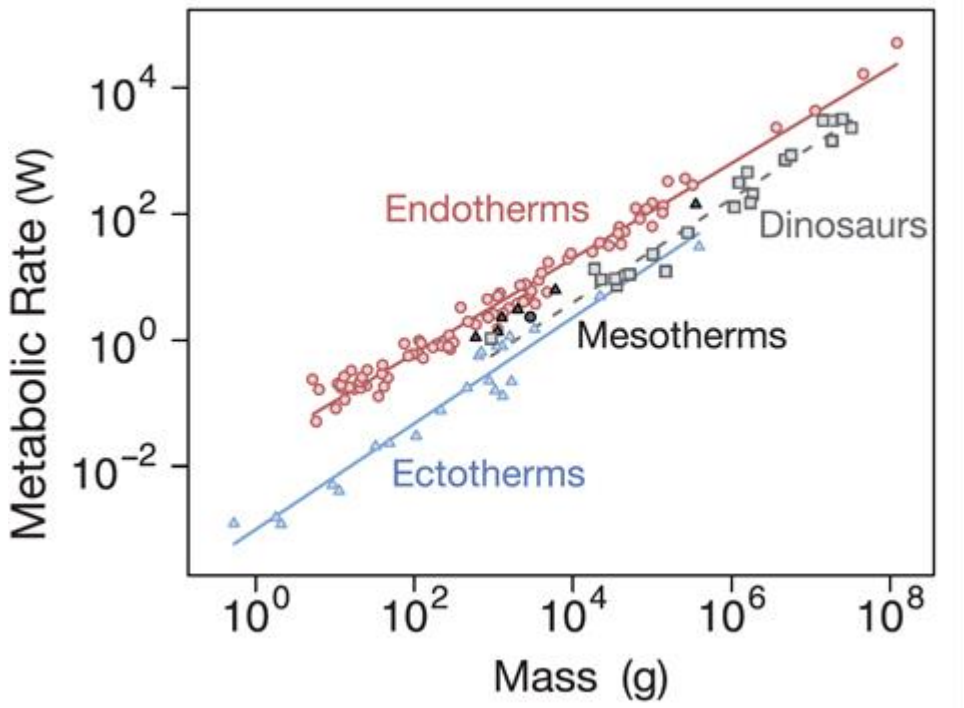

Caption: Resting metabolic rates (in watts) of 381 living vertebrate species and 21 extinct dinosaur species plotted against their body masses (in grams). Endotherms are red, mesotherms are black, ectotherms are blue, and dinosaurs are gray. Regression lines through the points show the best fit between body mass and metabolic rate for endotherms, ectotherms, and dinosaurs, but not for mesotherms.

BACKGROUND INFORMATION

Most animals are able to thermoregulate, or regulate their internal body temperature, in order to survive temperature changes in the environment. Thermoregulation strategies range from ectothermy ("cold-blooded") to endothermy ("warm-blooded"). Ectotherms can tolerate a range of body temperatures, but they regulate their body temperature to avoid extremes by using behavioral strategies like basking in the sun. Endotherms, such as birds and mammals, generate internal heat from their metabolism to maintain a constant body temperature. Mesotherms—a relatively small group of animals that includes leatherback turtles, bluefin tuna, and great white sharks—use their metabolism to raise or lower their body temperature above or below that of their environment, but they do not maintain a constant body temperature. Metabolic rates also drive growth rates, so endotherms tend to grow faster than ectotherms. So where do dinosaurs fit?

Dinosaurs were once thought to be slow-growing ectotherms: lumbering animals with slow metabolisms similar to modern reptiles. But evidence from growth rings in fossil bones suggests that their growth rates were quite high and more closely matched those of endotherms. To shed more light on the type of thermoregulation that dinosaurs used—ectothermy, endothermy, or mesothermy—John Grady and colleagues compared fossil evidence with growth and metabolic rates of 381 living animal species. Because metabolic rate can vary with outside temperature, they selected only species that live in warm environments with temperatures similar to those in the Mesozoic Era. Determining the metabolic rates in extinct species, however, is not that easy. First,

they used growth rings and the dimensions of fossil dinosaur bones to estimate growth rate and body mass (respectively) of 21 species of extinct dinosaurs. Then, using the correlation between growth rate and metabolic rate across clades of living species, they predicted the dinosaurs' metabolic rates. This study provides important evidence for mesothermy in dinosaurs, but additional lines of evidence will be critical as scientists continue to test the mesothermy hypothesis.