



## SUE DALE TUNNICLIFFE INVESTIGATES YOUNG CHILDREN'S UNDERSTANDINGS OF EXCRETION

# Where does the drink

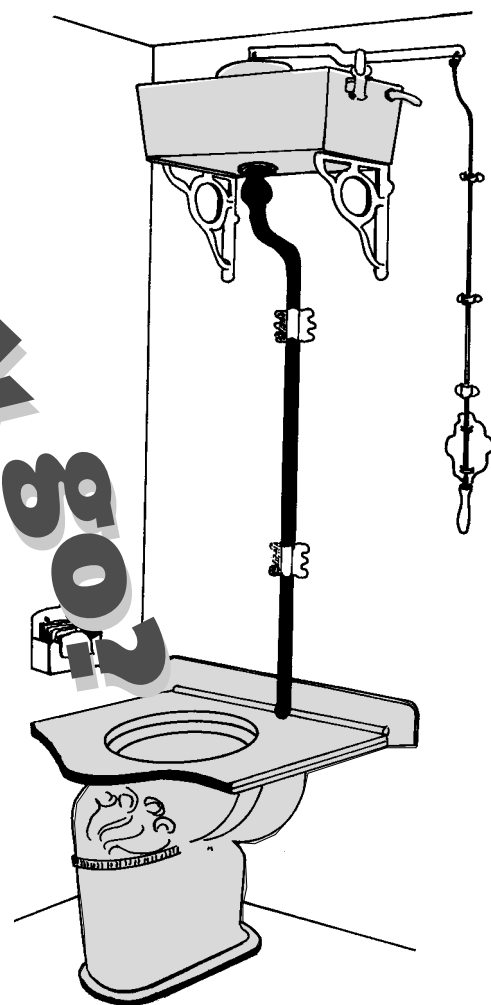
**I**n England the National Curriculum does not specifically mention the excretory system at key stages 1 and 2. Research by Reiss and Tunnicliffe (2001, 2002) has shown that children's knowledge of the organs and organ systems in their bodies increases with age but remains incomplete, even at maturity, unless they specialise in studying biology. The children were simply asked to draw what they thought was inside their body and were given no cues. All but the very young drew their own outline of the body and then inserted the organs and organ systems they could recall.

Work in France, conducted by Pierre Clément (Clément, 2003) has shown that digestion, circulation and excretion are taught at several stages in primary and secondary schools and with varying detail. Nevertheless, in answer to the question: 'Where does the litre of beer that you just drank go?', two-thirds of French first-year university science students provided drawings in which the intestine ends in the bladder. This conception (continuous tubing) then decreases in biology students, but disappears only in biology teachers. It is a classic example of several types of obstacle to more

accurate understanding. The children did not understand about the permeability of biological tubes, allowing fluids to pass from one to another, nor the links between the excretory, digestive and circulatory systems.

Clément suggested three stages of understanding (Figure 1):

- Stage 1: A continuous tube.
- Stage 2: A continuous tube with an extra tube from the bladder but no connection between the two.
- Stage 3: The circulatory system providing the link between the digestive and excretory systems.



### The investigation

Following this research, I wanted to find out whether children with whom I was working had an understanding of the excretory and digestive systems. Children in years 3 (age 7/8) and 5 (age 9/10) were presented with two scenarios by their class teacher, while I observed. To set the scene the children were told that what went into the body came out in some way. They were then presented with the two tasks:

- It is very hot and you are very thirsty so you drink a lot of water. What happens? Draw the

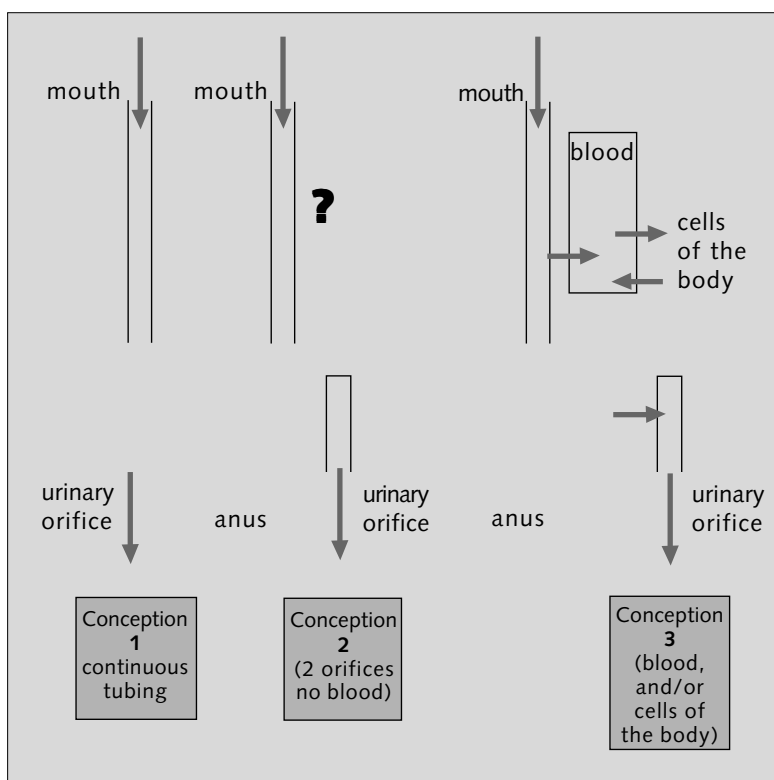


Figure 1 The three stages of understanding about digestion and excretion (Clément and Tunnicliffe, 2002)

Table 1 Analysis of drawings scored on 0–6 scale

| Level | Attribute   |
|-------|---|
| 0     | Nothing   |
| 1     | Lines   |
| 2     | A tube (not always with exit; sometimes covered with clothes or blind ending)           |
| 3     | Tube and side store   |
| 4     | Tube and side tube, sometimes to store and with exit for side store                     |
| 5     | Tube with organs – bladder, kidney, stomach, etc.                                       |
| 6     | Biological explanations involving the circulatory system with hepatic portal vein, etc. |

pathway through your body of the water you drink.

■ Your baby sister is crawling on the floor and finds a diamond ring that your mother has dropped. She puts it in her mouth and swallows it. Eventually it comes out in her nappy. Draw the pathway the ring takes through your sister.

The topic raised giggles especially amongst the older children but they soon got down to completing

their drawings.

From looking at their drawings I decided that the English children showed intermediate stages of knowledge within Clément’s lowest level stage, that of a continuous tube from entry into the body to exit. After further careful study of the drawings from the two classes, patterns emerged, which enabled me to devise a six-point scale for scoring them (Table 1).

The same scheme was used for

Table 2 Excretion: Year 3 responses to *Where does the water go?* (N = 28)

| Level         | Girls     | Boys      | Total     |
|---------------|-----------|-----------|-----------|
| 0             | 4         | 0         | 4         |
| 1             | 3         | 4         | 7         |
| 2             | 6         | 9         | 15        |
| 3             | 1         | 1         | 2         |
| 4             | 0         | 0         | 0         |
| 5             | 0         | 0         | 0         |
| 6             | 0         | 0         | 0         |
| <b>Totals</b> | <b>14</b> | <b>14</b> | <b>28</b> |

analysing the ‘ring’ drawings. For example, a level 3 was a drawing with a stomach indicated in the digestive tract, whilst level 4 was a digestive system with further differentiation of regions of the tract.

**Results**

Examples of the children’s drawings are shown in Figures 2, 3 and 4. For the first task, on excretion, the analysis of the results for the year 3 children is given in Table 2. For the second task, effectively on digestion, the results are given in Table 3.

Table 3 Digestion: Year 3 responses to *What pathway does the ring take?* (N = 28)

| Level         | Girls     | Boys      | Total     |
|---------------|-----------|-----------|-----------|
| 0             | 1         | 1         | 2         |
| 1             | 2         | 2         | 4         |
| 2             | 9         | 8         | 17        |
| 3             | 1         | 3         | 4         |
| 4             | 1         | 0         | 1         |
| 5             | 0         | 0         | 0         |
| 6             | 0         | 0         | 0         |
| <b>Totals</b> | <b>14</b> | <b>14</b> | <b>28</b> |

Similar results were obtained for year 5 children except that in year 5 a larger number of children (eight girls and one boy) were scored at level 3 (a tube with a side store). Likewise the results for the pathway of the ring for the year 5 children reflected this same trend of an increasing number of children attaining level 3: seven children from year 5 revealed a level 3 understanding compared with four of the year 3 children.

The results suggest that even year 5 children lack understanding of the structure of the excretory system, although they have better understanding of the digestive system; they know that it is a continuous tube from mouth to anus. This is a fundamental feature of coelomate animals, of which the earthworm is an excellent example to discuss with the children, although such an important

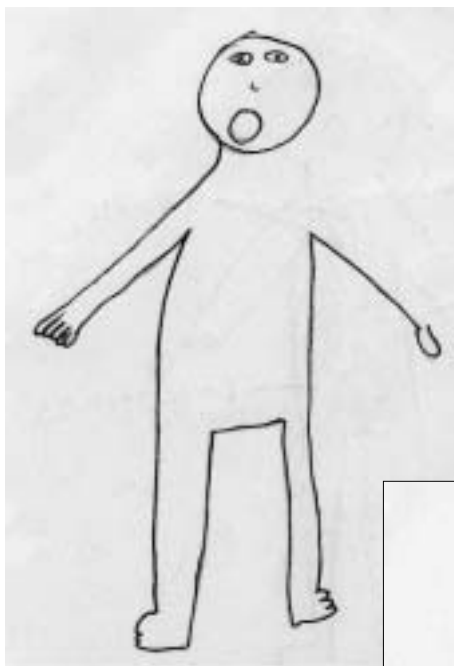


Figure 2 A level 0 drawing with no system indicated

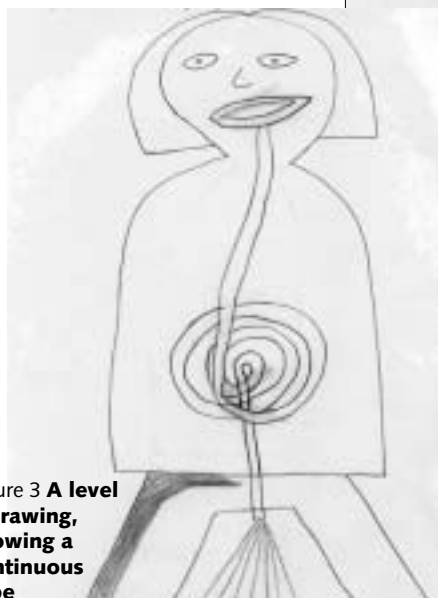


Figure 3 A level 2 drawing, showing a continuous tube

biological point is seldom made in primary science lessons.

### Discussion and implications for teaching

Excretion is not named as such in the National Curriculum and, from my observations of lessons about digestion, the role that the digestive tract plays in excretion is rarely mentioned. The body systems, including the digestive system, are taught in isolation, so children are not provided with a

holistic integrated view. Children's knowledge of excretion includes being aware of the salient organs (the kidney and bladder) from their everyday knowledge but few children hold a biological understanding.

When teaching children about the human body it is very useful:

- to find out at the beginning of the work what children already know from their everyday life and from previous work in school;

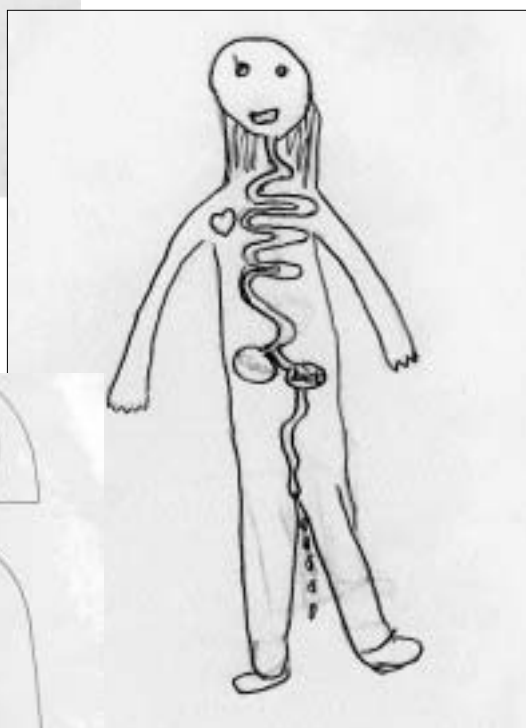


Figure 4 A level 2 drawing with a side store added

- to find out what 'body' words the children know and can recognise and what meaning they ascribe to them;

- to ask children to do drawings and explain what they draw - Can they name what they have drawn and talk about its function? Where did they find out about this?

The digestive and excretory systems work in partnership; you can't have one without the other in a fully, independently functioning body. We have tended to teach these systems in isolation from other systems, such as the circulatory and respiratory systems and the skin. The elim-

ination of fibre and waste products, such as the breakdown pigments of the red blood cells that colour the faeces, are not often mentioned. Discussion of excretion is often restricted to the production and voiding of fluid and associated with the excretory organs of the kidney and the bladder, ureter and urethra. However, the skin is also an important excretory organ (through perspiration), while the lungs play a role in excreting carbon dioxide and water vapour. Excretion needs to be placed in the context of the integrated working of the whole body. Maybe we need to be less squeamish about these matters.

### References

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