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MYOCARDIAL GLYCOGEN CONTENT OF SOME REPRESENTATIVE VERTEBRATES

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THE polysaccharide glycogen is the immediately available fuel reserve for energy metabolism along the glycolytic pathway. In muscle, including cardiac muscle, it has considerable physiological significance, especially during hypoxia, and is observed to vary in level under diverse physiological conditions[1-5]. Further, chamberwise variations in heart glycogen content are also reported in some vertebrates[2,6]. Nevertheless, data on glycogen content of myocardium of vertebrates adapted to diverse ecological conditions and activity levels are scant. Accordingly, it was thought that a study on the glycogen content of the different chambers of the heart of some representative vertebrates would yield valuable information regarding the adaptive physiology of vertebrate myocardium with reference to glycogen.

Nine representative vertebrates, adapted to diverse ecological conditions and activity levels, were chosen for the present study. Myocardial samples were excised from healthy adult animals of both sexes and comparable body size. Glycogen was estimated by the method of Seifter *et al.*[7] using anthrone reagent. The data are given in table 1.

In general, lower vertebrates show higher glycogen content in the myocardium than birds and mammals. Further, variation between the chambers is much more in lower vertebrates than in birds and mammals. This probably indicates that the carbohydrate fuel reserve, glycogen, has a greater significance in the physiological adaptation of the myocardium of lower vertebrates than that of birds and mammals.

Glycogen content of myocardium of *Cybium* is not so high in comparison with that of some other lower vertebrates. In fact, relatively higher glycogen values are seen in the myocardium of *Rana*, with significant regional variation, especially between the two ventricular halves, the right half showing a higher glycogen content than the left. This may be due to greater muscular effort of the right ventricular half in pumping venous blood to the pulmonary and cutaneous respiratory surfaces. Functional differentiation of the right and left halves

Table 1 *Glycogen content of myocardium of the different chambers of heart in nine vertebrates*

	Glycogen (μg/100 mg wet tissue) Atrium		Ventricle	
	Right	Left	Right	Left
Cybium guttatum	109.61 (6.52)		84.24 (5.34)	
Rana tigrina	354.16 (24.65)	329.46 (25.91)	758.58 (69.99)	473.14 (51.14)
Calotes versicolor	143.45 (13.63)	147.42 (14.41)	83.72 (15.51)	58.39 (9.02)
Geomyda trijuga	112.97 (7.21)	52.83 (5.11)	82.42 (6.24)	61.67 (4.51)
Lissemys punctata	2145.61 (121.07)	1605.23 (50.78)	1561.56 (70.88)	1904.14 (143.53)
Gallus domesticus	58.56 (3.71)	26.74 (2.63)	35.72 (2.59)	24.81 (1.21)
Columba livia	36.66 (2.28)	29.65 (2.82)	23.55 (3.57)	18.16 (1.21)
Carpa sp.	98.81 (5.58)	127.64 (11.58)	94.81 (7.02)	136.73 (9.57)
Pteropus giganteus	40.95 (5.21)	31.94 (2.97)	26.42 (1.73)	15.78 (1.21)

Values are the mean of ten assays with standard error in parentheses.
Variance analysis was carried out and the F ratio was calculated to test the significance of variations. Significant variation is observed between animals ($P<0.01$) and between chambers ($P<0.01$).

of the ventricle of amphibians has been reported by Johansen and Hansen[8].

Among reptiles, *Calotes* and *Geomyda* do not show significant variations in glycogen content of ventricular myocardium. Unlike *Lissemys*, which is a diving form, *Calotes* and *Geomyda* do not confront prolonged anoxia and may not be in need of large stores of glycogen. However, significant chamberwise variations are observed in the myocardium of *Lissemys*. In the present study, the highest glycogen values were obtained for the myocardium of *Lissemys*, followed by that of *Rana*, which are diving forms. High glycogen has also been reported for the myocardium of another diving turtle, *Chrysemys picta belli*[2]. Clark and Miller[3] attributed the anaerobic survival of the freshwater turtle *Pseudomys scripta elegans* to low metabolic requirement and capacity for sustained anaerobic glycolysis. Reeves[9] has shown that turtle hearts are capable of tolerating sustained anaerobiosis for prolonged periods, with glycogen the preferred substrate for myocardial energy supply.

In general, glycogen content of myocardium of birds and mammals are lower. No significant variations in glycogen level have been observed between *Gallus* and *Columba*. In fact, the myocardium of both species shows an oxidative type of metabolism, as evidenced by higher SDH activity with lipid as fuel[10]. Interestingly, the flying form *Pteropus* showed a much lower glycogen content than the less active and domesticated form *Capra*. High phosphorylase activity has been shown in the myocardium of *Pteropus*[11]. Probably, being a flying mammal, *Pteropus* needs greater glycogen turnover than *Capra*. Further, diurnal dormancy and subsequent bradycardia are generally observed in bats[12]. *Pteropus* also exhibits diurnal dormancy, and probably its myocardium depends on glycogen metabolism for energy as a result of physiological adaptation to daily torpor.

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MUTAGENIC POTENTIAL OF HUMAN KALA-AZAR HAEMOFLAGELLATE IN MOUSE

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WHILE the mutagenic potential of numerous chemical and physical agents in mice and other mammalian models is an established fact, the idea of microbes like viruses, mycoplasma, bacteria and fungi imperfecti acting as 'living mutagens' has also been proposed and examined[1-7]. Protozoans have not been similarly examined[8]. This communication extends the study to a protozoan parasite.

Leishmania donovani, the human kala-azar parasite, was cultured in diphasic Tobi's solid slant medium[9] and isolated in phosphate buffer, pH 7.2. One ml of a suspension containing approximately 5×10^7 parasites was injected intraperitoneally into Swiss albino mice (body weight about 20 g). Control mice, from the same stock, were given 1 ml of phosphate buffer. The parameters used to test the mutagenic potential of *L. donovani* in mouse were bone marrow chromosome aberrations, micronucleus test (MNT), frequency of sperm with abnormal head morphology and sperm depletion effect.

Bone marrow chromosome preparations were made 6 h and 24 h after injection following the standard colchicine–sodium citrate–acetic alcohol–flame drying–Giemsa staining schedule[10]. Two hundred metaphases from control and parasite-