Data Problems

23. Was Tyrannosaurus Rex Warm-Blooded? Display 5.27 shows several measurements of the oxygen isotopic composition of bone phosphate in each of 12 bone specimens from a single Tyrannosaurus rex skeleton. It is known that the oxygen isotopic composition of vertebrate bone phosphate is related to the body temperature at which the bone forms. Differences in means at different bone sites would indicate nonconstant temperatures throughout the body. Minor temperature differences would be expected in warm-blooded animals. Is there evidence that the means are different for the different bones? (Data from R. E. Barrick, and W. J. Showers, "Thermophysiology of *Tyrannosaurus rex*; Evidence from Oxygen Isotopes," *Science* 265 (1994): 222–224.)

5.27 Measurements of oxygen isotopic composition of vertebrate bone phosphate (per mil deviations from SMOW) in 12 bones of a single *Tyrannosaurus rex* specimen

Bone	Oxygen isotopic composition					
Rib 16	11.10	11.22	11.29	11.49		
Gastralia	11.32	11.40	11.71			
Gastralia	11.60	11.78	12.05			
Dorsal vertebra	10.61	10.88	11.12	11.24	11.43	
Dorsal vertebra	10.92	11.20	11.30	11.62	11.70	
Femur	11.70	11.79	11.91	12.15		
Tibia	11.33	11.41	11.62	12.15	12.30	
Metatarsal	11.32	11.65	11.96	12.15		
Phalange	11.54	11.89	12.04			
Proximal caudal	10.93	11.01	11.08	11.12	11.28	11.37
Mid-caudal	11.35	11.43	11.50	11.57	11.92	
Distal caudal	11.95	12.01	12.25	12.30	12.39	

24. Vegetarians and Zinc: An Observational Study. Previous studies suggest that vegetarians may not receive enough zinc in their diets. As the zinc requirement is particularly important during pregnancy, researchers conducted a study to determine whether vegetarian pregnant women are at greater risk from low zinc levels than are nonvegetarian pregnant women. Twenty-three women were monitored: twelve vegetarians who were pregnant, six nonvegetarians who were pregnant, and five vegetarians who were not pregnant. None of these women were smokers, and none of the nonpregnant women were taking oral contraceptives. The zinc status in each woman was measured by zinc content in the blood, urine, and hair. Display 5.28 presents the zinc levels in the hair. (Data from J. C. King et al., "Effect of Vegetarianism on the Zinc Status of Pregnant Women," *American Journal of Clinical Nutrition* 34 (1981): 1049–1055.) What evidence is there that pregnant vegetarians tend to have lower zinc levels than pregnant nonvegetarians?

25. Duodenal Ulcers. To clarify the importance of a certain kind of antibody activity (CCK) in gastrointestinal diseases, researchers assessed the CCK activity in the duodenal mucosa of 27 guinea pigs. Of these, 8 had gallstones, 8 had gastric ulcers, and 9 were healthy controls. The following CCK activity was determined by bioassay and measured in Ivy units per milligram of dry weight. (Data from S. Kataoka et al., "Bioassay of Cholecystokinin-Pancreozymin in Duodenal Mucosa," *Lancet* (1978): 1043.)