Public Abstract
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Researchers use computer models to study forces acting on the skull when an animal is eating. The American alligator and its relatives have the highest bite force of any animal measured, and this high bite force is responsible for the evolutionary success of these animals. The flat skull of alligators causes the jaw muscles to be diagonally oriented, meaning a simplified 2D model is insufficient. However, many previous models of alligators and their relatives were done in 2D, ignoring forces that act horizontally. To determine if 3D models can model how the skull works more accurately, I used CT scans to make 3D models of alligators from a wide range of sizes. Dissections helped determine how hard each jaw muscle can pull, and the mathematics of 3D lever analysis and finite element software were used to model the forces acting on the jaw joints and teeth when an alligator bites down on a food item. To check the accuracy of my predictions, I compared the bite forces I estimated with those measured from live alligators in captivity. I found that the techniques I used can accurately predict forces anywhere in the skull. Knowing this, I can now apply these methods to fossil relatives of alligators to understand the evolution of the skull in these animals.