to Prof. P. N. Ganapati for interest and encouragement.

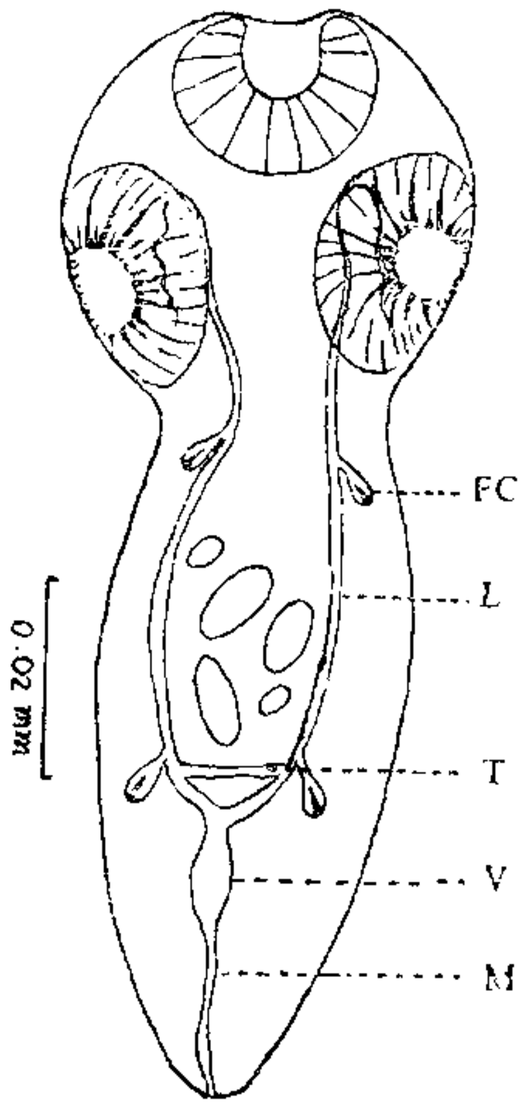

FIG. 1. Tetraphyllidean larva FC. Flame cell, L. Longitudinal canal, T. Transverse canal, V. Vesicle, M. Median stem.

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FAT AND CARBOHYDRATE LEVELS IN *MARTESIA FRAGILIS* IN RELATION TO SEX CHANGE

IT is known that *Martesia fragilis*, the wood-boring pholad, is stenomorphic and exhibits a sex change from a protandrous to a protogynous condition through a hermophroditic stage.[1] During a study of the chemical constituents of *M. fragilis* Srinivasan[2-4] reported that the fat and glycogen levels are not size dependent and are influenced by the gonadial activity and nutrition. The interrelationships between these two chemical constituents accumulated during the early and late sexual phases in its life-history in relation to their nature and significance are reported here.

Estimations of fat and carbohydrate content are made using techniques reported earlier.[5,6] It was observed that there was no relationship between fat and body size during growth stages (Table I). The immature and male *Martesia*

TABLE I

	Wet weight mg.	Glycogen %	Mean %	Wet weight mg.	Fat %	Mean %
Spent						
Immature or	10·00	3·25		19·17	12·6	
Male phase	17·35	2·84	2·77	29·50	16·0	
	41·50	2·22		30·20	13·9	13·24
				36·00	12·1	
				68·00	11·6	
Gravid	5·50	5·77				
	10·00	7·10	7·36			
	13·50	9·22				
Female	6·00	11·58		23·67	12·4	
phase	12·50	8·36	9·17	24·00	11·5	11·1
	24·00	7·58		43·90	10·0	
				69·00	10·5	

have greater amount of fat per unit weight than the females. In the young (immature or male phase) the percentage of fat varies from 11·6% to 16% for a range in wet weight of 19·17 to 68·00 mg. while in resting adults (mature female phases) it is 10% to 12·4% for 23·67 to 69·00 mg. of wet weight. It has been noted that in the actively boring *Martesia* the percentage fat is higher and as the animal grows in size and when the adult stage is reached (in the resting condition) there is a fall in the fat content.

The carbohydrate value as estimated by the glycogen content of entire animals in the burrowing phase is low (2·77%) and during growth and sex change into the female phase it rises to 9·17% with a mean of 4·88%.

The glycogen content is on an average higher in females than in males and in gravid females than in spent ones, which may suggest a relation to egg production requiring energy store. It may be inferred that so far as increase in size is concerned pholads which have to depend on plankton filtration may not be in a position to increase their carbohydrate content as much as their protein. The glycogen values of animals other than the gravid and spent ones do not

vary considerably with increase in weight as has been observed in *Teredo* (Lane *et al.*).[7]

It will be seen from the above observations that during growth and sex change the percentage of fat declines during the female resting phase whereas the carbohydrates register a threefold increase during the same phase resulting in a balanced proportion of these two constituents in the resting adult phase. The high fat content in *M. fragilis* appears to be due to the animal's dependence for nutrition on zooplankton which is richer in fats than in carbohydrates.[8] The higher fat content in young burrowing forms, compared to glycogen, suggests the possibility of fat forming a considerable part of the metabolic substrate, especially in the young stages when the animals are active borers with higher energy requirements. Also, the above observations are substantiated by the fact that twice as much energy is produced per gram of fat when oxidized as per gram of carbohydrate (Raymont and Conover).[8]

The data presented in Table I show an increase of carbohydrates in maturing forms. This is probably because of the concentration of glycogen in the gonads rather than a uniform increase in all tissues. Hopkins and Hutchinson[9] in tracing the fluctuations of nitrogen and carbon in parasitic cestodes remark that a fall in the nitrogen level during growth has been considered as a mere reciprocal of the important metabolite which is likely to be glycogen. If this were true, as a general principle, it is supported by the fact that when glycogen concentration increases in the gonads, the nitrogen decreases in the whole animal relative to carbohydrates as has been shown by the author.[10] Hence, it is probable that during growth, sex change and in female phase the glycogen forms an important metabolite.

The fat and carbohydrate levels of *M. fragilis*, a pelagic form in the inshore area, are higher than in *M. striata* an allied species occurring in fixed timber structures of the harbour which is an enclosed area. The differences in the chemical constituents observed in the two species may possibly be due to the provision of greater opportunities for intensive feeding for *M. fragilis* than for *M. striata*. Also, the availability of zooplankton-rich food is expected to be higher in the coastal area than inside the harbour where it will be limited owing to factors like pollution and low oxygen content of sea-water.

Thus, the above observations show that in *M. fragilis* the lipids are more important as metabolites in the earlier male phase (actively burrowing) when carbohydrate levels are lower. However, as the animals grow and undergo sex change into the female phase (*i.e.*, when the animals have ceased burrowing) the carbohydrates accumulate in larger quantities and are of considerable importance as metabolites.

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IONIC REGULATION IN *MARPHYSA GRAVELYI* SOUTHERN (POLYCHAETA)

IN an earlier paper,[1] it was shown that chlorides are regulated in *Marphysa gravelyi* Southern, a brackish-water Eunicid. Analyses (mean of 10 estimations) of Na and K ions using Zeiss Flame Photometer, show that (Table I) these

TABLE I

Experimental Medium ‰	Final Body Fluid Concentration in mM/l						
	Values			Ratios			
	Cl	Na	K	Na:Cl	K:Cl	K:Na	:(Na+Cl)/(K+Cl)
9	301	150	28	1:2	1:11	1:5	1:1·4
11	358	135	24	1:3	1:15	1:5	1:1·3
16	305	90	18	1:3	1:17	1:5	1:1·2
26	464	163	33	1:3	1:14	1:5	1:1·2

ions also are regulated. The Na content of the body fluid ranged from 90 mM/1 in worms exposed to 16‰ external salinity to 163 mM/1 in worms exposed to 26‰. The K ions ranged from 18 mM/1 to 33 mM/1 in worms exposed to similar external dilutions. When the ratios are considered, there is a remarkable constancy; for example, the ratios between Cl and Na is