# Mechanoadaptation in Burrowing Mice

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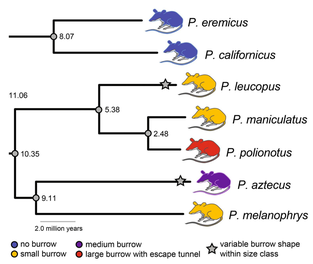
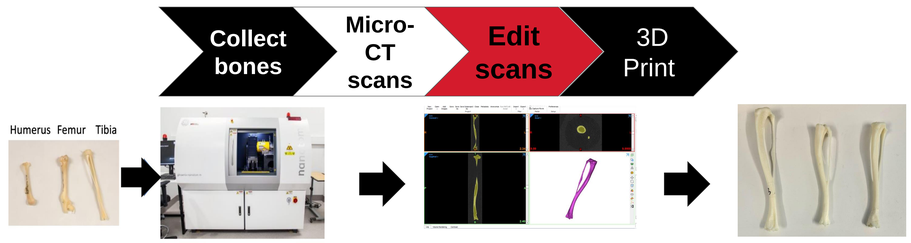
## Abstract

The goal of this research is to characterize the differences in bone morphology between five different species of deer mice based on their burrowing behavior. This research allows us to better understand how bones adapt to environments and behavior. We utilized Micro-CT imaging for accurate 3D printing of mice bones, and then extracted data from those bones to analyze the Normalized Cross Sectional Area (nCSA) and Normalized Second Moment of Area (nIMax). We found that while burrowing behavior played a prominent role in bone adaptation, other factors also influence bone structure.

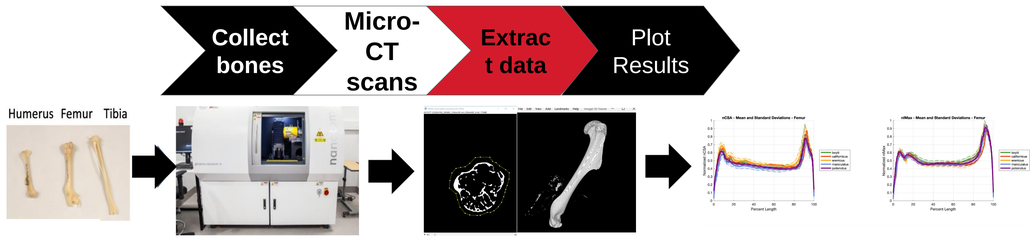



## Experimental Methods

**a. Can we see physical differences in real life models?**



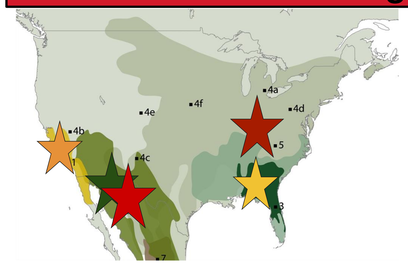

**b. Analyze differences in morphology with data and graphs**



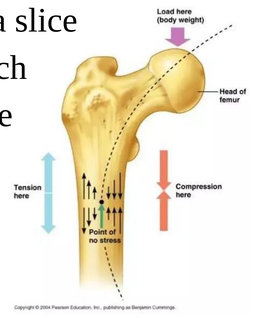

## Conclusion and Future Steps

The nCSA ranking partially aligns with burrowing habits, but not entirely. The high ranking of Peromyscus eremicus and Peromyscus californicus wasn't expected given their lack of burrowing behavior. However, other factors such as harsh environments and locomotor adaptations could explain this. The nIMax ranking better aligns with expected activity levels. Peromyscus boylii's first place could be due to its climbing adaptations, while intense burrowing activity can explain Peromyscus polionotus's second place. The two non-burrowers, P. eremicus and P. maniculatus, sit in third and last place respectively, which is more expected. The results suggest that bone adaptation is indeed influenced by mechanical loading, but the relationship isn't as straightforward as we thought. Factors beyond just burrowing, including other intensive activities and environmental pressures, can also play significant roles in their placement. After seeing these results, we could conduct an analysis on these additional factors to more thoroughly analyze the effects of mechanical load on bone adaptation.

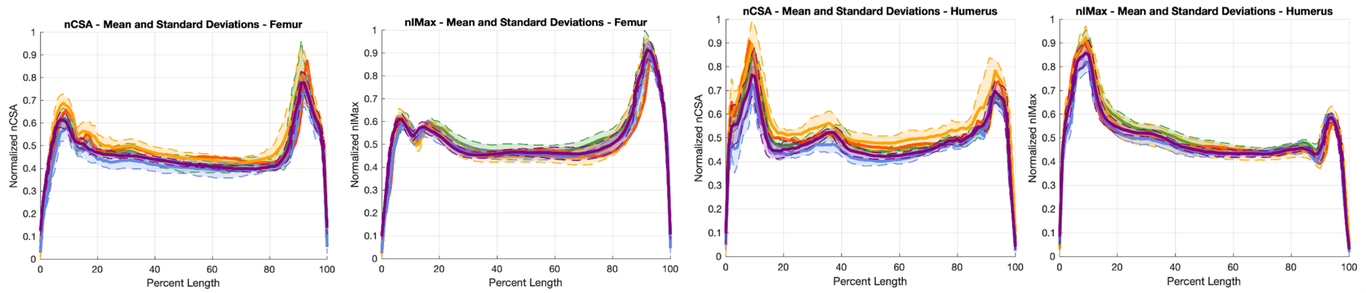
## Background



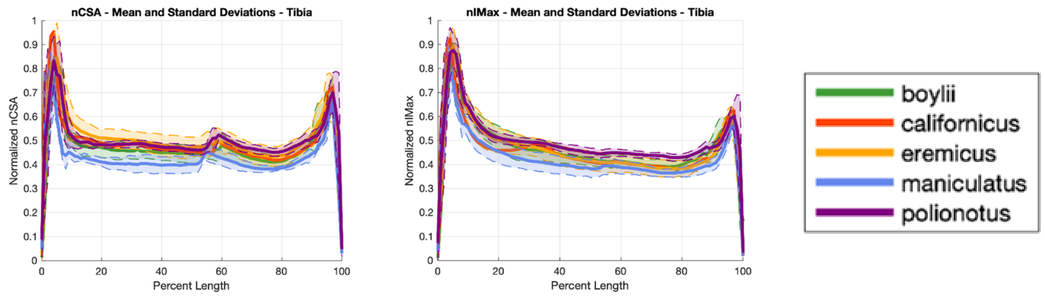
Our research consists of observing 5 different types of Peromyscus species: P. *Californicus*, *Maniculatus* *P. Boylii*, *and P. Eremicus.* Wolff's law claims that healthy bones will adapt to stress it is subjected to. Our researches aims to find if differing burrowing behavior and environments impact the mechanoadaptation of bones in deer mouse species. In analyzing the data, we studied the nCSA, which is the area of a slice of bone perpendicular to its length, which indicates the overall strength of the bone (the amount of force it can withstand), and the nIMax, which measures how the area of the bone is distributed around an axis.




## Results




**Femur** **Humerus**

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