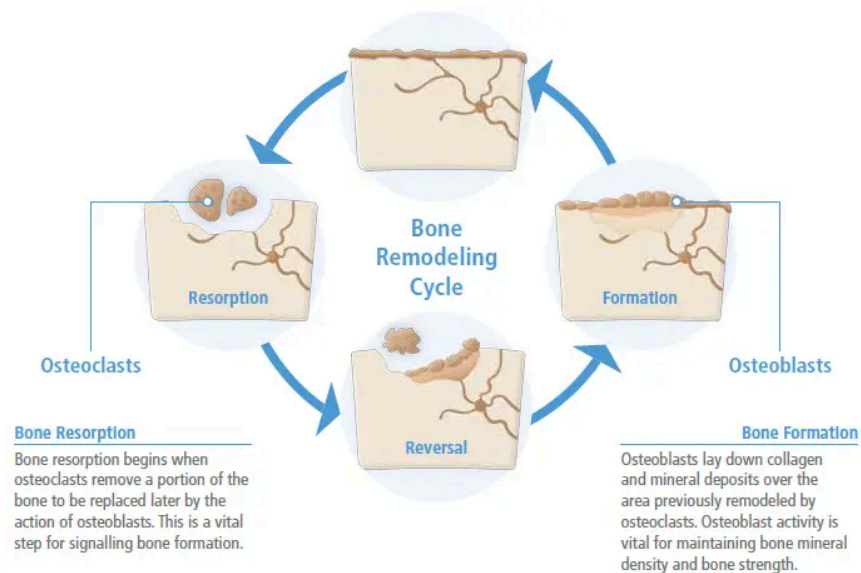


## Bone Remodeling Presentation Handout



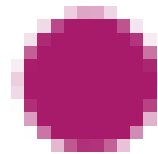
Bone renewal through the bone remodelling cycle

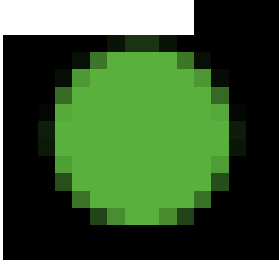
### Agents:

#### Osteoblasts

**In biology:** Detects cracks in the bone -> Releases a signal called RANKL -> this merges nearby osteocytes into an osteoclast precursor, which is then turned into an actual osteoclast -> osteoblast remodels all bone that is reabsorbed by the osteoclast

**In the simulation:** Osteoblast will sense nearby patches with cracks, stop, spawn an osteocyte on top of the crack, and when the osteocyte dies it will chase all nearby black patches and turn them white



<p><b>Osteoclast</b></p> <p><b>In biology:</b> Is present in different functions, but for bone remodeling it will resorb bone in order to allow it to be remodeled. Then performs programmed cell death on itself.</p> <p><b>In the simulation:</b> Resorbs bone for a predetermined amount of moves, then dies.</p>	
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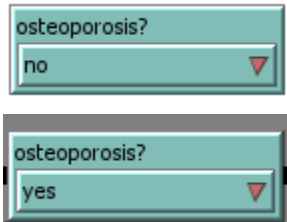

### Patches:

White patches: Fully formed bone

Gray patches: Naturally formed cracks in the bone

Black patches: Resorbed bone waiting to be remodeled

### Conditions:

<p><b>Osteoporosis:</b></p> <p><b>In biology:</b> Bone disease that makes bone brittle and weak. This is because it slows the amount of time it takes to remodel and heal the bone. Basically this means there is an imbalance in the relationships between the osteoblasts and osteoclasts. Osteoclasts are overactive, while osteoblasts are underactive</p> <p><b>In the simulation:</b> osteoporosis causes osteoclasts to resorb more bone, osteoblasts move slower, and only bind to 75% of cracks it sees.</p>	
<p><b>Activity Level:</b></p> <p><b>In biology:</b> Tiny cracks form in the bone due to normal activity, which is what most bone remodeling fixes. More cracks will be formed in the bone when activity is increased as well, which will be simulated in this project. When these cracks in the bone are not repaired and more load is applied, they can become larger and larger, eventually becoming a fracture.</p> <p><b>In the simulation:</b> This variable impacts how often new cracks in the bone are formed.</p>	

low has a 3% chance of creating a crack in the bone every tick, while average has a 6% chance, and intense has a 9% chance.

