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**Practical Report**

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**Biological Terms in Science Textbooks Used in  
Compulsory Education in Japan****Kunio UMENO***Former Nakamura Gakuen University, Fukuoka, Japan*

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**Abstract**

The author has been researching effective ways of implementing biology education within compulsory education in Japan for many years. To serve as a basic reference for this work, an investigation into the usage of biological terminology in compulsory education science textbooks was performed. The definition of “biological terms” used in this paper includes not only technical terms for biology, but also words related to biology that are also used in daily conversation. The investigation includes the generation of a comprehensive list of biological terms from all the approved, commercially-available science textbooks used in compulsory education, and notation of how many textbooks each of the terms is used in at each grade level (a maximum of six textbooks for elementary school or five for lower secondary school). This paper outlines the results of that investigation.

*Key words:* Biological terms, Compulsory education, Science textbooks

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**Introduction**

Japan adopted the 6-3-3-4 education system immediately after World War II, and has used it since. Compulsory education is a total of nine years, consisting of six years of elementary school and three years of lower secondary school. During this period of compulsory education there is no independent subject “Biology,” and biological items are taught within the broader subject “Science.” Since 1992, Science itself is no longer taught in the first two grades of elementary school, only being taught in the third and higher grades.

The curriculum in Japanese elementary and lower secondary schools is specified by the

Ministry of Education, Culture, Sports, Science and Technology in its Course of Study (*Gakushu shido yoryo*, national curriculum standards for elementary and secondary schools). Textbooks are normally prepared by private textbook publishers in accordance with these guidelines, and only those which are officially approved by the national authority are used in schools. At present, six series of science textbooks have been so approved for use in elementary school and five for use in lower secondary school.

The author has been researching effective ways of implementing biology education within compulsory education for many years. To serve as a basic reference for this work, an investiga-

tion into the usage of biological terminology in compulsory education science textbooks was performed. The lowest grade covered in the investigation was necessarily the third grade, and as pupils at this level are still learning the language itself, the definition of “biological terms” used here includes not only technical terms for biology, but also words related to biology that are also used in daily conversation. As a result, “terms related to biology education” would be more precise than “biological terms.”

The investigation includes the generation of a comprehensive list of related terms from all the approved, commercially-available science textbooks used in compulsory education, and notation of how many textbooks each of the terms is used in at each grade level. This paper outlines the results of that investigation.

### **Method of Investigation**

#### *Extraction of Biological Terms*

The investigation covered all approved, commercially-available science textbooks used in compulsory education. At the elementary school level, all grades and units were covered, but because lower secondary schools have a vocabulary considerably larger than that used in elementary schools, the investigation at the lower secondary school level was limited to units related to biology in four areas (physics, chemistry, biology and earth science).

Biological terms were extracted from these textbooks and classified into the following three groups:

Group 1: Botanical names (species names, along with group and common names); this group includes fungi, algae and bacteria.

Group 2: Zoological names (species names, along with group and common names); this group includes protozoan.

Group 3: General terms (other biological terms including vocabulary from daily conversation related to organisms)

#### *Universality of extracted terms*

The degree of universality was also determined for all extracted terms by counting the number of textbooks each appears in, and results were organized by school grade.

The method used to indicate universality for elementary school textbooks was slightly different from that used for lower secondary school textbooks. Elementary school textbooks are divided by school grade, so there are four textbooks for 3rd grade to 6th grade in each series. At first, the universality of each term is expressed by numbers one through six, for each school grade, by counting how many of the six investigated textbooks it is used in. The sum of the universality ratings for each of the four school grades (3rd to 6th grades) was used to indicate universality of each term for the entire elementary school period. Theoretically, then, the maximum universality is 24 (six points times four years).

For lower secondary schools, textbooks are not divided by school grade. Each term was assigned a universality of one to five, representing how many of the five investigated textbooks it was used in, and this value was also used to indicate universality for the lower secondary school period.

### **Results and Conclusions**

#### *Compilation of Term Types*

As indicated in Table 1, there were a total of 434 biological terms in the elementary school science textbooks, specifically 81 botanical names, 114 zoological names and 239 general terms. Of these, however, only 118 terms were found in all six series of textbooks (universality of 6 or more). For the 118 terms with universality

**Table 1 The number of biological terms found in elementary school science textbooks**

Biological Terms	Universality						Total
	6 or more	5	4	3	2	1	
<b>Group 1 Botanical Names</b>	<b>11</b>	<b>0</b>	<b>3</b>	<b>6</b>	<b>9</b>	<b>52</b>	<b>81</b>
Rate (%)	(13.6)	(0)	(3.7)	(7.4)	(11.1)	(64.2)	(100)
<b>Group 2 Zoological Names</b>	<b>13</b>	<b>7</b>	<b>9</b>	<b>8</b>	<b>16</b>	<b>61</b>	<b>114</b>
Rate (%)	(11.4)	(6.1)	(7.9)	(7.0)	(14.0)	(53.5)	(100)
<b>Group 3 General Terms*</b>	<b>94</b>	<b>20</b>	<b>16</b>	<b>21</b>	<b>34</b>	<b>54</b>	<b>239</b>
Rate (%)	(39.3)	(8.4)	(6.7)	(8.8)	(14.2)	(22.6)	(100)
<b>Totals</b>	<b>118</b>	<b>27</b>	<b>28</b>	<b>35</b>	<b>59</b>	<b>167</b>	<b>434</b>
Rate (%)	(27.2)	(6.2)	(6.5)	(8.1)	(13.6)	(38.5)	(100)
<b>Cumulative Total</b>	<b>118</b>	<b>145</b>	<b>173</b>	<b>208</b>	<b>267</b>	<b>434</b>	

**\*Breakdown of Group 3**

	6 or more	5	4	3	2	1	Total
<b>Botanical Terms</b>	<b>29</b>	<b>3</b>	<b>1</b>	<b>4</b>	<b>9</b>	<b>9</b>	<b>55</b>
<b>Zoological Terms</b>	<b>44</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>21</b>	<b>42</b>	<b>147</b>
<b>General Biological Terms</b>	<b>21</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>37</b>
<b>Total</b>	<b>94</b>	<b>20</b>	<b>16</b>	<b>21</b>	<b>34</b>	<b>54</b>	<b>239</b>

of 6 or more, 11 were botanical names, representing 13.6% of all botanical names found; 13 were zoological names (11.4%) and 94 were general terms (the largest group, at 39.3%). The total of 118 terms, in addition, only represents 27.2% of all terms (434 in total).

For lower secondary school science textbooks (in the biology area), as indicated in Table 2, there was a total of 1,083 terms found, consisting of 224 botanical names, 331 zoological names and 528 general terms. Of these, 170 terms were found in all textbooks (universality of 5).

A breakdown of these 170 terms shows that 20 were botanical names (8.9% of all botanical names), 21 zoological names (6.3%) and 129 general terms (24.4%). For lower secondary schools, then, the 170 terms common to all textbooks represent 15.7% of all terms (1,083), indicating clearly that the degree of difference

among textbooks is greater at the lower secondary school level than at the elementary school level.

*Terms with High Universality*

As discussed above, a total of over 1,500 biological terms was found in the science textbooks used in compulsory education. A complete listing would demand far too much space, so terms with universality of four or greater in elementary and lower secondary school textbooks are shown in Tables 3 through Table 8, along with their respective universality ratings. The lists of botanical and zoological names (Tables 3, 4, 6 and 7) have been generally sorted according to biological classification. The lists of general terms (Tables 5 and 8) have been divided into botanical, zoological and general groups.

Elementary Schools

As indicated in Table 3, the botanical name

**Table 2** The number of biological terms found in lower secondary school science textbooks

Biological Terms	Universality					Total
	5	4	3	2	1	
<b>Group 1 Botanical Names</b>	<b>20</b>	<b>24</b>	<b>19</b>	<b>44</b>	<b>117</b>	<b>224</b>
Rate (%)	(8.9)	(10.7)	(8.5)	(19.6)	(52.2)	(100)
<b>Group 2 Zoological Names</b>	<b>21</b>	<b>23</b>	<b>37</b>	<b>42</b>	<b>208</b>	<b>331</b>
Rate (%)	(6.3)	(6.9)	(11.2)	(12.7)	(62.8)	(100)
<b>Group 3 General Terms*</b>	<b>129</b>	<b>52</b>	<b>57</b>	<b>88</b>	<b>202</b>	<b>528</b>
Rate (%)	(24.4)	(9.8)	(10.8)	(16.7)	(38.3)	(100)
<b>Total</b>	<b>170</b>	<b>99</b>	<b>113</b>	<b>174</b>	<b>527</b>	<b>1083</b>
Rate (%)	(15.7)	(9.1)	(10.4)	(16.1)	(48.7)	(100)
<b>Cumulative Total</b>	<b>170</b>	<b>269</b>	<b>382</b>	<b>556</b>	<b>1083</b>	

**\*Breakdown of Group 3**

	5	4	3	2	1	Total
<b>Botanical Terms</b>	<b>34</b>	<b>12</b>	<b>9</b>	<b>14</b>	<b>42</b>	<b>111</b>
<b>Zoological Terms</b>	<b>77</b>	<b>31</b>	<b>34</b>	<b>50</b>	<b>108</b>	<b>300</b>
<b>General Biological Terms</b>	<b>18</b>	<b>9</b>	<b>14</b>	<b>24</b>	<b>52</b>	<b>117</b>
<b>Total</b>	<b>129</b>	<b>52</b>	<b>57</b>	<b>88</b>	<b>202</b>	<b>528</b>

with the highest universality in elementary school textbooks was “garden balsam.” Common terms to all textbooks were entirely names of spermatophytes.

For zoological names (Table 4), common terms in the invertebrate field to all textbooks were entirely names of insects. For vertebrates, “human being” (indicating the species) was the most common, followed by “medaka (or killifish)”, with very few other terms featuring high universality.

For general terms at the elementary school level (Table 5), there were 33 botanical, 70 zoological and 27 general terms.

Lower Secondary Schools

For botanical names in lower secondary schools (Table 6), there was one term common to all textbooks (universality of five), namely “bacteria” relating to Monera, one term “fungi” relating to Mycota, and 18 terms relating to

spermatophytes, specifically three gymnosperms and 14 angiosperms. There were no terms relating to algae, bryophytes or pteridophytes.

For zoological names (Table 7), there were seven common terms related to invertebrates (invertebrates, amoeba, paramecium, earthworm, insects, springtail, water flea), and 14 related to vertebrates (including five class names such as “Mammalia”).

The general terms found (Table 8) in all lower secondary school textbooks consisted of 34 botanical, 77 zoological and 18 general terms.

**Postscript**

There is insufficient space to examine each of the indicated terms individually so the author omits detailed discussion. In general, there are far more specialized biological terms found in science textbooks than for any other area, leading to a number of comments that the study of biology

in school is excessively dependent on rote memorization. Key questions, therefore, are which terms of this enormous vocabulary should be learned in compulsory education, and what type of curriculum is best suited to teaching them. The author hopes that this research may prove of some value in determining the answers to these questions.

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**Table 3 Botanical names in elementary school science textbooks with universality of four or greater**

No.	Classification	English name	Japanese name	Universality				
				3rd	4th	5th	6th	Sum
1	Dicotyledoneae	balsamine/ garden balsam	hosenka	6	1	4	3	14
2		dishcloth gourd	hechima		6	5		11
3		kidney bean	ingenmame			6	5	11
4		apple	ringo		1	3	4	8
5		cherry tree	sakura		6		2	8
6		potato	jagaimo		2		6	8
7		cabbage	kyabetsu	6			1	7
8		morning glory	asagao	1		4	1	6
9		pumpkin	kabocha			5	1	6
10		bottle gourd	hyotan		2	2		4
11		orange	mikan	3	1			4
12		sunflower	himawari	1	1	1	1	4
13	Monocotyledoneae	corn	tomorokoshi	2		6	3	11
14		rice plant	ine			2	5	7

**Table 4 Zoological names in elementary school science textbooks with universality of four or greater**

No.	Classification	English name	Japanese name	Universality				
				3rd	4th	5th	6th	Sum
<b>INVERTEBRATA</b>								
1	Mollusca	shellfish	kai				5	5
2	Arthropoda	insect	konchu	6	4	2	1	13
3		beetle	kabutomushi	5	1		6	12
4		cabbage butterfly	monshiro-cho	6			2	8
5		locust	batta	6	1		1	8
6		migratory locust	tonosama-batta	6	1			7
7		butterfly	cho	6				6

**Table 4** (Continued)

No.	Classification	English name	Japanese name	Universality				
				3rd	4th	5th	6th	Sum
8	Arthropoda (Continued)	swallow-tail.	ageha	4	2			6
9		pill bug	dangomushi				5	5
10		bee	mitsubachi			4		4
11		cricket	koorogi	3	1			4
12		dragonfly	tonbo	4				4
13		emma field cricket	emma-korogi	3	1			4
14		praying mantis	kamakiri	1	3			4
<b>VERTEBRATA</b>								
15	Pisces	fish	sakana			5	6	11
16		medaka / killifish	medaka			6	5	11
17		crucian carp	funa				4	4
18		red medaka	himedaka			3	1	4
19	Amphibia	frog / toad	kaeru		4		1	5
20	Reptilia	dinosaur	kyoryu				5	5
21		(a kind of dinosaur)	fukuiryu				4	4
22	Aves	bird	tori	1	3	1	4	9
23		swallow	tusbame		5		1	6
24		hen / cock	niwatori				5	5
25	Mammalia	human being / man	hito	5	5	6	6	22
26		rabbit / hare	usagi	1			5	6
27		cow / bull	ushi				5	5
28		horse	uma			1	4	5
29		Japanese antelope	nihon-kamoshika				4	4

**Table 5** General terms in elementary school science textbooks with universality of four or greater

No.	Classification	English	Japanese	Universality				
				3rd	4th	5th	6th	Sum
<b>BOTANICAL</b>								
1	General	plant	shokubutsu	6	6	6	6	24
2		tree	ki	6	6	1	6	19
3		grass	kusa	5		3	5	13
4		bush	kusamura	5	4			9
5		water plant	mizukusa	2		5	1	8
6		rice	kome			3	2	5
7		vegetable	yasai			3	2	5
8	Vegetative organ	leaf	ha	6	6	6	5	23
9		fertilizer	hiryo	4	3	6	6	19

Table 5 (Continued)

No.	Classification	English	Japanese	Universality				
				3rd	4th	5th	6th	Sum
10	Vegetative organ (Continued)	stem	kuki	6	6	6	1	19
11		bud	me	6	5	5	2	18
12		root	ne	6	2	6	1	15
13		germination	hatsuga			6	4	10
14		branch	eda	1	6		2	9
15		sowing	tanemaki	3	4	1		8
16		seedling	nae	1	1	5	1	8
17		sprout	mebae	3	2	2		7
18		fallen leaf	ochiba		3		3	6
19		height of grass	kusatake	2	1		1	4
20	Reproductive organ	fruit	mi	5	6	6	3	20
21		flower	hana	6	6	6	1	19
22		[flower] bud	tsubomi	5	2	6		13
23		seed	tane	6	6	1		13
24		seed	shushi			6	4	10
25		cotyledon	shiyo	3	1	3	1	8
26		petal	hanabira	1		6		7
27		female flower / pistillate flower	mebana			6		6
28		male flower / staminate flower	obana			6		6
29		pistil	meshibe			6		6
30		pollen	kafun			6		6
31		pollination	jufun			6		6
32		stamen	oshibe			6		6
33		nectar	mitsu	2	2		1	5
<b>ZOOLOGICAL</b>								
34	General	body	karada	6	1	5	6	18
35		animal	dobutsu	2	5	4	6	17
36		abdomen	hara	6		4	1	11
37		face	kao	6	1	1	3	11
38		head	atama	6	1	3		10
39		insect / bug / worm	mushi	2	4		3	9
40		thorax	mune	6			2	8
41		abdomen	onaka		1	3	3	7
42	Digestion & Absorption	food [of animal]	esa	5	4	4	2	15
43		food	tabemono	6	1	2	5	14
44		mouth	kuchi	4	2	2	6	14

Table 5 (Continued)

No.	Classification	English	Japanese	Universality					
				3rd	4th	5th	6th	Sum	
45	Digestion & Absorption (Continued)	feces	fun	5			4	9	
46		anus	komon				6	6	
47		colon / large intestine	daicho				6	6	
48		digestion	shoka				6	6	
49		small intestine	shocho				6	6	
50		stomach					6	6	
51		alimentary canal	shokakan				5	5	
52		esophagus	shokudo				5	5	
53		saliva	daeki				5	5	
54		feces	ben				4	4	
55		intestine	cho				4	4	
56		tooth	ha				4	4	
57		Respiration	breathing	iki	1	1		5	7
58			gill	era				6	6
59	lung		hai				6	6	
60	trachea		kikan				6	6	
61	gill cover		erabuta				5	5	
62	nose		hana				5	5	
63	Circulation	heart	shinzo			5	6	11	
64		blood	ketsueki			3	6	9	
65		blood vessel	kekkan			2	4	6	
66		pulse	myakuhaku			1	5	6	
67		stethoscope	choshinki				6	6	
68		body temperature	taion		1		4	5	
69		pulsation	hakudo				4	4	
70	Sensation & Movement	hand / arm / paw / tentacle	te	6	3	6	5	20	
71		eye	me	6	2	5	1	14	
72		foot / leg / paw / tentacle	ashi	6	1	5	1	13	
73		finger / toe	yubi	3		5	2	10	
74		arm	ude			6	3	9	
75		feather / wing	hane	6	3			9	
76		antenna	shokkaku	6				6	
77		bone	hone				6	6	
78		caudal fin	obire				6	6	
79		odor	nioi		1		5	6	
80		wrist	tekubi				6	6	
81		finger tip	yubisaki			1	4	5	

Table 5 (Continued)

No.	Classification	English	Japanese	Universality					
				3rd	4th	5th	6th	Sum	
82	Sensation & Movement (Continued)	call / cry	nakigoe	2	2			4	
83		ear	mimi		1	1	2	4	
84		skin	hifu				4	4	
85	Development	egg	tamago	6	6	5	1	18	
86		breeding	sodachi (-kata)	6	5	4	1	16	
87		larva	yochu	6	4		4	14	
88		adult / imago	seichu	6	4			10	
89		child / cub	kodomo	1	2	4	2	9	
90		pupa	sanagi	6	3			9	
91		baby	akachan		1	4		5	
92		birth	tanjo			5		5	
93		mother	hahaoya			5		5	
94		placenta	taiban			5		5	
95		tadpole	otamajakushi		5			5	
96		umbilical cord	hesono-o			5		5	
97		uterus	shikyu			5		5	
98		adult	otona		3		1	4	
99		amniotic fluid	yosui			4		4	
100		child / cub	ko		2	2		4	
101		green caterpillar	aomushi	4				4	
102		Ecology	dwelling	sumika	6	1		4	11
103	migratory bird		wataridori		4			4	
<b>GENERAL</b>									
104	General	life	seikatsu	3	2	3	6	14	
105		living thing	ikimono	1	5	2	1	9	
106		life	seimei			5	2	7	
107		fossil	kaseki				6	6	
108		hair	ke	1		4	1	6	
109		life	inochi		2	2	2	6	
110		life	kurashi				4	4	
111		living thing	seibutsu			1	3	4	
112		Nutrition	nutriment	yobun			6	6	12
113			skin / bark	kawa	6	1	3		10
114	respiration		kokyu				6	6	
115	absorption		kyushu				5	5	
116	Development	growth	seicho	1	4	6	5	16	
117		development	hassei			5	5	10	

**Table 5** (Continued)

No.	Classification	English	Japanese	Universality				
				3rd	4th	5th	6th	Sum
118	Development (Continued)	female	mesu			4	1	5
119		male	osu		1	4		5
120		fertilized egg	juseiran			4		4
121	Instrument / Tool	magnifying lens	mushimegane	6	1	6	4	17
122		microscope	kenbikyo			6	6	12
123		dissection microscope	kaibo-kenbikyo			5	4	9
124		gas detector	kitai-kenchikan				6	6
125		thermometer	ondokei	6				6
126	Substance	carbon dioxide	nisanka-tanso				6	6
127		iodine solution	yoso-eki				6	6
128		nitrogen	chisso				6	6
129		oxygen	sanso				6	6
130		starch	denpun				6	6

**Table 6** Botanical names in lower secondary school science textbooks with universality of four or greater

No.	Classification	English name / Scientific name	Japanese name	Universality
1	Monera	bacteria	saikin(rui)	5
2	Protista	<i>Closterium</i> spp.	mikazukimo	4
3		<i>Euglena</i> spp.	midorimushi	4
4		<i>Pinnularia</i> spp.	hanekeiso	4
5	Mycota	fungi	kinrui	5
6		mushroom	kinoko	4
7		mould	kabi	4
8	Spermatophyta	seed plants / spermatophytes	shushi-shokubutsu	5
9	Gymnospermae	gymnosperms	rashi-shokubutsu	5
10		cycad	sotetsu	5
11		ginkgo	icho	5
12		cryptomeria / Japanese cedar	sugi	4
13		pine tree	matsu	4
14	Angiospermae	angiosperms	hishi-shokubutsu	5
15	Dicotyledoneae	dicotyledons / dicots	soshiyo-shokubutsu	5
16	Choripetalae	choripetalous plants	ribenka (rui)	4
17		camellia	tsubaki	5
18		chickweed	hakobe	5
19		pea	endo	5
20		rape	aburana	5

Table 6 (Continued)

No.	Classification	English name / <i>Scientific name</i>	Japanese name	Universality
21	Choripetalae (Continued)	shepherd's-purse	nazuna	5
22		beech	buna	4
23		cherry tree	sakura	4
24		fava bean / broad bean	soramame	4
25		balsamine / garden balsam	hosenka	4
26		<i>Vicia angustifolia</i>	karasunoendo	4
27	Sympetalae	sympetalous plants	gobenka (rui)	4
28		azalea	tsutsuji	5
29		<i>Erigeron philadelphicus</i>	harujion	5
30		dandelion	tanpopo	4
31		<i>Gnaphalium affine</i>	hahakogusa	4
32		<i>Taraxacum japonicum</i>	kansai-tanpopo	4
33		<i>Taraxacum officinale</i>	seiyo-tanpopo	4
34		<i>Taraxacum platycarpum</i>	kanto-tanpopo	4
35		<i>Veronica persica</i>	ooinunofuguri	4
36	Monocotyledoneae	monocotyledons / monocots	tanshiyo-shokubutsu	5
37		<i>Commelina communis</i>	tsuyukusa	5
38		<i>Egeria densa</i>	ookanadamo	5
39		onion	tamanegi	5
40		<i>Tradescantia obiensis</i>	murasaki-tsuyukusa	5
41		lily	yuri	4
42		<i>Miscanthus sinensis</i>	susuki	4
43		<i>Poa annua</i>	suzumenokatabira	4
44		rice plant	ine	4

Table 7 Zoological names in lower secondary school science textbooks with universality of four or greater

No.	Classification	English name/ <i>Scientific name</i>	Japanese name	Universality
<b>INVERTEBRATA</b>				
1	Invertebrata	invertebrates	musekitsui-dobutsu	5
2	Protista	amoeba	ameba	5
3		paramecium	zorimushi	5
4	Annelida	earthworm	mimizu	5
5	Mollusca	bladder snail	sakamakigai	4
6	Arthropoda	insect	konchu	5
7		springtail	tobimushi	5
8		water flea	mijinko	5

Table 7 (Continued)

No.	Classification	English name/ <i>Scientific name</i>	Japanese name	Universality
9	Arthropoda (Continued)	<i>Asellus hilgendorffii</i>	mizumushi	4
10		bee	mitsubachi	4
11		black fly	buyu	4
12		centipede	mukade	4
13		Japanese freshwater crab	sawagani	4
14		<i>Mataeopsephemus japonicus</i>	hirata-doromushi	4
15		pill bug	dangomushi	4
16		<i>Protohermes grandis</i>	hebitonbo	4
<b>VERTEBRATA</b>				
17	Vertebrata	vertebrates	sekitsui-dobutsu	5
18	Pisces	fishes	gyorui	5
19		crucian carp	funa	5
20		medaka / killifish	medaka	4
21	Amphibia	amphibian	ryoseirui	5
22		frog / toad	kaeru	5
23		common toad	hikigaeru	4
24		newt	imori	4
25	Reptilia	reptiles	hachurui	5
26		lizard	tokage	5
27		snake	hebi	4
28		tortoise / turtle	kame	4
29	Aves	birds	chorui	5
30		hawk	taka	4
31		hen / cock	niwatori	4
32	Mammalia	mammals	honyurui	5
33		cat	neko	5
34		cheetah	chita	5
35		human being / man	hito	5
36		Japanese monkey	nihonzaru	5
37		rabbit / hare	usagi	5
38		dog	inu	4
39		Iriomote wild cat	iriomote-yamaneko	4
40		lion	raion	4
41		mole	mogura	4
42		monkey	saru	4
43		rat / mouse	nezumi	4
44		squirrel	risu	4

**Table 8 General terms in lower secondary school science textbooks with universality of four or greater**

No.	Classification	English	Japanese	Universality
<b>BOTANICAL</b>				
1	General	plant	shokubutsu	5
2		tree	ki	5
3		bean / pea	mame	4
4		grass	kusa	4
5		water plant	mizukusa	4
6	Vegetative organ	branch	eda	5
7		chloroplast	yoryokutai	5
8		epidermis	hyohi	5
9		fibrous root	higene	5
10		fibrovascular bundle	ikansoku	5
11		lateral root	sokkon	5
12		leaf	ha	5
13		main root	shukon	5
14		photosynthesis	kogosei	5
15		root	ne	5
16		root hair	konmo	5
17		scale	rinpen	5
18		sprout	mebae	5
19		sieve tube	shikan	5
20		stem	kuki	5
21		stoma	kiko	5
22		transpiration	josan	5
23		vein	yomyaku	5
24		vessel	dokan	5
25		fallen leaf	ochiba	4
26		fiber / stripe / texture	suji	4
27		germination	hatsuga	4
28		netted venation	mojomyaku	4
29		parallel venation	heikomyaku	4
30	variegation	furi	4	
31	Reproductive organ	cotyledon	shiyo	5
32		female flower / pistillate flower	mebana	5
33		flower	hana	5
34		fruit	kajitsu	5
35		male flower / staminate flower	obana	5
36		ovary	shibo	5

Table 8 (Continued)

No.	Classification	English	Japanese	Universality
37	Reproductive organ (Continued)	ovule	haishu	5
38		pistil	meshibe	5
39		pollen	kafun	5
40		pollination	jufun	5
41		seed	shushi	5
42		stamen	oshibe	5
43		stigma	chuto	5
44		anther	yaku	4
45		calyx	gaku	4
46		pinecone	matsukasa	4
<b>ZOOLOGICAL</b>				
47	General	animal	dobutsu	5
48		bird	tori	5
49		fish	sakana	5
50	Digestion & Adsorption	alimentary canal	shokakan	5
51		anus	komon	5
52		bile / gall	tanju	5
53		colon / large intestine	daicho	5
54		digestion	shoka	5
55		esophagus	shokudo	5
56		food	shokumotsu	5
57		gall bladder	tanno	5
58		gastric juice	ieki	5
59		liver	kanzo	5
60		mouth	kuchi	5
61		pancreas	suizo	5
62		pancreatic juice	suieki	5
63		saliva	daeki	5
64		salivary gland	daekisen	5
65		small intestine	shocho	5
66		stomach	i	5
67		tooth	ha	5
68		villus	jumo	5
69		amylase	amiraze	4
70	digestive enzyme	shokakoso	4	
71	digestive juice	shokaeki	4	
72	fang / canine tooth	kenshi	4	

Table 8 (Continued)

No.	Classification	English	Japanese	Universality
73	Digestion & Adsorption (Continued)	feces	fun	4
74		molar	kyushi	4
75		tongue	shita	4
76	Respiration	alveolus	haiho	5
77		gill	era	5
78		lung	hai	5
79		trachea	kikan	5
80		breathing	iki	4
81		bronchus	kikanshi	4
82	Circulation	artery	domyaku	5
83		blood	ketsueki	5
84		blood plasma	kessho	5
85		blood vessel	kekkan	5
86		capillary	mosaikkekkan	5
87		circulation	junkan	5
88		erythrocyte	sekikekkyu	5
89		heart	shinzo	5
90		hemoglobin	hemogurobin	5
91		leucocyte	hakukekkyu	5
92		lymphatic vessel	rinpakan	5
93		tissue fluid	soshikieki	5
94		vein	jomyaku	5
95		arterial blood	domyakuketsu	4
96		blood platelet	kesshoban	4
97		pulmonary circulation	hai-junkan	4
98		systemic circulation	tai-junkan	4
99		valve [of vein]	ben	4
100		venous blood	jomyakuketsu	4
101		Excretion	bladder	boko
102	excretion		haishutsu	5
103	kidney		jinzo	5
104	urine		nyo	5
105	ureter		yunyokan	4
106	Sensation & Movement	backbone	sebone	5
107		bone	hone	5
108		brain	no	5
109		cochlea	uzumakikan	5

Table 8 (Continued)

No.	Classification	English	Japanese	Universality
110	Sensation & Movement	drum membrane / tympanum	komaku	5
111	(Continued)	ear	mimi	5
112		eye	me	5
113		foot / leg	ashi	5
114		iris	kosai	5
115		joint / articulation	kansetsu	5
116		motor nerve	undo-shinkei	5
117		muscle	kinniku	5
118		nerve	shinkei	5
119		nervous system	shinkeikei	5
120		nose	hana	5
121		odor / smell	nioi	5
122		reflex [ <i>of animal</i> ]	hansha	5
123		retina	momaku	5
124		sensory nerve	kankaku-shinkei	5
125		sensory organ	kankaku-kikan	5
126		skeleton	kokkaku	5
127		spinal cord	sekizui	5
128		unconsciousness	muishiki	5
129		arm	ude	4
130		caudal fin	obire	4
131		left eye	hidarime	4
132		lens [ <i>of eye</i> ]	renzu	4
133		pupil [ <i>of eye</i> ]	hitomi	4
134		right eye	migime	4
135		sense / sensation	kankaku	4
136		signal [ <i>of nerve</i> ]	shingo	4
137		sinew / tendon	ken	4
138		wing	tsubasa	4
139	Development	egg	ran	5
140		oviparity	ransei	5
141		tadpole	otamajakushi	5
142		viviparity	taisei	5
143		milk	chichi	4
144	Ecology	body temperature	taion	5
145		carnivore	nikushoku-dobutsu	5
146		feather	umo	5
147		herbivore	soshoku-dobutsu	5

Table 8 (Continued)

No.	Classification	English	Japanese	Universality
148	Ecology ( <i>Continued</i> )	homeotherms	ko'on-dobutsu	5
149		poikilotherms	hen'on-dobutsu	5
150		shell	kara	5
151		bait / food	esa	4
152		breeding	shiiku	4
153		nest	su	4
154		scale	uroko	4
<b>GENERAL</b>				
155	General	company / set / group	nakama	5
156		grouping	nakamawake	5
157		life	seikatsu	5
158		living thing	seibutsu	5
159		human being	ningen	4
160		life	seimei	4
161	Nutrition	absorption [ <i>of nutriment</i> ]	kyushu	5
162		body	karada	5
163		cell	saibo	5
164		nutriment	yobun	5
165		organ	kikan	5
166		particle	tsubu	5
167		respiration	kokyu	5
168		response	hanno	5
169		stimulus	shigeki	5
170		structure	tsukuri	5
171		surface	hyomen	5
172		wall	kabe	5
173		function	hataraki	4
174		hair	ke	4
175		plica	hida	4
176		salinity	enbun	4
177	Development <i>etc.</i>	child / cub	ko	5
178		growth	seicho	5
179		harmful / injurious	yugai	4
180		offspring	shison	4
181		plankton	purankuton	4