**Revision 6.1, D1, D2**

**Topic 6.1 Digestion and absorption**

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| 6.1.U1 | The contraction of circular and longitudinal muscle of the small intestine mixes the food with enzymes and moves it along the gut. |
| 6.1.U2 | The pancreas secretes enzymes into the lumen of the small intestine. [Students should know that amylase, lipase and an endopeptidase are secreted by the pancreas. The name trypsin and the method used to activate it are not required.] |
| 6.1.U3 | Enzymes digest most macromolecules in food into monomers in the small intestine. [Students should know that starch, glycogen, lipids and nucleic acids are digested into monomers and that cellulose remains undigested.] |
| 6.1.U4 | Villi increase the surface area of epithelium over which absorption is carried out. |
| 6.1.U5 | Villi absorb monomers formed by digestion as well as mineral ions and vitamins. |
| 6.1.U6 | Different methods of membrane transport are required to absorb different nutrients. |
| 6.1.A1 | Processes occurring in the small intestine that result in the digestion of starch and transport of the products of digestion to the liver. |
| 6.1.A2 | Use of dialysis tubing to model absorption of digested food in the intestine. |
| 6.1.S1 | Production of an annotated diagram of the digestive system. |
| 6.1.S2 | Identification of tissue layers in transverse sections of the small intestine viewed with a microscope or in a micrograph. [Tissue layers should include longitudinal and circular muscles, mucosa and epithelium.] |

**Topic D.1:  Human Nutrition**

[**http://www.biologyforlife.com/d1-human-nutrition.html**](http://www.biologyforlife.com/d1-human-nutrition.html)

**Essential Idea:**A balanced diet is essential to human health.

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| **D.1.U1** | **Essential nutrients cannot be synthesized by the body; therefore they have to be included in the diet.**   * Define “essential” as related to dietary nutrients. * Define “non-essential” as related to dietary nutrients.   In the News:   * [Fundamental plant chemicals trace back to bacteria](http://www.sciencedaily.com/releases/2014/08/140807121848.htm) (2014-08-07) |
| **D.1.U2** | **Dietary minerals are essential chemical elements.**   * State the difference between a vitamin and a mineral. * List two example essential minerals.   Class Materials:   * [Vitamins and minerals notes](https://docs.google.com/presentation/d/1sUPjiDODSIGgxQB0Oy3qTbfuen6HV-9K2Pw4fr_JsXQ/edit?usp=sharing) * ​[Statement D.1.U2](https://drive.google.com/file/d/0B7EoydxcWA7pT2RGNEtQeDNQZkk/view?usp=sharing) |

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| **D.1.U3** | **Vitamins are chemically diverse carbon compounds that cannot be synthesized by the body.**   * Define vitamin. * Given a molecular diagram of a vitamin, determine if t is hydrophobic or hydrophilic. * Compare the properties of water soluble and fat soluble vitamins. * List two example water soluble vitamins and two example fat soluble vitamins.   Class Materials:   * [Vitamins and minerals notes](https://docs.google.com/presentation/d/1sUPjiDODSIGgxQB0Oy3qTbfuen6HV-9K2Pw4fr_JsXQ/edit?usp=sharing) * [Statement D.1.U3](https://drive.google.com/file/d/0B7EoydxcWA7pQ2NmWkpGQ0pLY1E/view?usp=sharing) |
| **D.1.U4** | **Some fatty acids and some amino acids are essential.**   * Outline the concept of “conditionally essential” using amino acid examples. |

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| **D.1.U5** | **Lack of essential amino acids affects the production of proteins.**   * Outline the effect of protein deficiency malnutrition on children and adults. |
| **D.1.U6** | **Malnutrition may be caused by a deficiency, imbalance or excess of nutrients in the diet.**   * Outline two causes of malnutrition. |

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| **D.1.U7** | **Appetite is controlled by a centre in the hypothalamus.**   * Describe how hormones and the appetite control center regulate a desire to eat. |
| **D.1.U8** | **Overweight individuals are more likely to suffer hypertension and type II diabetes.**   * Define hypertension. * Outline the reasons for the relationship between weight gain and hypertension. * Outline the causes of the two type of diabetes mellitus. * List risk factors associated with type II diabetes. * State symptoms of type II diabetes. * List cardiovascular effects of type II diabetes.   **In the News:**   * [Can you be obese and still be healthy?](http://news.sciencemag.org/biology/2014/07/can-you-be-obese-and-still-be-healthy) (2014-07-03) * [Grizzly research offers surprising insights into diabetes-obesity link](http://www.sciencedaily.com/releases/2014/08/140805131959.htm) (2014-08-05) * [Distribution of Weight Status among Adults with Diabetes](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6331a5.htm?s_cid=mm6331a5_x) (2014-08-13) * [Is Samoa's Obesity Epidemic A Harbinger For Other Developing Nations?](http://www.npr.org/sections/thesalt/2016/04/07/473371279/is-samoa-s-obesity-epidemic-a-harbinger-for-other-developing-nations) (2016-04-07) |

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| **D.1.U9** | **Starvation can lead to breakdown of body tissue.**   * State the cause of starvation. * Explain loss of muscle mass during starvation.   In the News:   * [What Happens To The Body And Mind When Starvation Sets In?](http://www.npr.org/sections/goatsandsoda/2016/01/20/463710330/what-happens-to-the-body-and-mind-when-starvation-sets-in) (2016-01-20) |
| **D.1.A1** | **Production of ascorbic acid by some mammals, but not others that need a dietary supply.​**   * State the function of ascorbic acid, Vitamin C. * Analyze a cladogram based on the mutations in the GLO gene, used in Vitamin C synthesis. * Outline the cause, symptoms and treatment of scurvy. |

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| **D.1.A2** | **Cause and treatment of phenylketonuria (PKU).**   * Outline the genetic cause of phenylketonuria. * List consequences of phenylketonuria if untreated. * State how phenylketonuria is treated.   Class Materials:   * ​[Unit note packet](https://drive.google.com/file/d/0B7EoydxcWA7pblcyalFtOVBJS0E/view?usp=sharing) (filled out) * [Statement D.1.A2](https://drive.google.com/file/d/0B7EoydxcWA7pSEo2UXFscF8tS0tVZkduTjlZVmZqRW9VbHBv/view?usp=sharing) |
| **D.1.A3** | **Lack of Vitamin D or calcium can affect bone mineralization and cause rickets or osteomalacia.**   * Explain the relationship between vitamin D, calcium, osteomalacia and skin cancer.   Class Materials:   * [Skin Cancer and Vitamin D](https://docs.google.com/presentation/d/1CZE-J2pO91Owa0Zo9nM1ZYKHF_rdCAc0DInld4xUYRQ/edit?usp=sharing) * [Statement D.1.A3](https://drive.google.com/file/d/0B7EoydxcWA7pc2FNSURqV19IYVU/view?usp=sharing)   ​In the News   * [Minority Teens May Need An Extra Vitamin D Boost (2015-12-23)](http://www.npr.org/sections/health-shots/2015/12/22/460341474/in-highest-latitudes-minority-teens-may-need-an-extra-vitamin-d-boost) |

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| **D.1.A4** | **Breakdown of heart muscle due to anorexia.**   * List symptoms associated with anorexia nervosa. * Outline the effect of anorexia nervosa on heart muscle tissue. |
| **D.1.A5** | **Cholesterol in blood as an indicator of the risk of coronary heart disease.**   * Outline factors that indicate that dietary cholesterol may not be the exclusive cause of the correlation between blood plasma cholesterol levels and risk of coronary heart disease. |

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| **D.1.S1** | **Determination of the energy content of food by combustion.**   * Explain how a calorimeter can be used to determine the energy content in food. * Calculate the energy content of a food sample using calorimetry data.   Class Materials:   * [Calorimetry notes (in packet)](https://drive.google.com/open?id=0B7EoydxcWA7pSm5vZjVaamt0dkk) * [Statement D.1.S1](https://drive.google.com/file/d/0B7EoydxcWA7pRVc3eEJ5SGhWSWc/view?usp=sharing) |
| **D.1.S2** | **Use of databases of nutritional content of foods and software to calculate intakes of essential nutrients from a daily diet.**   * Use a computer application to keep a record of food consumed in a single day. * Compare tracked food intake to the recommended intake of nutrients.   Class Materials:   * [Nutritional content of food (in unit packet)](https://drive.google.com/open?id=0B7EoydxcWA7pSm5vZjVaamt0dkk) * [Statement D.1.S2](https://drive.google.com/file/d/0B7EoydxcWA7pOHlIcWVfS0ZDRmM/view?usp=sharing) |

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| **D.1.** **NOS** | **Falsification of theories with one theory being superseded by another—scurvy was thought to be specific to humans, because attempts to induce the symptoms in laboratory rats and mice were entirely unsuccessful.**   * Based on cladistics, explain why some animals are poor models for the study of scurvy. |

**Topic D.2:  Digestion**

[**http://www.biologyforlife.com/d2-digestion.html**](http://www.biologyforlife.com/d2-digestion.html)

**Essential Idea:**  Digestion is controlled by nervous and hormonal mechanisms.

At SHS, Topic D.2 is taught in the following class unit(s):

* [The Digestive System](https://drive.google.com/open?id=1ScgzAZHjzQE5_mHL0wD4Ea3UL0ze3BXAQPqNOJJds44) (unit 39)

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| **D.2.U1** | **Nervous and hormonal mechanisms control the secretion of digestive juices.**   * Describe when the secretion of digestive juices must be controlled. * State to mechanisms by which secretion of gastric juices is controlled. |
| **D.2.U2** | **Exocrine glands secrete to the surface of the body or the lumen of the gut.**   * Define alimentary canal. * Contrast endocrine glands with exocrine glands. * Label a diagram of an exocrine gland with the following terms:  secretory cells, lumen, duct, secretory vesicles, basement membrane and acinus. * Discuss the relationship between the structures of an exocrine gland cell and the function of the cell. * State the name and location of three exocrine glands associated with the alimentary canal. * State the composition of saliva, gastric juice and pancreatic juice.   Class Materials:   * *Former syllabus* [Mark scheme](http://www.biologyforlife.com/uploads/2/2/3/9/22392738/h2.pdf) (pdf) |

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| **D.2.U3** | **The volume and content of gastric secretions are controlled by nervous and hormonal mechanisms.**   * Using a flow chart or concept map, diagram the interactions between nervous and hormonal mechanisms that regulated the secretion of gastric juices.   In the News:   * [Is obesity an addiction?](http://www.scientificamerican.com/article.cfm?id=is-obesity-an-addiction) Links to article preview only (2013-08-28) * [Mind over milkshake: How your thoughts fool your stomach](http://www.npr.org/blogs/health/2014/04/14/299179468/mind-over-milkshake-how-your-thoughts-fool-your-stomach) (2014-04-14) |
| **D.2.U4** | **Acid conditions in the stomach favour some hydrolysis reactions and help to control pathogens in ingested food.**   * Outline three roles of acid in the stomach. |

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| **D.2.U5** | **The structure of cells of the epithelium of the villi is adapted to the absorption of food.**   * Outline the role of the following structures of villi epithelial cells:  tight junctions, microvilli, mitochondria, pinocytic vesicles, proteins imbedded on the apical surface and proteins imbedded on the basal surface.   Class Materials:   * *Former syllabus* [Mark scheme](http://www.biologyforlife.com/uploads/2/2/3/9/22392738/h3.pdf) (pdf) |
| **D.2.U6** | **The rate of transit of materials through the large intestine is positively correlated with their fibre content.**   * List benefits of fibre in a healthy diet. * State the relationship between food fibre contents and rate of transit through the large intestine.   In the News:   * [Dietary fibre acts on brain to suppress appetite](http://www.nature.com/news/dietary-fibre-acts-on-brain-to-suppress-appetite-1.15127) (2014-04-29) |

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| **D.2.U7** | **Materials not absorbed are egested.**   * Define dietary fibre. * State two examples of dietary fibre. * Define egestion. * List materials that are egested from the body. |
| **D.2.A1** | **The reduction of stomach acid secretion by proton pump inhibitor drugs.**   * State the role stomach mucus. * State the cause of ulcer and acid reflux. * Outline the role of the H+, K+ -ATPase protein pump in the production of an acidic stomach. * Outline the use, function and effect of proton pump inhibitors to treat gastric disease. |

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| **D.2.A2** | **Dehydration due to cholera toxin.**   * Outline the cause and consequences of cholera infection. * Explain the effect of cholera toxin on intestinal cells. |
| **D.2.A3** | ***Helicobacter pylori* infection as a cause of stomach ulcers.**   * Define stomach ulcer. * Outline evidence that suggest *Helicobacter pylori* infection has a role in stomach ulcer and stomach cancer.   In the News:   * [Human–microbe mismatch boosts risk of stomach cancer](http://www.nature.com/news/human-microbe-mismatch-boosts-risk-of-stomach-cancer-1.14501) (2014-01-13) * [The Iceman had a tummy bug](http://news.sciencemag.org/evolution/2016/01/iceman-had-tummy-bug) (2016-01-07) |

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| **D.2.S1** | | **Identification of exocrine gland cells that secrete digestive juices and villus epithelium cells that absorb digested foods from electron micrographs.**   * List three features that can be used to identify exocrine gland cells as viewed in electron micrographs. * List four features that can be used to identify villus epithelium cell as viewed in electron micrographs. |
| **D.2.** **NOS** | **Serendipity and scientific discoveries—the role of gastric acid in digestion was established by William Beaumont while observing the process of digestion in an open wound caused by gunshot.**   * Describe how William Beaumont was able to determine the role of the stomach in chemical digestion of food. | |