GLUCO-SULFATASE. III.[1]

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We have reported in the preceeding communication[1] that our sulfatase exists not only in *Eulota* spp., but also in other mollusks, such as mud-snail (*Viviparus japonicus* Martens). It would be interesting, therefore, to investigate the existence of our sulfatase in wider ranges of the molluscan phylum.

Those materials investigated in the present researches were partially obtained from the market and others collected at the Misaki Marine Biological Station. The experimental manipulations are the same as described in the preceeding papers, that is, the enzyme solutions were prepared as usual from the ground contents of materials with a centrifuge and the hydrolysed sulphate was titrated by the benzidine-method.

The experimental data are summarized below in Table 1. In this table, (S) means the amount of sulphate in 1 c.c. as sulphur in miligram, and (%) means the percentage of this sulphur to the total sulphur (free sulphate and ethereal sulphate). Those data in brackets mean the corresponding controls.

Table 1.

Species \ Days		2	4	5	6	7	Date of collection
1. *Lymnaea*	(S)	0.023 (0.008)	0.049 (0.007)	0.088 (0.010)			Middle of May
	(%)	1.2 (0.4)	2.6 (0.4)	4.7 (0.5)			
2. *Paphia*	(S)	0.039 (0.000)	0.149 (0.000)		0.181 (0.024)		
	(%)	1.4 (0.0)	5.2 (0.0)		6.4 (0.8)		
3. *Ostrea*	(S)	0.065 (0.042)	0.077 (0.057)		0.088 (0.057)		
	(%)	2.3 (1.5)	2.7 (2.0)		3.1 (2.0)		
4. *Anadara*	(S)	0.019 (0.016)	0.042 (0.015)		0.060 (0.016)		
	(%)	0.7 (0.6)	1.5 (0.5)		2.1 (0.6)		

(1) Gluco-Sulfatase II, *J. Chem. Soc. Japan*, **54** (1933), 59.

Table 1.—(*Continued*)

Species \ Days		2	4	5	6	7	Date of collection
5. *Turbo*	(S)	0.198 (0.079)	0.230 (0.078)		0.284 (0.079)		End of June
	(%)	7.0 (2.8)	8.1 (2.7)		10.0 (2.8)		
6. *Corbicula*	(S)	0.013 (0.000)	0.038 (0.000)		0.048 (0.000)		
	(%)	0.5 (0.0)	1.3 (0.0)		1.7 (0.0)		
7. *Meretrix*	(S)	0.195 (0.147)	0.260 (0.151)		0.291 (0.202)		
	(%)	6.8 (5.2)	9.1 (5.3)		10.2 (7.1)		
8. *Haliotis*	(S)	0.230 (0.039)	0.349 (0.036)		0.410 (0.055)		Beginning of July
	(%)	8.1 (1.4)	12.2 (1.3)		14.4 (1.9)		
9. *Rapana*	(S)	0.142 (0.091)		0.182 (0.070)		0.231 (0.076)	
	(%)	5.0 (3.2)		6.4 (2.5)		8.1 (2.7)	
10. *Monodonta*	(S)	0.318 (—)	0.436 (0.000)			0.537 (0.018)	Middle of July
	(%)	11.2 (—)	15.3 (0.0)			18.9 (0.6)	
11. *Clava*	(S)	0.281 (0.066)	0.344 (0.063)			0.483 (0.066)	
	(%)	9.9 (2.3)	12.1 (2.2)			16.9 (2.3)	
12. *Coronatus*	(S)	0.338 (—)	0.416 (0.000)			0.560 (0.000)	
	(%)	11.9 (—)	14.6 (0.0)			19.6 (0.0)	
13. *Charonia*	(S)	1.190 (0.152)	1.923 (0.154)		2.130 (0.177)		End of July
	(%)	41.8 (5.3)	67.5 (5.4)		74.8 (6.2)		
14. *Onchidium*	(S)	0.148 (0.012)	0.237 (0.007)		0.288 (0.024)		
	(%)	5.2 (0.4)	8.3 (0.2)		10.1 (0.8)		
13′. *Charonia*	(S)	1.160 (0.234)	1.495 (0.228)		1.674 (0.231)		
	(%)	59.8 (12.0)	77.1 (11.7)		86.5 (11.9)		

Table 1.—(*Concluded*)

Species \ Days		2	4	5	6	7	Date of collection
15. *Tetraclita*	(S)	0.049 (0.030)	0.055 (0.037)		0.067 (0.052)		Middle of September
	(%)	2.5 (1.5)	2.8 (1.9)		3.5 (2.7)		
16. *Ischinochiton*	(S)	0.110 (0.022)	0.222 (0.028)		0.305 (0.027)		
	(%)	5.7 (1.7)	11.5 (1.4)		15.7 (1.4)		
17. *Bathytoma*	(S)	0.133 (0.006)	0.197 (0.006)		0.196 (0.006)		
	(%)	6.9 (0.3)	10.2 (0.3)		10.1 (0.3)		
18. *Strombus*	(S)	0.118 (—)	0.274 (0.014)		0.369 (0.014)		
	(%)	6.1 (—)	14.1 (0.7)		19.0 (0.7)		
19. *Latrunculus*	(S)	0.062 (0.043)		0.083 (0.048)		0.093 (0.046)	Middle of October
	(%)	3.3 (2.2)		4.3 (2.5)		4.8 (2.4)	
20. *Chicoreus*	(S)	0.135 (0.106)		0.286 (0.096)		0.324 (0.096)	
	(%)	7.0 (5.4)		14.7 (4.9)		16.7 (4.9)	

The scientific names of the above forms are:

1. *Lymnaea japonica* Joy.
2. *Paphia philipinarum* Adams.
3. *Ostrea gigas* Thum.
4. *Anadara inflata* Reeve.
5. *Turbo cornutus* Solander.
6. *Corbicula leana* Prime.
7. *Meretrix meretrix* Linné.
8. *Haliotis gigantea* Gmelin.
9. *Rapana thomasiana* Grosse.
10. *Monodonta labis* Linné.
11. *Clava kochi* Philippi.
12. *Turbo coronatus corensis* Recluz.
13. *Charonia lamps* Linné.
14. *Onchidium verruculatum* Cuvier.
15. *Tetraclita squamosa japonica* Pilsbry.
16. *Ischinochiton.*
17. *Bathyloma luhdorfi* Lischke.
18. *Strombus luhuanus* Linné.
19. *Latrunculus japonicus* Sowerby.
20. *Chicoreus sinensis* Reeve.

Now, let us rearrange the above experimental results in the order of the maximum hydrolysing power of the animals studied, and classify them according to taxonomy.

Table 2.

No	Specific names (Japanese names in brackets.	Class.	Order.	Hydrolysed % of glucose-sulphate.
1.	*Charonia lampas* (*Boshu-bora*).	Gastropoda.	Prosobranchiata.	74.6% (2)
2.	*Viviparus japonicus* (*Tanishi*).	,,	,,	36.3%*
3.	*Turbo coronaus* (*Sugai*).	,,	,,	19.6%
4.	*Strombus luhuanus* (*Magaki*).	,,	,,	18.3%
5.	*Monodonta labis* (*Ishidatami*).	,,	,,	18.3%
6.	*Eulota* (*Maimai*).	,,	Pulmonuta.	17.0%*
7.	*Clava kochi* (*Kanimori*).	,,	Prosobranchiata.	14.6%
8.	*Ischinochiton* (*Hizaragai*).	Amphieeura.	Placophora.	14.3%
9.	*Haliotis gigantea* (*Awabi*).	Gastropoda.	Prosobranchiata.	12.5%
10.	*Chicoreus sinensis* (*Kiebora*).	,,	,,	11.8%
11.	*Bathytoma luhdorfi* (*Shyazikugai*).	,,	,,	9.8%
12.	*Onchidium verruculatum* (*Isoawamochi*).	,,	Pulmonata.	9.3%
13.	*Turbo cornutus* (*Sazae*).	,,	Prosobranchiata.	7.2%
14.	*Paphia philipinarum* (*Asari*).	Pelecypoda.	Eulamellibranchiata.	5.6%
15.	*Rapana thomasiana* (*Akanishi*).	Gastropada.	Prosobranchiata.	5.4%
16.	*Lymnaea japonica* (*Monoaragi*).	,,	Pulmonata.	4.2%
17.	*Meretrix meretrix* (*Hamaguri*).	Pelecypoda.	Eulamellibranchiata.	3.1%
18.	*Latrunculus japonicus* (*Baigai*).	Gastropoda.	Prosobranchiata.	2.4%
19.	*Corbicula leana* (*Shijimi*).	Pelecypoda.	Eulamellibranchiata.	1.7%
20.	*Anadara inflata* (*Akagai*).	,,	Filibranchiata.	1.5%
21.	*Ostrea gigas* (*Kaki*).	,,	Pseudolamellibranchiata.	1.1%
22.	*Tetraclita squamosa* (*Kurofujitsubo*).	Crustacea.	Cirripedia.	0.8%

(*Viviparus* and *Lymnaea* are fresh water forms and *Eulota* terrestrial; others are marine animals).

* These data are from the preceeding papers.

(2) During this communication under press, we have experienced that the enzyme of *Charonia* can hydrolyse 82.7% of the ester in 10 days. As another example of Gastropoda we have further investigated *Bursa bufo* Röding (*Naruto-bora*). Its enzyme decomposed 80.5% of the substrate in 10 days.

With a few exceptions, the activity of enzyme of Gastropoda is decidedly stronger than that of Pelecypoda. *Chiton* is the only exception in the first thirteen examples. It shows strong enzyme action but belong to Amphineura. The Amphineura are more primitive than Gastropoda.

From No. 14 to No. 22 no regularity can be found. But to discuss these small differences of activity of enzyme, the analytical data have to be fairly constant for all examples. Our analytical data, however, cannot fulfill this condition; its activity seems to vary by the metabolic condition of animals and the properties of protein of the enzyme solution are not always the same and seem to have some influence upon analytical data. Therefore we wish to leave this question of irregularity open for the future studies. Anyhow, so far as we have experienced, it can be said that the very active gluco-sulfatase is always found in Gastropoda, though it is not the case vice versa.

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