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Irritable Bowel Syndrome and Constipation

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1. Introduction

A hypothetical model of the digestive system that can create the symptoms of Irritable Bowel Syndrome (IBS) was originally published as (Dobson, 2008). This chapter presents the model and includes additional research. The model accounts for all types of IBS.

A mechanism that creates **constipation**, improved diagnostic criteria, suggestions for testing the model, treatment options, diagrams showing how the autonomic nervous system creates IBS symptoms, and photomicrographs of the insoluble food fibres triggering IBS, are included.

The data necessary to write this chapter was collected over four decades. Initially the aim of the research was to treat a member of the author's family who has severe IBS-D, and successful treatment programs have been developed. In addition the observed symptoms of all types of IBS, have suggested the hypothesis on which this chapter is based.

2. A worldwide digestive illness

IBS is one of the most common maladies that a GP encounters. The symptoms of IBS range from mild and intermittent, to severe, continuous and incapacitating. Rates of occurrence have been measured at up to 25% in some countries. The economic burden is tens of billions of dollars annually for the USA alone (Schwetz & Chang, 2004) (Drossman, 2007).

GPs diagnose IBS by eliminating other digestive disorders. The symptoms demonstrate that something is wrong but they can find no visible damage. The GP has few treatment options available and they are often ineffective. The patient goes away and tries to cope. Their days can be miserable. They may suffer from **constipation**, bloating, cramping, diarrhoea, all four, or even none of these and instead, a host of other ailments. They may be unable to work, afraid to eat, and suffer from weight loss & malnutrition. They may have herb & fibre supplements, laxatives, and/or anti-diarrhoea medicines at hand. The author has also noted secondary symptoms such as depression, headache, hallucinations, guts ache, lack of energy, weight loss, skin infections, back pain, aching limbs, athlete's foot, ingrown nails, and other minor problems caused by malnutrition.

2.1 Types of IBS

These three types are widely recognized (Drossman 2007): IBS-C (**constipation** predominant), IBS-D (diarrhoea predominant), and IBS-A or IBS-M (alternating or mixed, **constipation** & diarrhoea).

These descriptions contain the symptoms as observed by the author...

1. IBS-C... the primary symptom is **constipation**. Bloating may be hard to detect but is always present. It begins in the morning when breakfast is eaten and then may disappear overnight. Bowel movements are hard to pass, and diarrhoea never occurs. Borborygmi (gurgling), cramping, and difficulty with fat digestion may be present.
2. IBS-D... the primary symptom is diarrhoea. This usually occurs on arising as the 'morning rush', but it can also happen at other times. When **constipation** is a symptom, bloating is never present. Borborygmi and irritation around the anus are always present. Cramping and difficulty with fat digestion may be present.
3. IBS-A or IBS-M... bloating, **constipation** and diarrhoea that alternate irregularly are the primary symptoms. Borborygmi, irritation around the anus, cramping, and difficulty with fat digestion may be present.

3. The hypothesis

Digestion in the small intestine is a batch process with three sequential sections corresponding to the natural divisions of the intestine. These are the duodenum, the jejunum, and the ileum. It is governed by a brain controller divided into four sub-controllers, each of which has a unique neurotransmitter. Control faults in this process cause the disorder irritable bowel syndrome.

This hypothesis has been created by the author in order to explain the symptoms of IBS that he has observed over a period of decades. It accurately creates all types of IBS when faults occur in its control mechanisms.

3.1 Transport controllers

There are two transport control systems for the process...

1. The primary control system is a brain controller that is part of the autonomic nervous system. It is divided into four sub-controllers. The duodenum, the jejunum & the ileum each have a dedicated transport sub-controller. These three sub-controllers produce output only when input is received. They obtain input from sensors in the walls of the intestine that detect food soup. Output regulates transport and mixing in the small intestine. Correct control happens regardless of the variable input caused by different foods. The food soup is moved backwards and forwards so that chemicals can be mixed in, and the rate of absorption of nutrients & chemicals controlled. It is then transferred to the next section at the correct time, and at the correct speed (slow).
2. A secondary control system called the MMC is applied when primary controller outputs are absent. This is a reflex action of the enteric nervous system. It is normally only active when the intestine has no food in it. When food is present, and the primary controller is defective, the transport speed set by the secondary controller is dependent on the type of foods eaten and the state of the autonomic nervous system. There is no control of mixing or timing, and movement is in the forward direction only. When the speed is too fast, IBS occurs.

3.2 Chemical controllers

Two systems control addition of digestive chemicals to the duodenum...

1. The primary system is the fourth sub-division of the small intestine brain controller. Cells in the wall of the duodenum release CCK hormone (Rehfeld J.F., 2004) into the bloodstream when food soup containing fat is pumped in from the stomach. The brain detects this hormone and sends a nerve signal to the muscle that empties the gall bladder and pancreas. The pancreas provides protease enzymes, lipase enzymes, & bicarbonate. The gall bladder provides bile salts. If this controller is defective, then insufficient chemicals are added to the duodenum.
2. The secondary controller is the enteric nervous system which adds chemicals when it detects; the amount and type of fibre eaten, cooked proteins (meats, fish, & eggs), fruit acids (alpha hydroxy acids), dairy proteins, and some herbs & spices (e.g. ginger). The amount added however is insufficient, and extra must be provided by the primary controller in order to complete the digestive process.

3.3 Primary control faults

The following defects may occur...

1. One or more of the four neurotransmitters in the primary controller may be deficient or absent. This reduces or eliminates output from one or more sub-controllers of the primary controller.
2. A toxic insult may destroy intestinal sensors that provide input to the primary controller. This reduces or eliminates output from the sub-controller of the affected part of the intestine.
3. Surgical procedures may sever input nerves to the primary controller or output nerves from the primary controller to the intestine.
4. Misalignment of neck vertebrae may put pressure on nerves connecting the primary controller to the small intestine.
5. In infancy, development of nerve connections from the brain to the small intestine, may fail to be completed.
6. Any other fault that interrupts communication between the small intestine and the brain.

3.4 IBS-B – Bile deficient IBS

When the neurotransmitter in the primary chemical controller is missing or deficient, insufficient lipases and bile salts are added to the food soup. Undigested fats impair nutrient uptake in the jejunum, and the reabsorption of chemicals in the ileum. Indigestion is followed by fast, loose, grey bowel movements containing fat (steatorrhea). The absence of the brown bile pigment stercobilin causes the grey colour, and when fat is present in the colon, the enteric nervous system automatically evacuates it. IBS-B may occur alone but often it accompanies one of the other three types of IBS. When it does, the symptoms of the other types become severe.

3.5 Constipation – Creation of the IBS barrier

The IBS Barrier is created when food soup is present in the small intestine, and a section under the control of the secondary transport controller precedes a section under the control of the primary transport controller. When the primary controller detects the too fast movement of food soup, it constricts the intestine to stop the flow. It will not allow food soup to travel too fast. The Barrier causes the IBS symptoms of bloating and **constipation**.

The Barrier is created by parts of the autonomic nervous system. Variation in the level of activity in this system causes Barrier strength to vary. It is strong on arising when adrenal hormones are released to start the metabolism. The symptoms of the Barrier start when breakfast is eaten. When stress releases more adrenal hormones during the day it again increases in strength. It will relax overnight if adrenal hormones and the autonomic nervous system return to a low level.

3.5.1 IBS-C caused by a neurotransmitter deficiency

There are six forms;

- The duodenum controller output is deficient or missing. This causes a Barrier to form at the start of the jejunum. When a breakfast containing cereal is eaten, immediate, severe bloating occurs. Backpressure in the duodenum keeps the valve from the gall bladder and pancreas closed, so that insufficient chemicals are added to the food soup (see Diagram 1).
- Form (a) as above together with IBS-B.
- The jejunum controller output is deficient or missing. This causes a Barrier to form at the start of the ileum. When a breakfast containing cereal is eaten, borborygmi occurs followed by hard to detect, slight to moderate bloating. Onset of these symptoms is delayed by a few minutes (see Diagram 2).

#	Primary controller			Symptoms	
	Chemical	Duodenum	Jejunum		Ileum
(a)	O	X	O	O	Immediate severe bloating that disappears overnight. Cramping possible. Constipation. Steatorrhea. No borborygmi.
(b)	X	X	O	O	Immediate severe bloating that disappears overnight. Cramping & borborygmi possible. Constipation. Steatorrhea. Severe symptoms.
(c)	O	O	X	O	Delayed borborygmi and delayed hard to detect, mild, bloating that disappears overnight. Cramping possible. Constipation.
(d)	X	O	X	O	Delayed borborygmi and delayed hard to detect, mild, bloating that disappears overnight. Cramping possible. Constipation. Steatorrhea. Severe symptoms.
(e)	O	X	X	O	Immediate borborygmi and immediate hard to detect, mild, bloating that disappears overnight. Cramping possible. Constipation.
(f)	X	X	X	O	Immediate borborygmi and immediate hard to detect, mild, bloating that disappears overnight. Cramping possible. Constipation. Steatorrhea. Severe symptoms.

Legend: X = defective and O = functioning

Table 1. Summary of the six forms of IBS-C

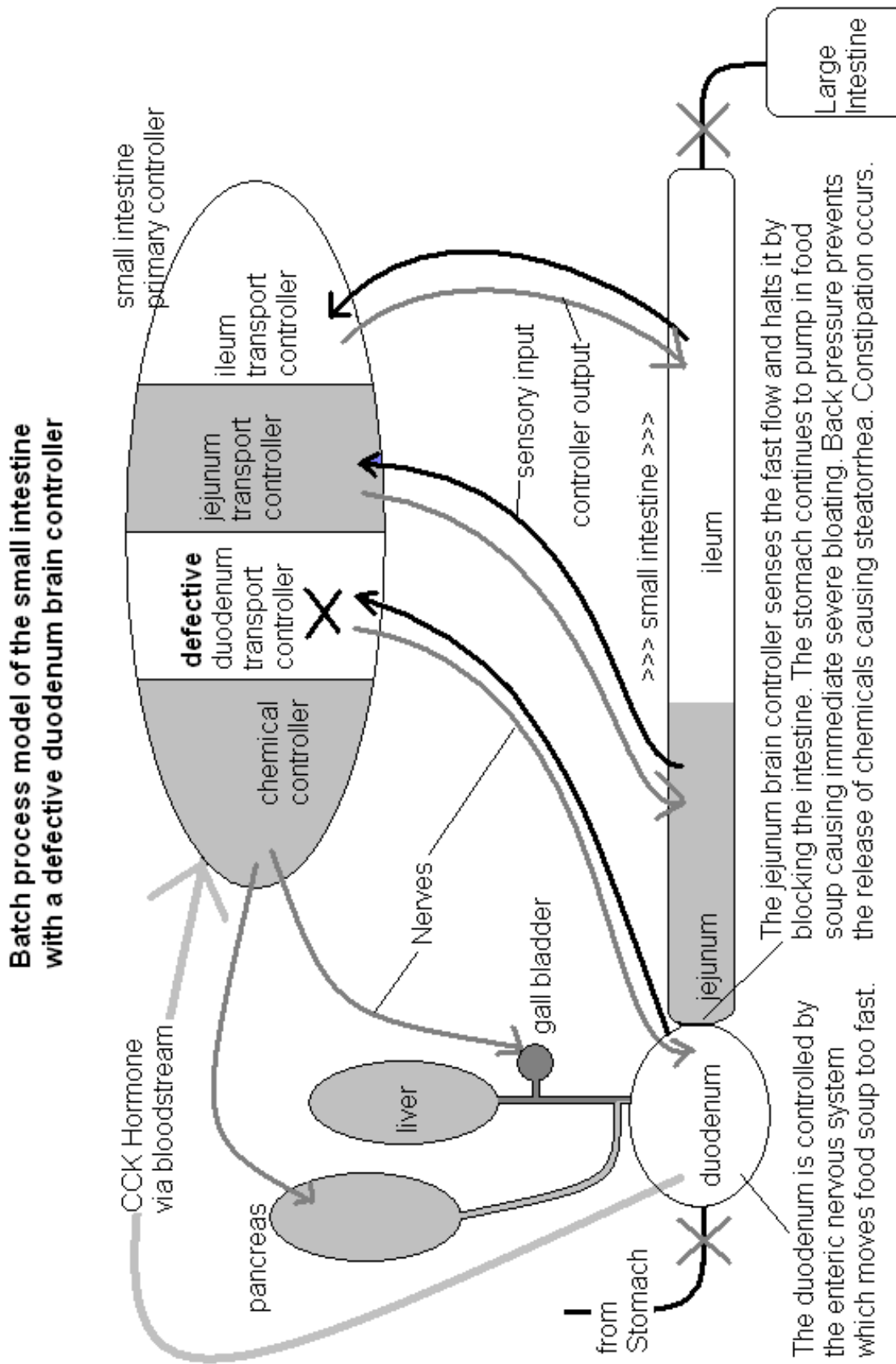


Diagram 1. Schematic showing how the model creates IBS-C form (a)

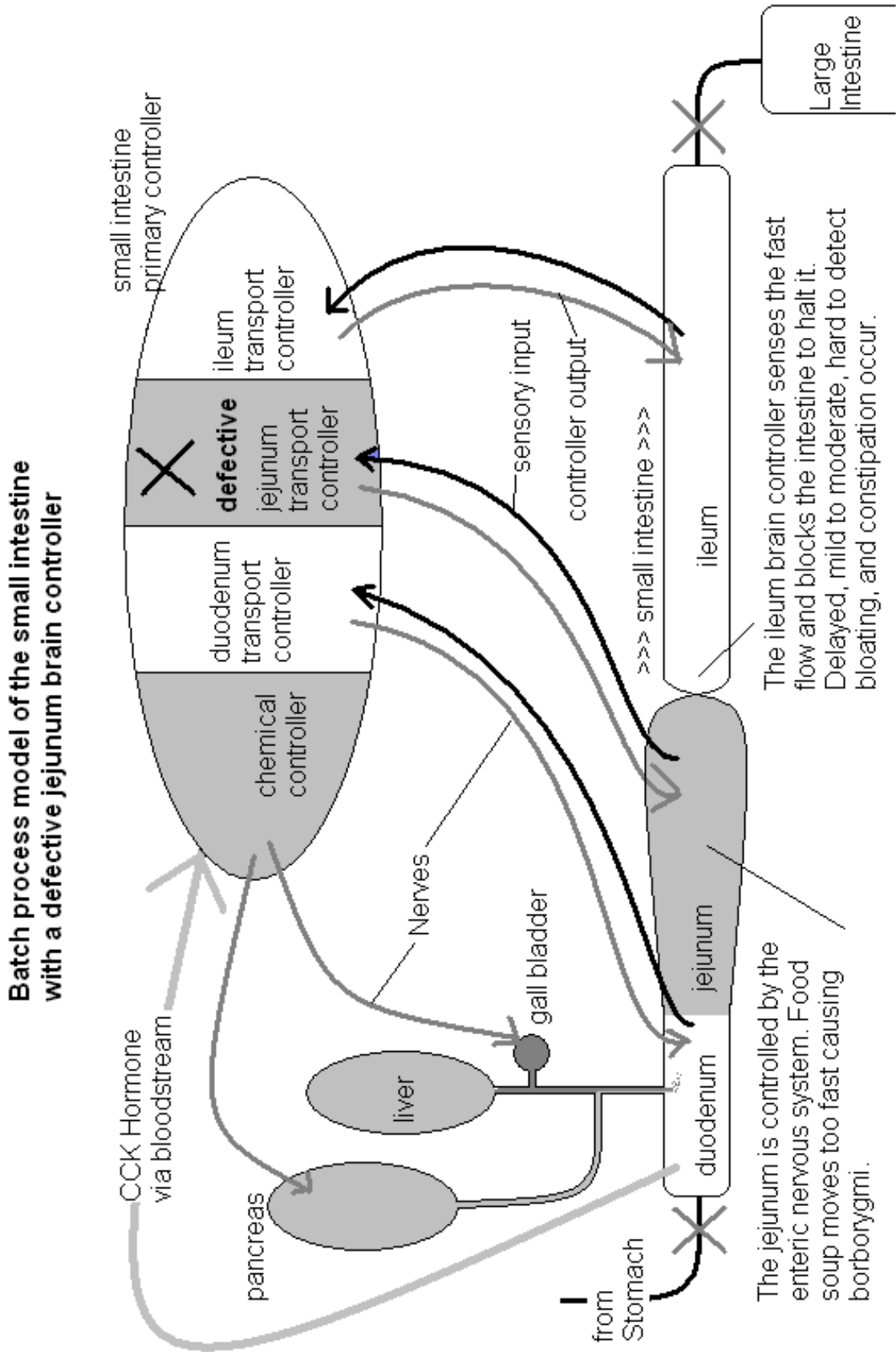


Diagram 2. Schematic showing how the model creates IBS-C form (c)

- d. Form (c) as above together with IBS-B.
- e. Both the duodenum and jejunum sub-controller outputs are deficient or missing. This causes a Barrier to form at the start of the ileum. When a breakfast containing cereal is eaten, borborygmi occurs followed by hard to detect, slight to moderate bloating. Onset of these symptoms is immediate.
- f. Form (e) as above together with IBS-B.

3.6 The uncontrolled ileum - Diarrhoea

When the ileum is no longer correctly controlled by the primary transport controller, the secondary transport controller moves food soup at speed into the colon. The soup contains high levels of chemicals & possibly fats, and these cause automatic evacuation of the colon. The level of activity in the autonomic nervous system controls the valve at the end of the small intestine. When adrenal hormones are released on arising, the valve is easy to open, and the ileum immediately pushes its contents into the colon (the morning rush). When stress occurs during the day and releases adrenal hormones, the valve is again easier to open. Overnight the valve becomes more firmly closed. In severe cases of IBS-D & A, the ileum can push food soup through the valve at any time.

3.6.1 IBS-D caused by a neurotransmitter deficiency

There are six forms;

- a. The ileum controller output is deficient or missing. When a breakfast containing cereal is eaten, borborygmi begin when food soup reaches the ileum several hours later. Diarrhoea occurs immediately after food soup reaches the end of the ileum or on arising (see Diagram 3).
- b. Form (a) together with IBS-B.
- c. The ileum and jejunum controller outputs are deficient or missing. When a breakfast containing cereal is eaten, borborygmi begin when food soup reaches the jejunum a few minutes later. Diarrhoea occurs immediately after food soup reaches the end of the ileum or on arising.
- d. Form (c) together with IBS-B.
- e. The ileum, jejunum and duodenum controller outputs are deficient or missing. When a breakfast containing cereal is eaten, borborygmi begin immediately. Diarrhoea occurs immediately after food soup reaches the end of the ileum or on arising.
- f. Form (e) together with IBS-B.

3.6.2 IBS-A caused by a neurotransmitter deficiency

There are two forms;

- a. The duodenum and ileum sub-controller outputs are deficient or missing. This causes IBS-C plus IBS-D. **Constipation** and diarrhoea alternate irregularly. The state of the autonomic nervous system controls the alternation.
- b. Form (a) together with IBS-B.

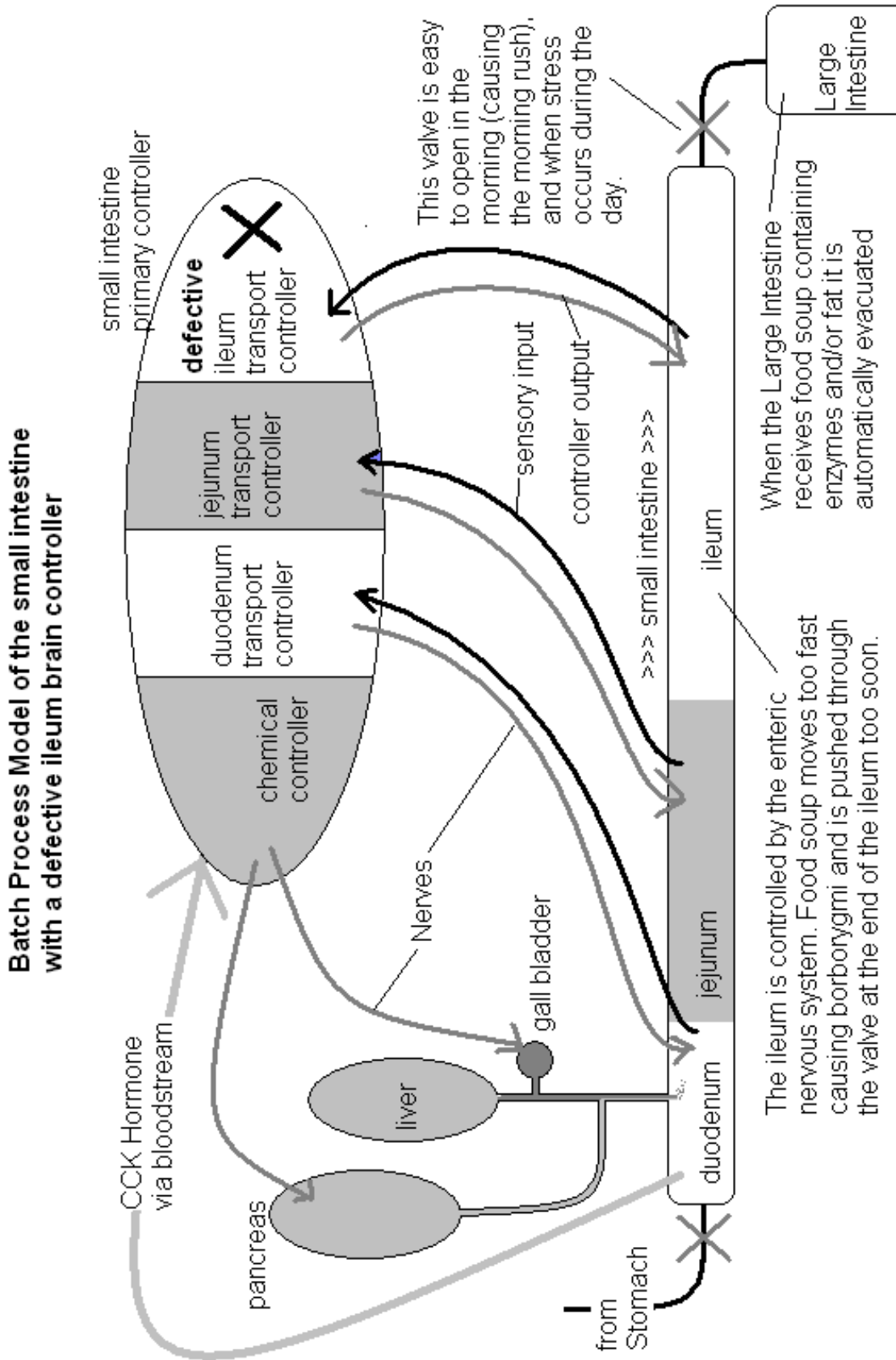


Diagram 3. Schematic showing how the model creates IBS-D form (a)

#	Primary controller				Symptoms
	Chemical	Duodenum	Jejunum	Ileum	
(a)	O	O	O	X	Borborygmi starting several hours after eating. Diarrhoea
(b)	X	O	O	X	Borborygmi starting several hours after eating. Diarrhoea. Steatorrhea. Severe symptoms.
(c)	O	O	X	X	Borborygmi starting a short time after eating. Diarrhoea
(d)	X	O	X	X	Borborygmi starting a short time after eating. Diarrhoea. Steatorrhea. Severe symptoms.
(e)	O	X	X	X	Borborygmi starting immediately after eating. Diarrhoea.
(f)	X	X	X	X	Borborygmi starting immediately after eating. Diarrhoea. Steatorrhea. Severe symptoms.

Legend: X = defective and O = functioning

Table 2. Summary of the six forms of IBS-D

#	Primary controller				Symptoms
	Chemical	Duodenum	Jejunum	Ileum	
(a)	O	X	O	X	Constipation & diarrhoea that alternate. Cramping, borborygmi, steatorrhea and severe bloating are possible.
(b)	X	X	O	X	Constipation & diarrhoea that alternate. Steatorrhea causes severe diarrhoea. Cramping, borborygmi and severe bloating are possible.

Legend: X = defective and O = functioning

Table 3. Summary of the two forms of IBS-A

3.7 Primary control fault summary

#	Primary controller				IBS Type(s)
	Chemical	Duodenum	Jejunum	Ileum	
1	X	O	O	O	B
2	O	X	O	O	C
3	X	X	O	O	C, B
4	O	O	X	O	C
5	X	O	X	O	C, B
6	O	X	X	O	C
7	X	X	X	O	C, B
8	O	O	O	X	D
9	X	O	O	X	D, B
10	O	O	X	X	D
11	X	O	X	X	D, B
12	O	X	X	X	D
13	X	X	X	X	D, B
14	O	X	O	X	A
15	X	X	O	X	A, B

Legend: X = defective and O = functioning

Table 4. Summary of the four types and fifteen forms of IBS produced when neurotransmitter deficiencies occur in the primary controller.

3.8 Other primary control faults

Any fault that disrupts sensory input from the small intestine to the brain or motor output from the brain to the small intestine will cause IBS symptoms. The section(s) of the intestine that are affected will not be the same as when a neurotransmitter is deficient. The first faulty section will cause an IBS Barrier to form at the start of the following brain controlled section. Subsequent defects will have little effect, except that diarrhoea symptoms will occur when a section that terminates the intestine is faulty. IBS-B cannot be produced by damage to the duodenum walls.

4. Variation in the expression of IBS symptoms

If you compare two subjects with the same type of IBS, the symptoms that they each suffer from can be different. The following factors explain how this variation occurs.

4.1 Food variables

When the enteric nervous system controls movement of food soup in the small intestine, the transport speed varies according to the types of food eaten. Some foods cause very fast speeds and others slower speeds.

More force is used to achieve very fast speeds, and the brain creates a stronger Barrier to stop the flow. A strong Barrier produces a complete transport halt for long periods, and

dehydration occurs prematurely. This causes later processes of the small intestine to take longer. **Constipation**, bloating & cramping are increased in severity.

On arising, the valve at the end of the ileum is easy to open, and fast speeds in the ileum trigger the 'morning rush'. Very fast speeds move food into the colon immediately it reaches the end of the ileum.

Cramping occurs when the speed of food is too fast, and a Barrier is formed with its associated bloating. This is the enteric nervous system attempting to force food through the Barrier.

Cramping also occurs when the intestinal muscles are moving food at speed, in any part of the intestine. This cramping is accompanied by loud borborygmi.

When the colon receives food soup from the ileum that contains fat and/or high levels of digestive enzymes, it evacuates at speed, often with cramping.

4.1.1 Fibre

Some fibre types stimulate fast speeds in the small intestine when the secondary controller is active. Fast speeds cause slight to moderate IBS symptoms and very fast speeds cause severe IBS symptoms. Other types of fibre stimulate slower speeds. Data on the transport speed of different foods, when the enteric nervous system is in control of the small intestine, is in Table 5.

<i>Food</i>	<i>Speed</i>		<i>Food</i>	<i>Speed</i>
Wholemeal cereal flours	supersonic		Dahls (hulled split legumes)	slow
Whole cereals	very fast		Vegetables	slow
White cereal flours	fast		Fruits	slow
Polished cereals	fast		Animal foods	slow
Whole legumes	supersonic		Nuts and seeds	slow

Table 5. Speed of food types when transported by the enteric nervous system.

The outer coat of legumes and most cereals contain the fibre types that stimulate fast speeds in the small intestine. This fibre can be classed as insoluble, but not all types of insoluble fibre stimulate fast speeds.

4.1.2 Examination of fibre from cereals and legumes

1. *Whole wheat flour*...this food causes severe IBS symptoms. Insoluble fibre was extracted from whole wheat flour (machine ground), by boiling in 3% hydrochloric acid for several hours. The fibre consisted of 'two dimensional' flakes of bran with sharply defined edges, ranging in size from 2mm to 0.01mm (see Figures 1, 2 & 3).
2. *Whole white rice*...this food causes slight to moderate symptoms of IBS. Insoluble fibre was extracted from polished rice by cooking, then crushing and boiling in 3% hydrochloric acid for several hours. The fibre consisted of large 'two dimensional' flat sheets with sharply defined edges, ranging in size from 2mm to 5mm (see Figure 4).

3. *Corn grits...* this food causes no IBS symptoms. Insoluble fibre was extracted by boiling coarse corn meal (machine ground) in 3% hydrochloric acid for several hours. At 40x magnification the fibre consisted of three dimensional amorphous clumps and fragments (see Figure 5). The fibre appears to be tangled clumps of soft fibrils at 400x magnification (see Figure 6).
4. *Split yellow peas...* this food causes no IBS symptoms. Insoluble fibre was extracted from hulled & split yellow peas by soaking overnight, crushing, and then boiling in 3% hydrochloric acid for several hours. The insoluble material was obloid and spherical lumps, 0.1 to 0.3 mm in diameter (see Figures 7 & 8). Sharp edges were not visible.
5. *Haricot bean endosperm (internal portion)...* this food causes no IBS symptoms. Insoluble fibre was extracted by soaking whole beans overnight, removing the external coat, and boiling the crushed endosperm in 3% hydrochloric acid for several hours. The insoluble material was obloid and spherical lumps, 0.1 to 0.2 mm in diameter (see Figures 9 & 10). Sharp edges were not visible.
6. *Haricot bean external coat...* this food causes severe IBS symptoms. Insoluble fibre was extracted by soaking whole beans overnight, removing the external coat, crushing it and boiling in 3% hydrochloric acid for several hours. The fibre consisted of flat two dimensional fragments about 1 to 5 mm in size (see Figure 11). At 400x magnification the material is seen to be composed of densely packed crystalline rods, about 0.03mm long and 0.01mm in diameter (see Figure 12). The rods are orientated at 90 degrees to the surface of the endosperm.
7. *Moong bean endosperm...* this food causes no IBS symptoms. Insoluble fibre was extracted by soaking whole beans overnight, removing the external coat, and boiling the crushed endosperm in 3% hydrochloric acid for several hours. The fibre consisted of obloid to spherical lumps, 0.1 to 0.2 mm in diameter (see Figure 13). Sharp edges were not visible.
8. *Moong bean external coat...* this food causes moderate IBS symptoms. Insoluble fibre was extracted by soaking beans overnight, removing the skin, crushing and then boiling it in 3% hydrochloric acid for several hours. The fibre is fragments of light coloured coat with dark veins (see Figure 14). The dark veins contain crystalline rods orientated like the sleepers on a railway track (see Figure 15). Figure 16 shows 0.05mm by 0.01mm rods removed from the dark veins.

4.1.3 Insoluble fibre

Currently all insoluble fibre is treated the same. This research has identified three distinct types of insoluble fibre;

1. *Cereal bran...* sharp edged, two dimensional flakes present in most cereals. It causes severe IBS symptoms when present in quantity.
2. *Legume micro-crystalline fibre...* these tiny, hard, crystalline rods are found in the external coats of legumes. In high numbers they trigger severe IBS symptoms.
3. *Soft insoluble fibre...* Soft amorphous material from corn, legumes, fruits, vegetables, nuts, seeds & animal foods. It caused no IBS symptoms.



Fig. 1. Insoluble fibre from whole meal wheat flour x 40. Image 3mm wide.

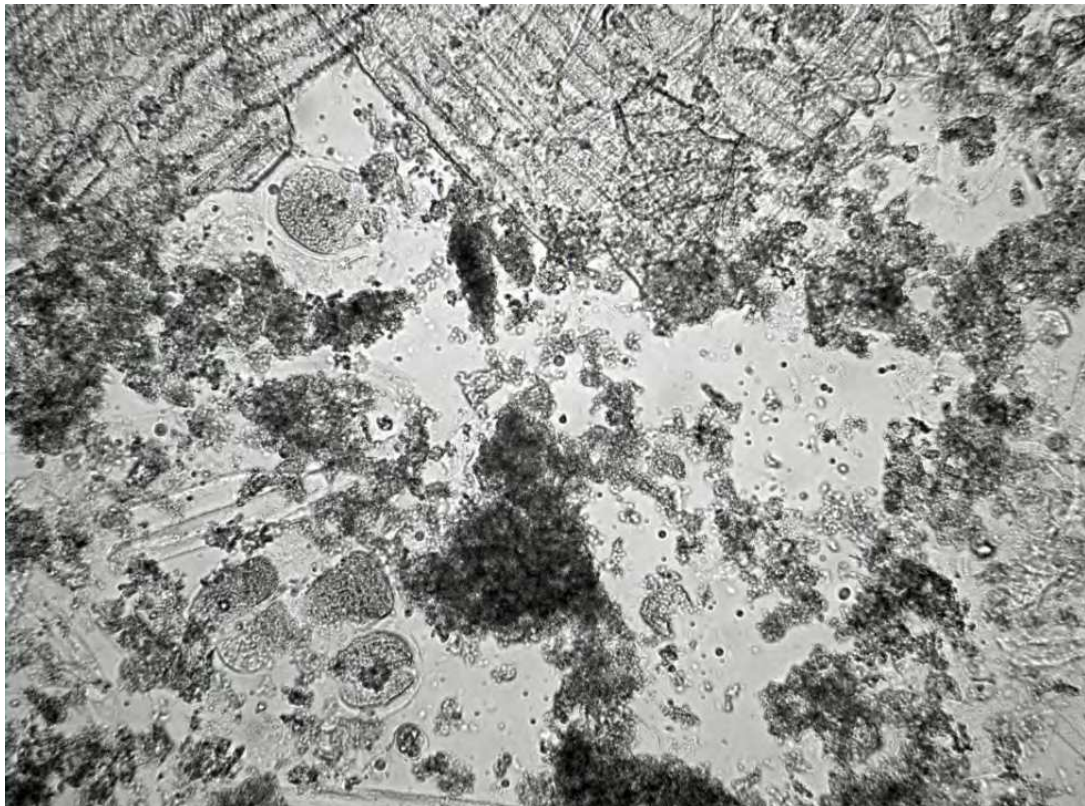


Fig. 2. Insoluble fibre from whole meal wheat flour x 160. Image 0.75mm wide

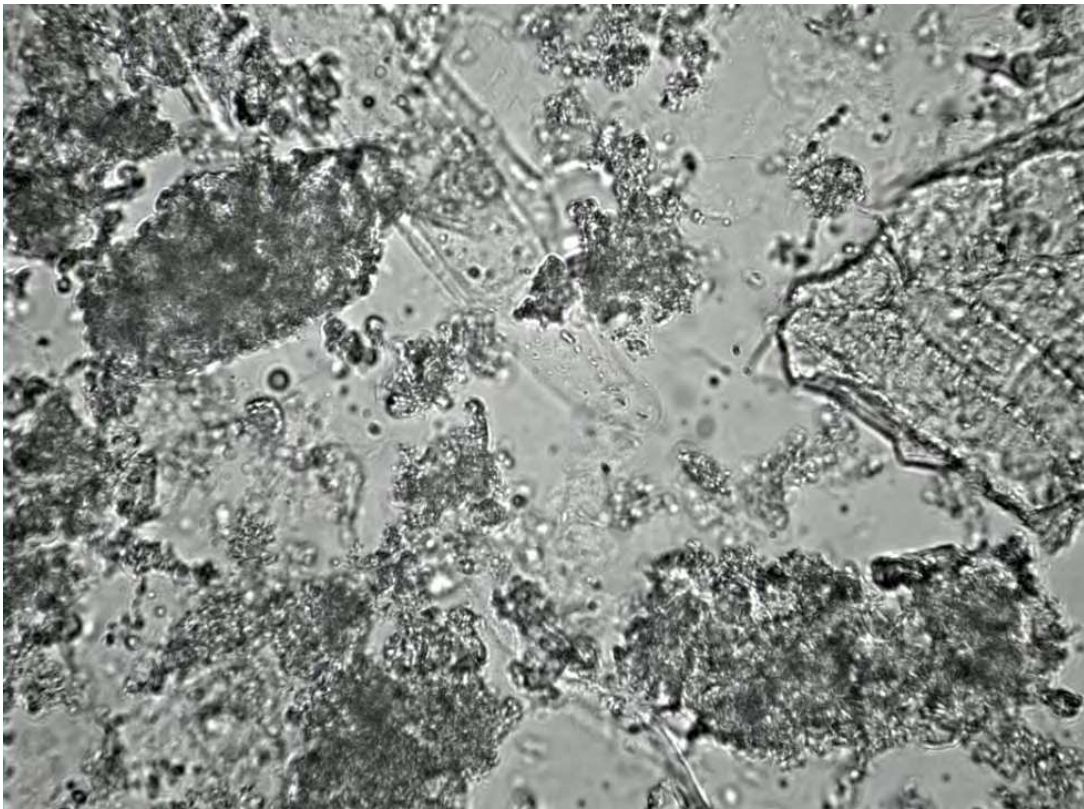


Fig. 3. Insoluble fibre from whole meal wheat flour x 400. Image 0.3mm wide

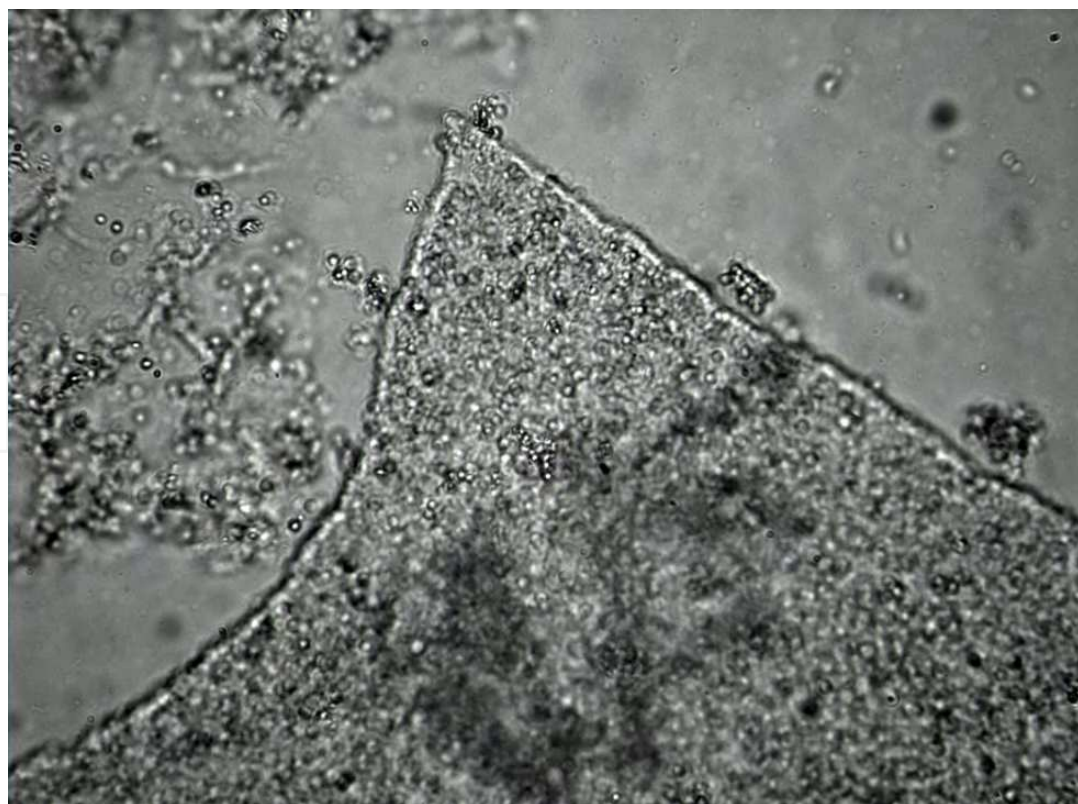


Fig. 4. Insoluble fibre from whole white rice x 400. Image 0.3mm wide

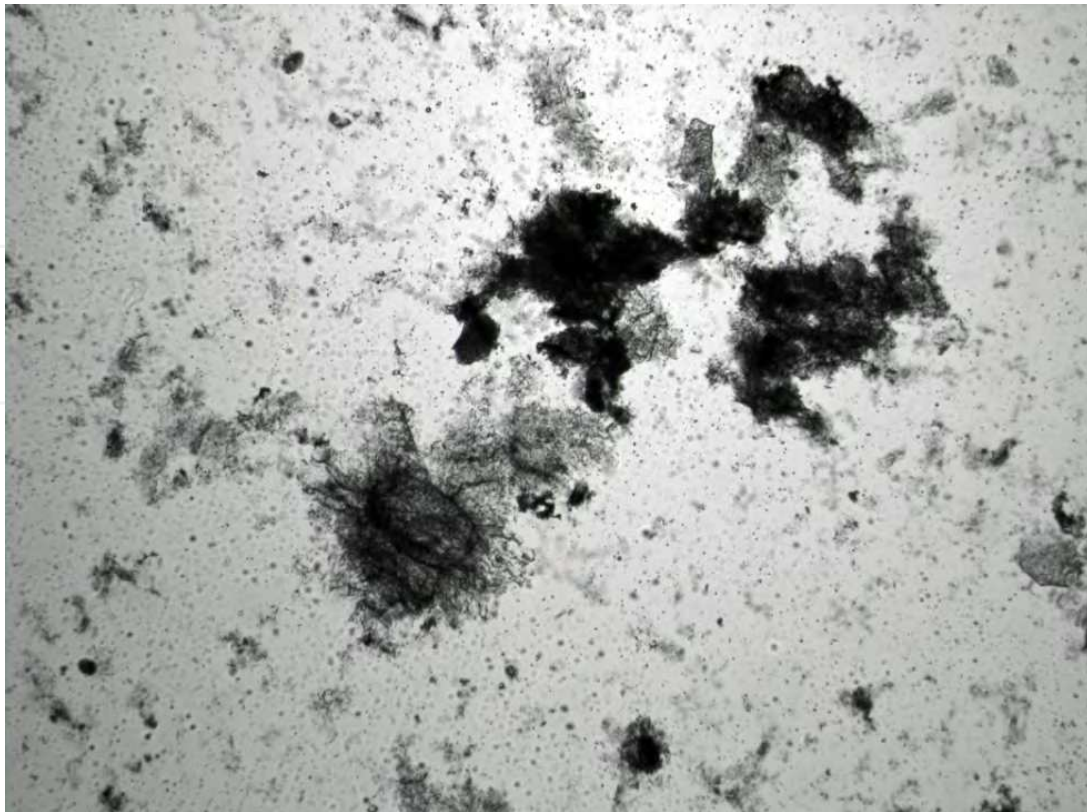


Fig. 5. Insoluble fibre extracted from corn grits x 40. Image 3mm wide.

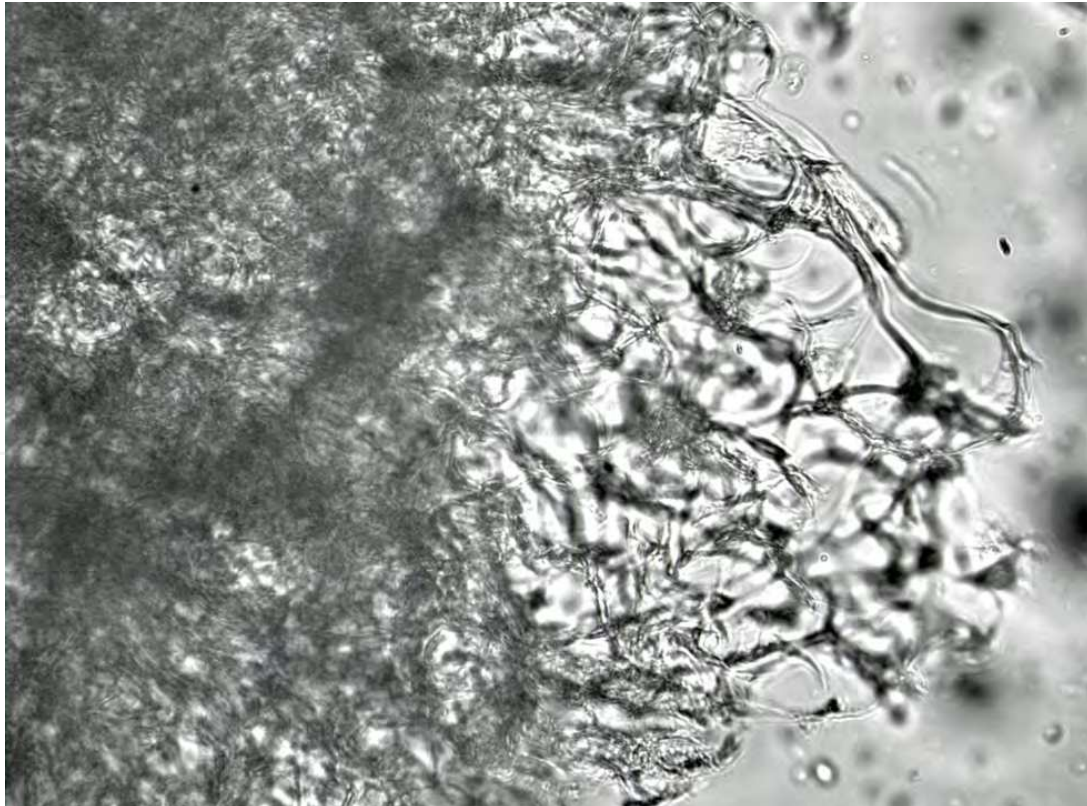


Fig. 6. Insoluble fibre extracted from corn grits x 400. Image 0.3mm wide.

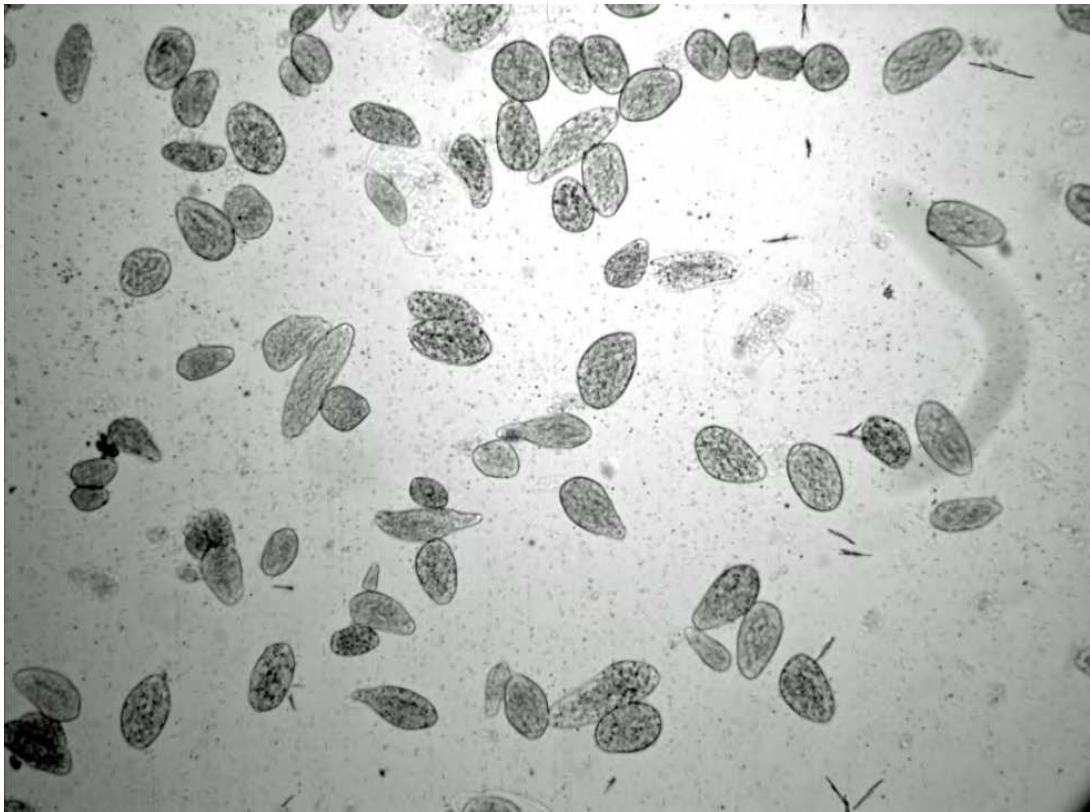


Fig. 7. Insoluble fibre from split yellow peas x 40. Image 3mm wide.



Fig. 8. Insoluble fibre from split yellow peas x 400. Image 0.3mm wide.

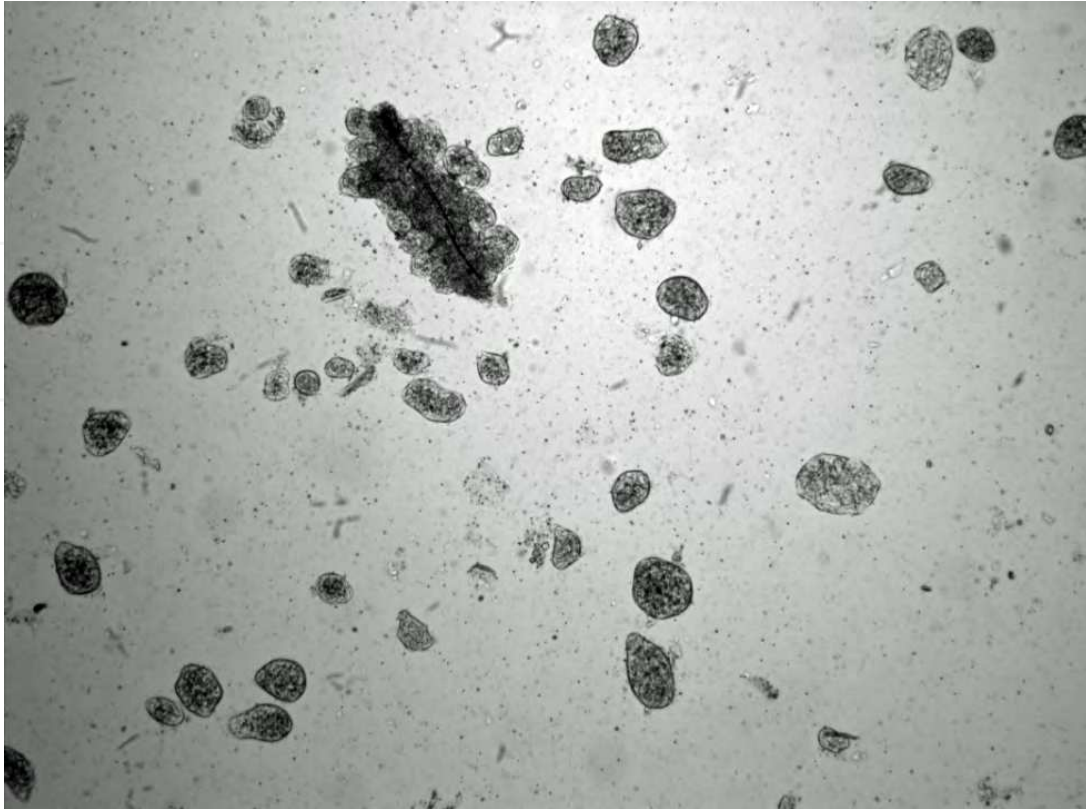


Fig. 9. Insoluble fibre from haricot bean endosperm x 40. Image 3mm wide.



Fig. 10. Insoluble fibre from haricot bean endosperm x 400. Image 0.3mm wide.



Fig. 11. Insoluble fibre from haricot bean external coat x 40. Image 3mm wide.

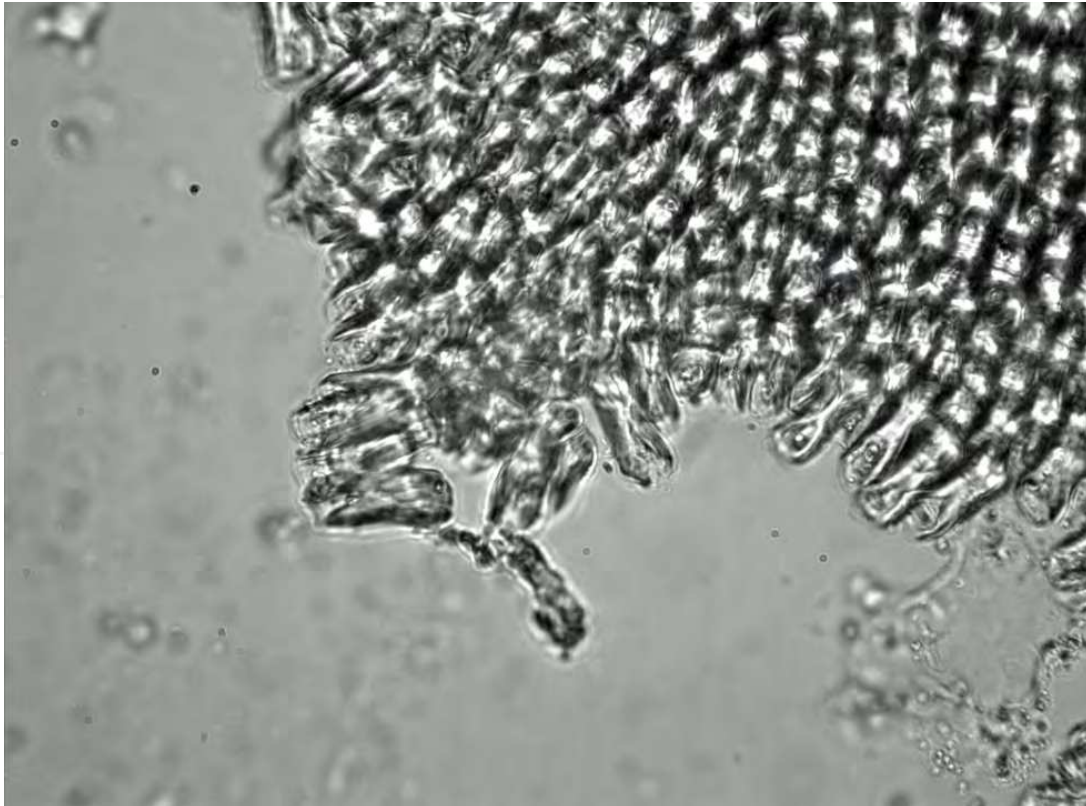


Fig. 12. Insoluble fibre from haricot bean external coat x 400. Image 0.3mm wide.

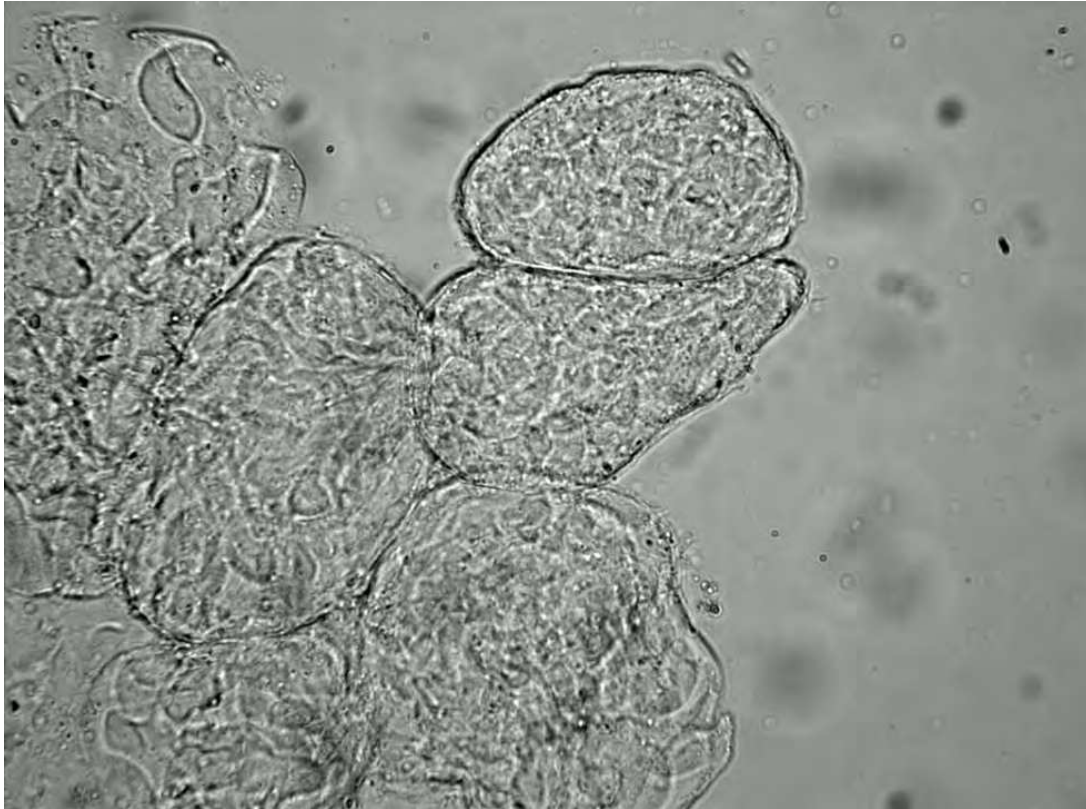


Fig. 13. Insoluble fibre from moong bean endosperm x 400. Image 0.3mm wide.

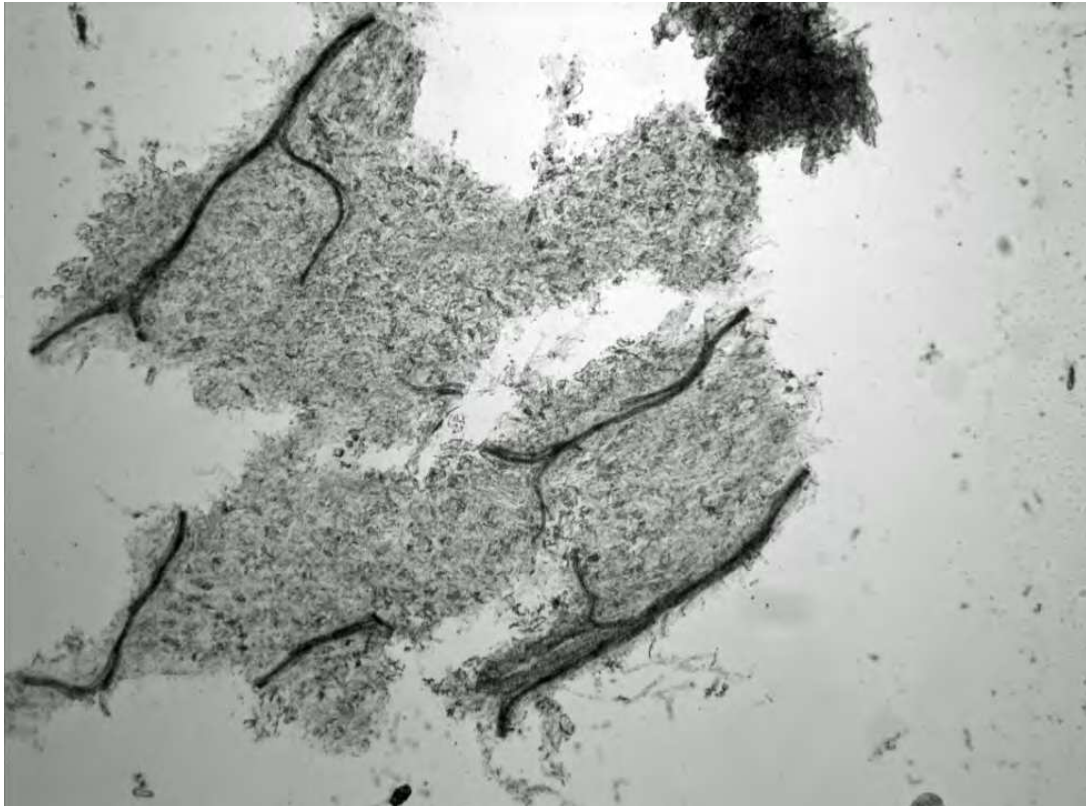


Fig. 14. Insoluble fibre from moong bean external coat x 40. Image 3mm wide.

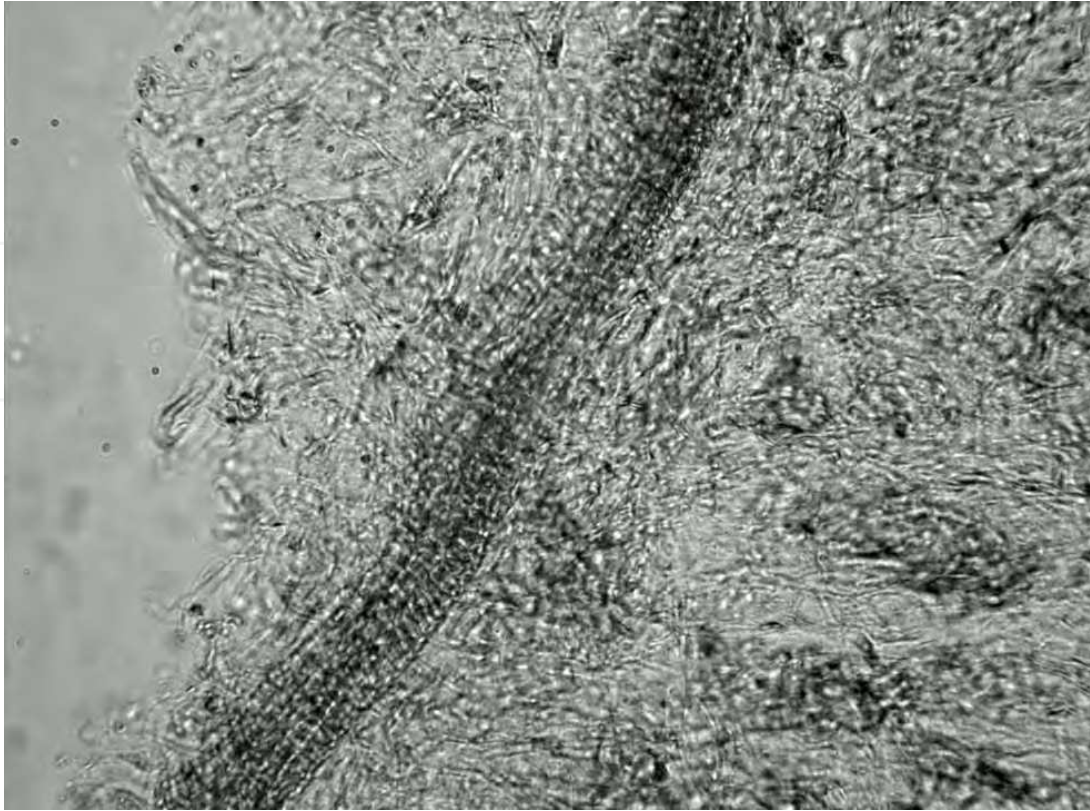


Fig. 15. Insoluble fibre from moong bean external coat x 400. Image 0.3mm wide.



Fig. 16. Insoluble fibre from moong bean external coat x 400. Image 0.3mm wide.

4.1.4 Foods that slow the digestive system

Some foods reduce the speed of the digestive system. This allows more time for dehydration to occur. Their effects are not seen when cereals and whole legumes are eaten. The foods are...

- Cooked protein foods... chemicals called heterocyclic amines (HCAs) are formed when proteins are cooked. These can have an anaesthetic action in the digestive system.
- Dairy foods have refrigerant properties that slow the digestive system. They also contain opioid peptides that slow the digestive system.
- Gluten is a protein found in some cereals. It contains opioid peptides that can slow the digestive system. It also causes leaky bowel syndrome (Fasano & Shea-Donohue, 2005).
- Fruits that are astringent can slow the digestive system by drying it up.
- Spices can dehydrate the digestive system and slow it down.

4.1.5 Trace minerals and depression

When a high starch, low fat, cooked protein diet is eaten, trace minerals are supplied by the bacteria that digest residual starch & protein in the colon. These bacteria transform inorganic trace minerals into absorbable organic trace mineral complexes. However in IBS-A & IBS-D, colonic bacteria are regularly expelled and no longer supply trace minerals. Lack of these minerals causes depression.

4.2 Cholesterol

The human body manages circulating cholesterol with the ileum. Cholesterol is used to make bile salts which are then stored in the gall bladder. This removes cholesterol from circulation. Bile salts are used to emulsify fats in the first and second sections of the small intestine and later on they can be reabsorbed in the third section (ileum). The ileum brain controller manages this recycling process. When cholesterol level is low, most bile salts are recycled. When cholesterol level is high, more bile salts are allowed to escape via the stool.

- IBS-B... here the chemical addition brain controller's ability to release bile salts from the gall bladder is restricted, and the gall bladder becomes full. Excess cholesterol can no longer be reduced by making bile salts.
- IBS-A & IBS-D... here the ileum brain controller's ability to manage the recycling of bile salts is compromised. Large amounts can be lost. Circulating cholesterol is diverted to bile salt manufacture, and a cholesterol deficit can occur.

4.2.1 Symptoms of cholesterol deficit & excess

When the ability to eliminate cholesterol via the digestive process is compromised, a high level of cholesterol causes the brain to display characteristic symptoms. When excessive amounts of bile salts are lost because of a defective ileum, a low cholesterol level causes similar symptoms. They are...

1. Visual hallucinations... these are kaleidoscopic moving patterns of colour that start near the centre of the visual field and radiate outwards. They are followed by...
2. Headaches and impaired brain function.

4.3 Variable level of the autonomic nervous system

The level of the autonomic nervous system is high on arising and when environmental stress occurs. Overnight it usually declines. This variation coincides with levels of adrenal hormones in the body. Now the small intestine is controlled by five divisions of the autonomic nervous system. Variation in the activity level of this system thus affects control of the small intestine. IBS symptoms are worst early in the morning. The characteristic IBS-A & D symptom of the 'morning rush' occurs when the enteric nervous system relaxes the valve terminating the ileum, moves the contents of the ileum prematurely into the colon, and evacuates the colon in response to the presence of raw enzymes and/or fat. The characteristic IBS-C & A symptom of bloating is worst on eating breakfast. The control speed set by the enteric nervous system is higher, and the strength of the Barrier is stronger.

4.4 Climate, age & constitution

- Living at arctic latitudes worsens symptoms, at tropical latitudes they improve.
- IBS is seldom severe in young people. IBS is often severe in old age.
- Some constitutions suffer more from IBS. Those that suffer most are thin and underweight. Substantial constitutions cope better.

4.5 Progression of the illness

A neurotransmitter deficiency (or deficiencies) in the small intestine brain controller, can develop over decades. IBS symptoms are mild and irregular at first, gradually become more frequent, then continuous.

4.6 Other causes of IBS

- Severing of nerves during surgery to the abdomen will cause symptoms immediately.
- Damage to the intestine from a toxic insult will cause symptoms immediately.
- Pressure on nerves in the neck area from misaligned vertebrae, will cause intermittent symptoms.
- Damage to intestinal nerves from pregnancy or childbirth, will result in immediate symptoms.
- Failure of nervous system development as an infant will cause symptoms to appear as soon as solid foods are fed.

5. Evidence for the model

5.1 No visible damage

Medical examination of most IBS patients shows no damage that can account for the symptoms. The automated controls of the digestive system are where the problems are likely to be.

5.2 Cereal and legume fibre

When consumption of cereals and whole legumes is stopped, IBS symptoms are dramatically improved. These foods stimulate too fast speeds when the enteric nervous system regulates transport in the small intestine.

5.3 Difficulty digesting fats

The model identifies three possible causes of fat in the stool (steatorrhea)...

1. When severe bloating is a symptom, backpressure in the duodenum prevents the release of sufficient chemicals.
2. When a defective ileum causes continual diarrhoea, large amounts of chemicals can be lost. The gall bladder and pancreas no longer contain enough chemicals.
3. IBS-B explains the other cases of impaired fat digestion. Here the brain can no longer release enough chemicals.

5.4 Irritation around the anus

Diarrhoea is often accompanied by irritation of the skin around the anus. When the ileum no longer efficiently recycles chemicals, bowel movements will contain raw protease enzymes. These attack the area around the anus.

5.5 Intestinal bloating

IBS bloating starts on arising when adrenal hormones are released and breakfast is eaten. Stress during the day further increases it. Overnight it can disappear. The autonomic nervous system is at a high level in the morning, high in response to stress and low overnight. It is likely to be causing the bloating.

The symptom of bloating displays two degrees. It is either severe, or slight to moderate and hard to detect. The duodenum is short (25 cm). When the Barrier is at the start of the jejunum and the stomach continues to pump in food soup, bloating is severe (see Diagram 1). The jejunum is 2-3m long. When the Barrier is at the start of the ileum, it causes only slight to moderate bloating (see Diagram 2) that is hard to detect.

5.6 Intestinal cramping

1. Cramping associated with bloating is the secondary transport controller trying to move food soup through a Barrier created by a primary transport controller. It pushes in one direction only (forward). The strength of the pushing depends on the type of food eaten, and the state of the autonomic nervous system.
2. Cramping associated with loud borborygmi is the secondary transport controller moving food soup too fast in the small intestine.
3. Cramping followed immediately by diarrhoea, occurs when the secondary transport controller causes the ileum to move food soup into the colon too soon. The soup contains enzymes and/or fat, and the colon is evacuated immediately at speed.

6. Suggestions for testing the model

6.1 Three kinds of IBS-C

Clinicians may be able to find the three kinds of neurotransmitter deficient IBS-C predicted by the hypothesis.

1. The duodenum brain controller is deficient. When a breakfast containing cereal is eaten, the symptoms are immediate severe bloating and possibly cramping. **Constipation** and steatorrhea occur.
2. The jejunum brain controller is deficient. When a breakfast containing cereal is eaten, symptoms are borborygmi, and hard to detect, slight to moderate bloating, both delayed by a few minutes. **Constipation** occurs. Cramping and steatorrhea are possible.
3. Both the duodenum and jejunum brain controllers are deficient. When a breakfast containing cereal is eaten, symptoms are immediate borborygmi, and immediate slight to moderate bloating that is hard to detect. **Constipation** occurs. Cramping and steatorrhea are possible.

6.2 Three kinds of IBS-D

The symptom of borborygmi may allow the clinician to find the three kinds of neurotransmitter deficient IBS-D predicted by the theory. If IBS-B occurs, this may cause borborygmi that will obscure the diagnosis.

1. The ileum brain controller is malfunctioning. Borborygmi will start several hours after a breakfast containing cereal is eaten. Diarrhoea occurs immediately food reaches the end of the ileum, or on arising the next morning. Cramping and steatorrhea are possible.
2. Both the ileum and jejunum brain controllers are malfunctioning. Borborygmi will begin a few minutes after starting to eat a breakfast containing cereal. Diarrhoea occurs immediately food reaches the end of the ileum, or on arising the next morning. Cramping and steatorrhea are possible.
3. The ileum, jejunum, and duodenum brain controllers are malfunctioning. Borborygmi will begin immediately after starting to eat a breakfast containing cereal. Diarrhoea occurs immediately food reaches the end of the ileum, or on arising the next morning. Cramping and steatorrhea are possible.

7. Coping with IBS symptoms

7.1 Key symptoms for diagnosis

The often confusing collection of symptoms that IBS presents, can be made sense of by using the key diagnostic criteria presented in Table 6.

<i>IBS Type</i>	<i>Identifying diagnostic symptoms</i>
IBS-A	Diarrhoea AND bloating
IBS-B	Steatorrhea often accompanied by severe symptoms of IBS-A, C, or D.
IBS-C	Constipation but NO diarrhoea
IBS-D	Diarrhoea but NO bloating.

Table 6. Diagnostic criteria for IBS

Diagnosis of IBS-B may cause problems, as steatorrhea can also be caused by continual diarrhoea that empties the gall bladder & pancreas, and by backpressure in the duodenum. If diarrhoea & severe bloating are absent, and steatorrhea is present, then IBS-B is indicated. The presence of severe symptoms is also indicative of IBS-B. However dietary trials are likely to be needed to find out if IBS-B is definitely present.

7.2 Healing the symptoms

IBS symptoms are dramatically reduced by removing cereals and whole legumes from the diet (Dobson, 2011; Sinclair 2003). Most remaining symptoms can be removed with Relaxation Therapies. When stress releases adrenal hormones, the autonomic nervous system moves to a higher level, and IBS symptoms become worse. A cascade occurs...

Stress → IBS → more Stress → severe IBS etc...

Relaxation Therapies (Blanchard 1993, 2001; Dobson 2011), keep the level of adrenal hormones lower and the autonomic nervous system operates at a lower level. The enteric nervous system then moves food soup slower, the Barrier diminishes, and the valve into the colon is harder to open.

8. Future research

The author is currently developing a range of diets to treat IBS. The hypothesis presented here, together with the diets and relaxation therapies, will eventually be published in a book written so that all can understand.

More research...

- Location of the small intestine controllers in the brain.
- Identification of the four neurotransmitters in the small intestine brain controller.
- Identification of the receptor for the hormone Cholecystokinin in the small intestine chemical controller.

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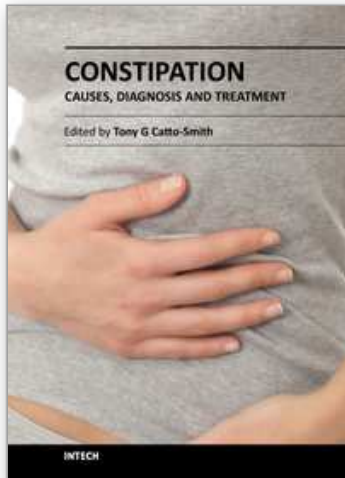
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Constipation is common in both adults and children. Estimates would suggest a median prevalence of around 12-16% in the general population. While regarded as a minor nuisance in some cases, its consequences can be severe, with a substantial impact on quality of life. Secondary faecal soiling has a profound psychological effect at all ages. This book provides contributions from authors with a range of backgrounds which clarify the pathogenesis, diagnosis, and therapy of constipation for the general population and also for certain high risk groups.

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