Cardiac and Pectoral Muscles of Trochilids.—Since hummingbirds are among the most active of birds and are able to fly at high speeds, I have been interested in determining the relative proportions of their hearts and pectoral muscles to the whole body. So far as I know little has been published on this subject. Rüppell (1931, Ornith. Monatsb., 39: 124) gives the heart and body weights of three species of trochilids, four specimens in all, three of them in captivity after being transported from Brazil to Berlin. I have determined the body weights and heart weights in several species and the weights of the pectoral musculature in a few species of trochilids. Dr. Alexander Wetmore of the Smithsonian Institution has been kind enough to identify all of the specimens.

The birds were weighed in the field on a spring balance made especially for this work (sensitivity to 0.25 gram). They were then placed in small plastic bags to prevent evaporation until reaching camp where they were weighed again on a torsion balance sensitive to 2 mg. The pectoral musculature was cut carefully away from the bone for weighing which was done on the torsion balance. After removing the pericardium, the large blood vessels were severed close to the heart, and all blood removed from the latter by means of filter paper. The hearts were weighed on a Roller-Smith torsion balance sensitive to 0.02 mg. All birds except *Archilochus colubris* were collected during January, February, and March in Panama.

Body weights were determined in 148 specimens, distributed among 25 species and subspecies. Heart weights were obtained in 84 specimens of 22 species and subspecies, and pectoral musculature weights in 13 specimens of 9 species and subspecies. Although the body weights were kept separate for the sexes, in only three species was there a difference. The significance of the difference between sexes was: for *Amazilia edward niveoventer* $P < 0.01$; for *Amazilia tzacatl tzacatl* $P < 0.01$; and for *Damophila julie panamensis* $P < 0.05$. A record was kept of the time of day at which each bird was killed. This ranged from 7 a.m. to 5 p.m. However the body weight in the same species bore no relation to this time.

Heart weights among individuals of the same species showed considerable variation in relation to the body weight (table 1). The standard errors are shown in species with more than four values. Although the standard error is usually not large, in several species the range was great because of values in a few individuals e.g, the greatest difference in extreme values was in *Selasphorus*, 1.50 to 2.86 per cent. Other examples are: *Anthracothorax*, 1.88 to 2.66 per cent; *Chlorostilbon*, 1.66 to 2.37 per cent; *Amazilia tzacatl*, 1.64 to 2.97 per cent.

Comparing species I found that except for the abnormal values, the heart ranged from 1.74 to about 2.40 per cent of the body weight. The limited number of determinations for the pectoral musculature shows the great proportion of the body found in this organ. The values range between 22.5 and 33.7 per cent in the different species and average 27.14 per cent.

Baldwin and Kendeigh (1938, Auk 55: 416–467) reported a daily rhythm of body weight, the lowest values occurring in the early morning and the greatest in the late afternoon or early evening. They attributed this to feeding. In those species where specimens were collected in the morning and afternoon I observed no such difference. However, my series was too small to be conclusive.

Rüppell (1931) reported species which were different from any of those studied by us. His heart values were somewhat higher than most of ours, being 2.265, 2.465, and 2.85 per cent. Three out of four of his specimens had been in captivity in Europe.

In a series of 300 species and subspecies of birds which I have collected, only 12

TABLE 1

CARDIAC AND PECTORAL MUSCLES OF TROCHILIDS

Form	Body weight in grams	Heart as per cent of body weight	Pectoral musculature as per cent of body weight
Glaucis hirsuta affinis	5 ♀ 6.13 ±0.32	(5) 2.27 ±0.19	(1) 27.6
	1 ♂ 6.95		
Phaethornis guy coruscus	3 ♂ 5.53; 5.72; 6.09	(3) 2.27; 2.40; 2.53	(1) 28.6
Phaethornis superciliosus cassinii	1 ♀ 6.15	(1) 2.19	
Phaethornis longuemareus saturatus	1 ♀ 2.64	(1) 2.42	
Phaeochroa cuvierii	4 ♀ 7.0; 7.5; 8.28; 9.0		
	8 ♂ 9.30 ±0.24	(6) 1.74 ±0.065	
Campylopterus hemileucurus	3 ♂ 11.2; 11.25; 13.30	(3) 1.87; 1.96; 2.01	(1) 33.7
Florisuga mellivora	2 ♀ 6.8; 7.12	(1) 1.83	
Colibri thalassinus cabanidis	1 ♀ 4.8		
	2 ♂ 5.1; 5.47	(2) 1.88; 2.01	
Anthracothorax nigricollis nigricollis	2 ♀ 7.2; 7.47	(2) 1.88; 2.66	
	2 ♂ 6.5; 7.22		
Chlorostilbon canivetii assimilis	7 ♀ 3.13 ±0.06	(8) 1.88 ±0.10	(2) 26.4; 26.5
	1 ♂ 3.03		
Damophila julie panamensis	5 ♀ 3.03 ±0.08	(5) 2.02 ±0.11	
	11 ♂ 3.35 ±0.08		
Amazilia amabilis costaricensis	3 ♀ 3.76; 3.8; 3.98	(3) 1.92; 2.05; 2.73	
	1 ♂ 4.78		
Amazilia amabilis decora	7 ♂ 4.74 ±0.14	(2) 1.87; 2.73	
Amazilia edward niveoventer	8 ♀ 4.43 ±0.08	(8) 2.28 ±0.09	(2) 27.0; 30.1
	12 ♂ 4.97 ±0.10		
Amazilia edward edward	2 ♀ 4.0; 4.3		
Amazilia tzacatl tzacatl	10 ♀ 4.72 ±0.10	(9) 2.12 ±0.08	(2) 26.3; 26.9
	12 ♂ 5.40 ±0.10		
Eupherusa eximia egregia	5 ♂ 4.35 ±0.10	(3) 2.28; 2.29; 2.46	
Elvira chionura	1 ♀ 2.83	(2) 1.92; 2.57	
	1 ♂ 2.93		
Chalybura buffonii micans	1 ♀ 5.6		
Lampornis castaneoventris	4 ♀ 4.74; 5.23; 5.5; 5.58	(6) 2.16 ±0.12	(1) 22.5
Heliodoxa jacula henryi	1 ♀ 7.39	(1) 1.98	(1) 27.9
Eugenes fulgens spectabilis	1 ♂ 5.7	(1) 2.16	
Heliothrix barroti	1 ♀ 5.7		
Archilochus colubris	3 ♀ 3.05; 3.4; 3.63	(2) 2.00; 2.62	
	2 ♂ 3.0; 3.4		
Selasphorus scintilla	9 ♀ 2.23 ±0.07	(11) 2.40 ±0.12	(2) 23.6; 25.8
	3 ♂ 2.1; 2.15; 2.75		

The number of individuals is shown in parenthesis.
Where there are more than four specimens the mean and standard error are shown.

possessed hearts 1.5 per cent or more of the body weight. From the activity of hummingbirds, the relatively greater size of the hearts might be expected.

Among the trochilids themselves, the smaller forms appear to possess relatively somewhat larger hearts than do larger forms. Thus in birds with bodies weighing between two and three grams (*Phaethornis longuemareus, Elvira,* and *Selasphorus*) the values were 2.42, 1.92 and 2.57, and 2.40 per cent. Birds weighing more than six grams (*Glaucis, Phaethornis superciliosus, Phaeochroa, Campylopterus, Florisuga, Anthracothorax,* and *Heliodoxa*) possessed hearts from 1.74 to 2.27 per cent of the body (one value of 2.66 for *Anthracothorax* may be atypical).

The relatively large pectoral musculature would indicate powerful flight and the sustained intense activity would demand more work from the trochilid heart than

that required in many other birds. Our observations show that the hummingbird has relatively the largest heart of all birds examined.

I am indebted to the Comly Fund and the Graduate School of the Ohio State University for grants in aid of this study. FRANK A. HARTMAN. *Department of Physiology, Ohio State University, Columbus, Ohio*

Food of the Great Horned Owl and Barn Owl in East Texas.—During a two year ecological study (1950–1951) of the Bob-white Quail in east-central Texas, specimens of several species of raptorial birds were collected and their stomach contents examined for remains of quail. Stomach analyses were supplemented with information obtained from 44 pellets, collected between February 22 and March 15, 1951, from three nestling and two adult Great Horned Owls (*Bubo virginianus*). The owl nest was located four miles east of Benchley, Robertson County, Texas, and was situated in the rotted crown of a large elm, the nest (the hollow crown) being approximately 35 feet from the ground.

The nest tree was one of many such elms forming a savanna in a low section of pasture. A small, permanent stream flowed between this low area and a high and drier pasture of bluestem grasses (*Andropogon* spp.). Because of the diversity of cover found in this area and the relatively high population of quail, a 640-acre section had been designated in January, 1950, as a research area for the study of quail activity and movement.

TABLE 1

ANALYSES OF 44 GREAT HORNED OWL PELLETS

Species of prey	*Number of Individuals*
Sylvilagus sp. (rabbit)	10
Sigmodon hispidus (Cotton Rat)	17
Reithrodontomys sp. (Harvest Mouse)	1
Glaucomys volans (Flying Squirrel)	1
Rattus norvegicus (Norway Rat)	1
Colinus virginianus (Bobwhite Quail)	1
Colaptes auratus (Flicker)	1
Fringillidae (sparrows)	2

Although the severe drought of the previous summer and fall had seriously affected pastureland and reduced much of the natural ground cover, cotton rats and cottontail rabbits remained plentiful. The cottontail was especially numerous in the brush, tall grass, and weeds that bordered the stream. Based primarily on skull identification, a qualitative analysis of each pellet was made to determine the species preyed upon and the frequency with which each occurred (table 1). Although cotton rats were taken in the greatest number, *Sylvilagus* sp. constituted the main bulk in the diet. Three other species of mammals and three species of birds were also consumed, but they were apparently taken incidentally rather than forming a major food item. The Bob-white was identified by the presence of leg band No. 45125 in one of the pellets; the quail had been banded on December 2, 1950, at the edge of a stretchberry thicket (*Smilax bona-nox*), approximately 100 yards from the nest tree. Prey species taken by this family of owls appeared to show a close correlation between consumption and availability.

On December 5, 1952, 375 complete pellets and portions of 80 other pellets of the