

*Sindhu Mathai - PhD project on
“Visual and verbal literacies in the context of human body systems”
Questionnaires, coding schemes, analysis and results*

Digestive System Phase 2 Part 3: Questionnaires with Scores Assignment

Part 3 A – Comprehension of Structure Diagrams

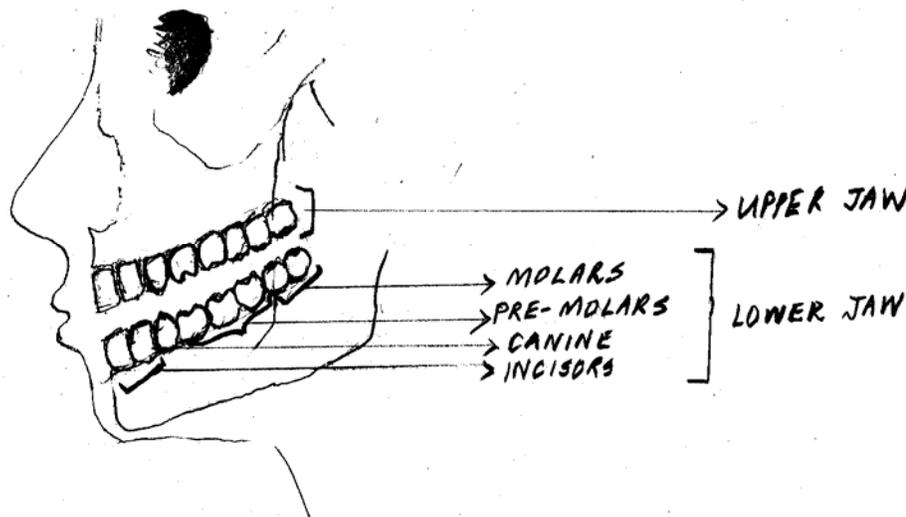
Each question carries a certain number of points which are given within brackets. Mean score for each passage was calculated by putting together scores obtained from all questions for Part 3a. However for Part 3b, three questions: 1, 3j and 2l were not taken into account in calculating the mean scores. All other questions were considered, and are marked with *.

Diagrams were adapted (simplified and converted to black and white line drawings) from: Broderick, M. (Ed.) (1994). The Human Body. Time Life’s Illustrated World of Science. Hong Kong: Time Life Inc.

Task 1

Fig. 1 shows the side-view of Divya's upper and lower set of teeth (that is one half of her full set of teeth). Her lower teeth are labelled. The corresponding upper teeth have exactly the same names.

Fig. 1



Now imagine that Divya is sitting in a dentist's clinic. The dentist says to her:

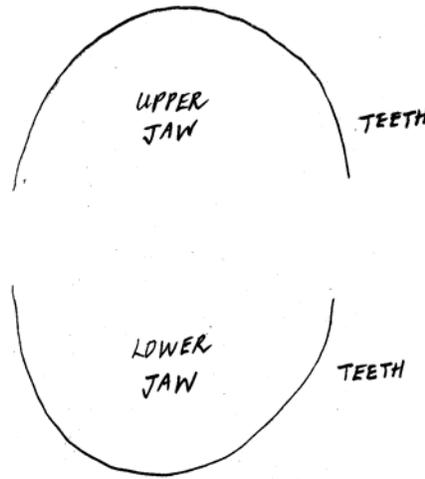
Dentist: Divya, please open your mouth wide.

(Divya opens her mouth as wide as possible.)

Dentist: A little wider ... Aah! Now I can see all your teeth.

1a. Show in a diagram how the dentist might see Divya's teeth when he looks into her mouth. Label the teeth in this diagram. Clue: use the format shown in Fig. 2 given below (1).

Fig. 2



1b. Now count Divya's teeth. Give the number of teeth in the table below. (13)

Type of tooth	Number in the upper jaw	Number in the lower jaw	Total number of teeth of this kind
Incisor			
Canine			
Pre-molar			
Molar			
Total number of teeth altogether:			

1c. Describe the shapes of each kind of tooth: an incisor, a canine, a pre-molar and a molar. Mention how they are different from each other. (4)

1d. How does each kind of tooth help in the process of chewing? (4)

1e. Is the shape of each tooth related to its function? How? (4)

1f. How many teeth do you have? (1)

1g. Are there any teeth you do not have? If so, when will you get them? (1)

1h. Why do you think you lost several teeth when you were about five-six years old? Are the teeth that you have now different from those teeth that you lost? How? (2)

1i. How do you think teeth fall off in old-age? Guess and explain through diagrams and words how this might happen. (2)

Task 2

2a. What is a cross-section? (1)

2b. Why do we draw cross-sections in diagrams? (1)

2c. Draw and label the cross-section of the wire that is given to you. (1)

2d. Give another example from everyday life where you saw a cross-section of something. (1)

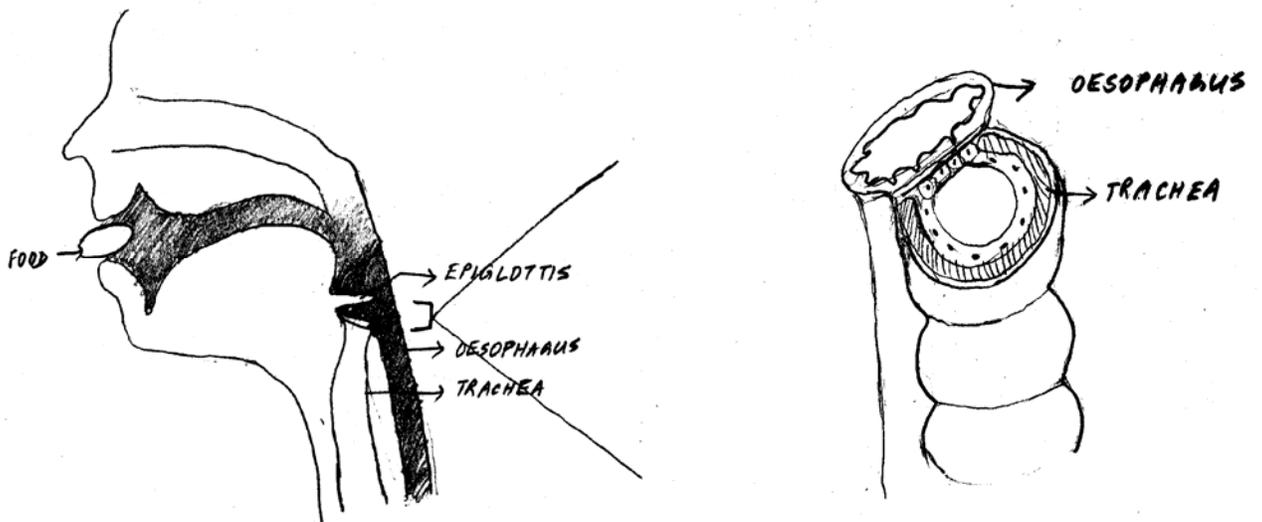
2e. What more information was the cross-section able to give you which the whole object could not? (1)

Task 3

The diagram below shows the trachea (wind-pipe) and the oesophagus (food-pipe), which are located close to each-other. Fig. 3 shows the structure of the trachea and the oesophagus and its location in the body. Fig. 4 shows the cross-section of the two organs. The cross-section shows us that the trachea is a hard, rigid tube compared to the oesophagus which is softer and less rigid.

Fig. 3 Location of the trachea and the oesophagus in the body

Fig. 4 Cross-section of the trachea and the oesophagus during normal breathing



3a. Make another drawing of the cross-section of the trachea and the oesophagus during normal breathing. Show the position of the epiglottis in your diagram. (3)

3b. Show how the trachea and the oesophagus would look like when you're swallowing a mouthful of food. Show a piece of food and the epiglottis in your diagram. (4)

3c. Supposing you choke while swallowing food, how will your previous diagram change? Show the changes that happen in another diagram (1).

Task 4

Read the passage given below

The small intestine is a long tube which has the task of absorbing nutrients after they have been broken down by juices from the stomach and pancreas. To absorb the nutrients effectively, the inner surface of the small intestine is compressed into hundreds of folds and lined with thousands of finger-like protrusions called villi.

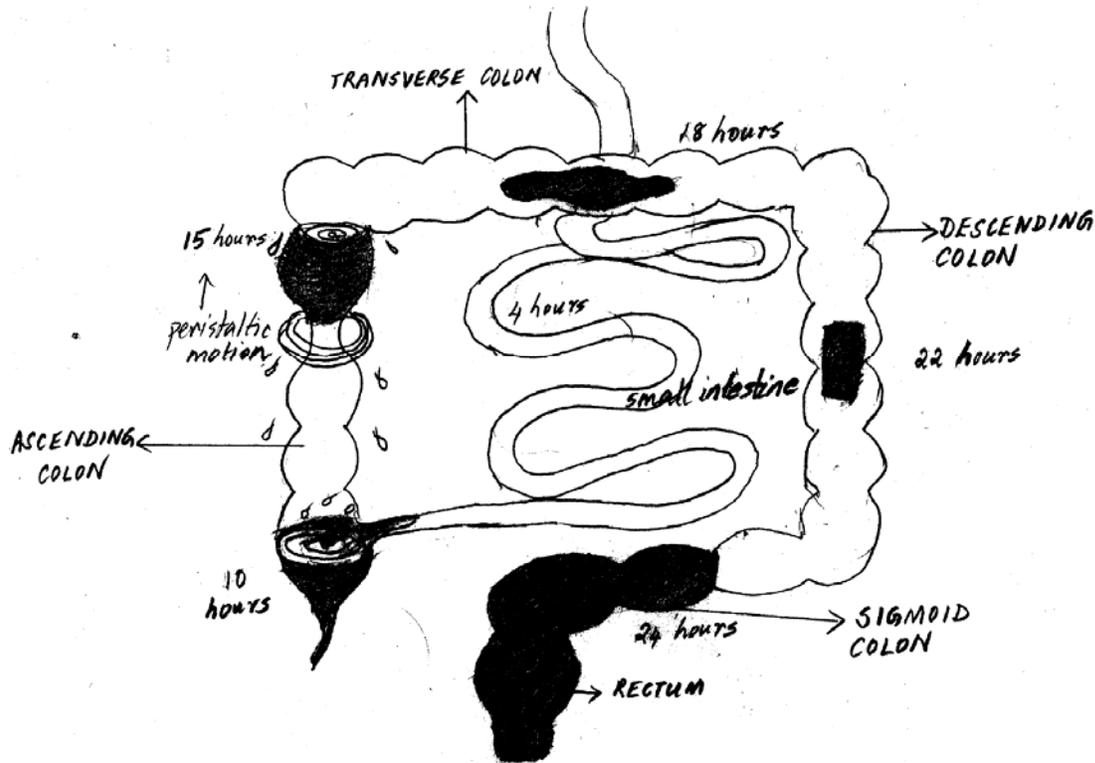
4a. Draw how you imagine the cross-section of the small intestine might look. (You need not show hundreds or thousands of folds or villi. A few will be sufficient for illustration.) (1)

Part 3 B – Comprehension of Function Diagrams

Each question carries a certain number of points which are given within brackets. For Part 3b, three questions: 1, 3j and 2l were not taken into account in calculating the mean scores. All other questions were considered, and are marked with *.

Task 1. Where does the food go after it is digested in the stomach? What happens to it in the small intestine? Where does it go from there? (3)

Task 2. Only the undigested part of the food goes into the large intestine. The diagram below illustrates the working of the large intestine. Go through the diagram carefully, then answer the following questions:



2a. Where is the food just before it enters the large intestine? (1) *

2b. In the diagram you see the labels "ascending colon", "transverse colon", "descending colon" and "sigmoid colon". Explain what these labels indicate. (4) *

2c. You also see the labels "10 hours", "15 hours", "18 hours", "22 hours" and "24 hours". Explain what these times indicate. (5) *

2d. You see a ring drawn around the part which is labelled "peristaltic motion". This ring shows that, in that place, the walls of the large intestine are contracting. Due to this contraction, the food material moves further ahead. Once the material has moved further, the walls relax to their normal position. This successive contraction and relaxation is called peristaltic movement.

How is peristaltic movement useful to us? (1) *

2e. In which parts of the large intestine would you expect peristaltic movement to happen? (1) *

2f. How much time after eating the food does it enter the large intestine? How long does it stay in the large intestine? Describe in the following Table how the food material looks - either liquid, semi-solid or solid, in different parts of the large intestine. (10) *

Time	Which part of the large intestine has it reached after this many hours?	State of the food		
		Solid	Semi-solid	Liquid
10 hours				
15 hours				
18 hours				
22 hours				
24 hours				

2g. How does the food material change as it goes through the large intestine? Why does it change? What parts get absorbed in the large intestine? (3) *

2h. What is faeces composed of? How does the large intestine help in the formation of faeces? (2) *

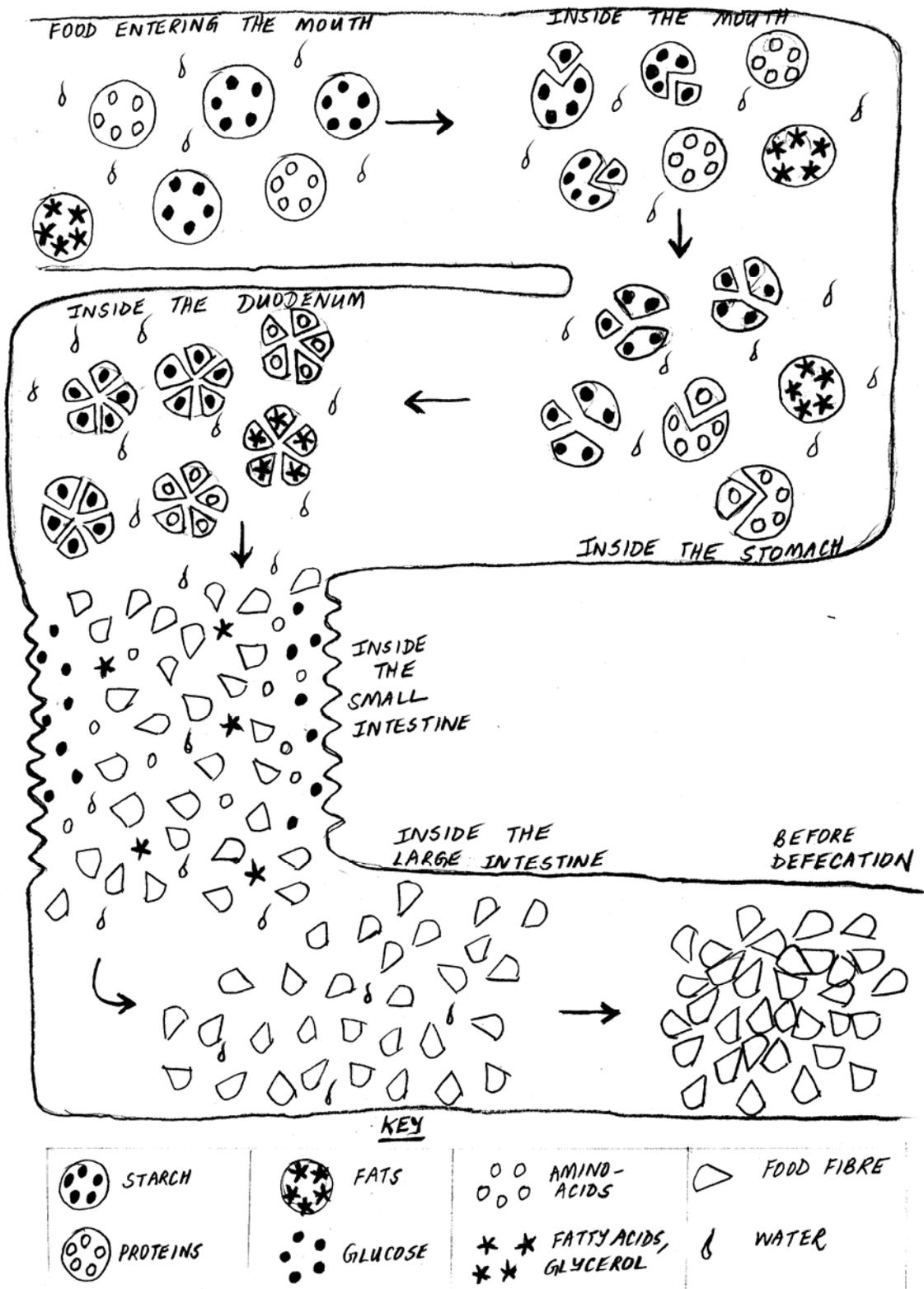
2i. Suppose that food stayed in the large intestine for longer than the normal time. What would be the result? (1) *

2j. Suppose peristaltic motion happened faster than normal. What would be the result? (1) *

2k. Explain step by step through words and drawings how peristaltic motion happens in the large intestine. Take a clue from the given drawing. (2) *

2l. Where else in the body do you see peristaltic motion? (1)

Task 3. The drawing below illustrates the process of digestion in the human body. Look through the diagram carefully and answer the questions below.



3a. What components of food are shown being taken in through the mouth? (3) *

3b. What changes are shown happening in the mouth? Why do these changes happen? (2) *

3c. What changes are shown happening in the stomach? Why do these changes happen? (2) *

3d. What changes are shown happening in the duodenum? Why do these changes happen? (2) *

3e. What changes are shown happening in the small intestine? Why do these changes happen? (2) *

3f. What components are shown being absorbed in the small intestine? (2) *

3g. What changes are shown happening in the large intestine? Why do these changes happen? (2) *

3h. What components are shown being absorbed in the large intestine? (1) *

3i. What are the components that are shown being excreted? (1) *

3j. Do you think that this diagram shows well what happens to food during digestion? Can you think of a better way of showing this? (2)

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Digestive System Phase 2 Part 3: Average scores, maximum scores and nature of questions

Questions used in calculation of comprehension scores are marked with *.

Part 3 A

Q No	Mean score	Max. score	Nature of question
1a*	0.88	1	drawing Divya's teeth from a top view
1c*	0.7	4	describing shapes of different kinds of teeth, and how each is different from the other
1d*	0.7	4	function of each tooth
2c*	0.55	1	draw and label the cross section of the given wire
2d*	0.47	1	example of CS from everyday life
1b*	0.44	13	counting Divya's teeth, different kinds and their number
1f*	0.44	1	how many teeth do you have?
2e*	0.42	1	what more information from CS, compared to whole object
2b*	0.4	1	why are cross sections drawn in diagrams
1e*	0.34	4	Structure-function relationships for each kind of tooth
1i*	0.34	1	teeth falling off in old age, reason
1h*	0.31	2	why did we lose milk teeth?
3a*	0.31	3	How are milk teeth diff from permanent ones?
2a*	0.29	1	another drawing of CS of trachea and oesophagus from normal breathing (one is given already in diagram)
3b*	0.29	3	what is a cross section
3c*	0.23	1	appearance of trachea and oesophagus
1g*	0.22	1	while swallowing a mouthful of food
4a*	0.07	1	diagram for choking while swallowing food
			when will you get teeth you do not have?
			cross-section of the small intestine

Part 3 B

Q No	Mean Score	Max score	Nature of question
1	0.93	3	absorption in the SI, where does it go from SI
2a*	0.93	1	connection between SI and LI
3a*	0.88	3	what components of food are shown being taken in through mouth?
2e*	0.81	1	In which part of LI would peristalsis occur?

2d*	0.71	1	meaning of peristaltic motion
2f*	0.7	11	state of food in each region of the large intestine, part reached after given pointers to time
3b*	0.7	2	what changes shown happening in the mouth? Why?
3i*	0.68	1	what components are being excreted?
2c*	0.62	1	meaning of time labels
2j*	0.58	1	if peristaltic motion is faster, then what result?
2g*	0.55	3	how does food material change in the large intestine, which parts get absorbed
3h*	0.55	1	what components absorbed in large intestine?
2h*	0.54	2	what is faeces composed of, how does LI help in faeces formation
2l	0.47	1	where else does peristalsis occur?
3f*	0.4	2	what components absorbed in small intestine?
3c*	0.38	2	what changes shown happening in the stomach? Why?
2k*	0.37	2	how does peristaltic motion happen in the large intestine?
3d*	0.34	2	what changes shown happening in the duodenum? Why?
3e*	0.33	2	what changes in SI and why? Why?
2i*	0.32	1	if food stays in large intestine for longer than normal time, what result?
3g*	0.3	2	what changes in LI? Why?
2b*	0.2	4	meanings of labels for the different regions of the LI
3j	0.08	1	asked to draw an alternative diagram which may better represent what happens

Structure-function tasks using diagrams

Task no.	Description	Number of sub-questions	Mean Score and (s.d.)
1	Orientation and arrangement of teeth in lateral (Fig. 5) and top views of the jaw	9	0.48 (0.23)
2	Meaning of "cross-section" and cross-sectional view of a given electric cable	5	0.42 (0.34)
3	Location and cross-sections of oesophagus and trachea (Figure 6)	3	0.23 (0.31)
4	Working of the large intestines (Figure 7)	11	0.46 (0.17)
5	Chemical action in the digestive tract (Figure 8)	9	0.41 (0.24)