1. NUTRITION AND MALNUTRITION

- **Nutrients** are **chemical substances** in **foods** that are **used** in the human body.
- **Nutrition** is the **supply** of nutrients.
- In humans, there are **essential nutrients** that **cannot be made by the body** and so must be in our **diet**. These essential nutrients are divided into different groups:

ESSENTIAL NUTRIENT	DESCRIPTION
Minerals	Specific elements such as **calcium** and **iron**
Vitamins	**Chemically diverse** compounds needed in **small amounts** by the body such as **ascorbic acid** (Vitamin C) and **calciferol** (Vitamin D)
Some amino acids	Some of the twenty amino acids cannot be made by the body and without them, **proteins cannot be made**
Some fatty acids	Some fatty acids are essential for the same reason, such as **omega-3 fatty acids**

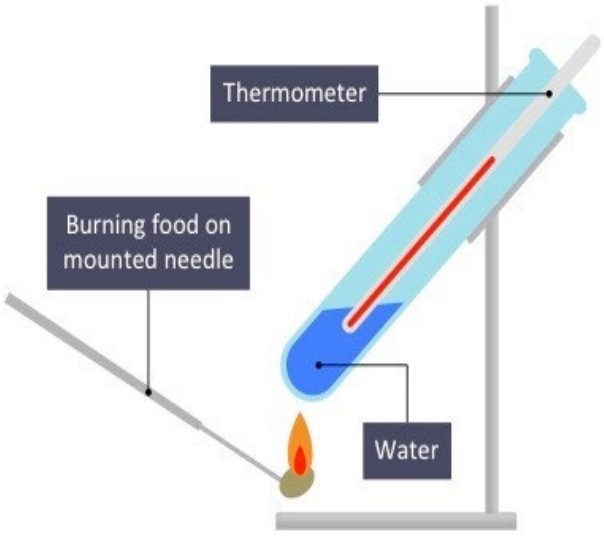
- Carbohydrates are almost always present in human diets but **specific carbohydrates** are **non-essential**.
- **Malnutrition** is a **deficiency**, **imbalance** or **excess** of **specific nutrients** in the **diet**.
- There are **many forms** of malnutrition, depending on which nutrient is present in excessive or insufficient amounts.

2. MEASURING ENERGY CONTENT

- The **energy content** of **food** can be estimated by burning a food sample of known mass and measuring the energy released via **calorimetry**.
- **Combustion** of the **food** source causes the stored energy to be released as **heat**, which **raises** the **temperature** of **water**.
- The amount of **energy** required to raise **1 g** of **water** by **1ºC** is **4.18** J – this is called the **specific heat capacity** of water.
- The **equation** for calculating the **energy content** of a food source via **calorimetry** is as follows:

$$\text{Energy content of food (J g}^{-1}\text{)} = \frac{\text{temperature rise (ºC) x water volume (ml) x 4.2 (J)}}{\text{mass of food (g)}}$$

- The biggest source of **error** in calorimetry is usually caused by the **unwanted loss** of **heat energy** to the surrounding **environment**.
- The food sources should be burnt at a **constant distance** from the **water** to ensure **reliability** of results.
- The **initial temperature** and **volume** of **water** should also be kept **constant** (1 g of water = 1 cm^3 or 1 ml).



When 0.5 g of food is burned, 20cm^3 of water warms up by 10ºC.

What is the energy content of the food, in J g^{-1}?

$$\text{Energy content of food (J g}^{-1}\text{)} = \frac{\text{temperature rise (ºC) x water volume (ml) x 4.2 (J)}}{\text{mass of food (g)}}$$

$$\text{Energy content of food (J g}^{-1}\text{)} = \frac{\text{10 (ºC) x 20 (ml) x 4.2 (J)}}{\text{0.5 (g)}} = \text{1680 J g}^{-1}$$

- More **accurate** estimates of energy content can be obtained by burning food in a **food calorimeter**, which **traps heat** from the **burning** much more **efficiently**.

3. ENERGY IN THE DIET

- **Carbohydrates**, **amino acids** and **lipids** can all be used in **aerobic respiration** as a source of energy.

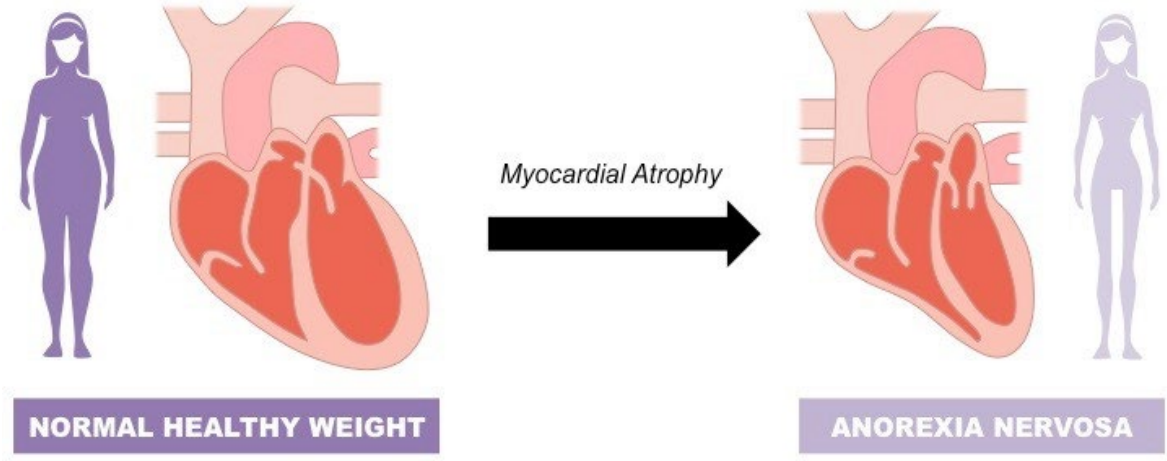
- If the energy in the diet is **insufficient**, reserves of **glycogen** and **fat** are broken down and used.

STARVATION = The prolonged shortage of food

Once reserves of glycogen and fat are used up, body tissues are broken down and used in aerobic respiration

ANOREXIA = A condition in which a person does not eat enough food to sustain the body, even though it is available

As above, body tissues are broken down and, in advanced cases, even heart muscle is broken down



OBESITY = Excessive storage of fat in adipose tissue, due to prolonged intake of more energy in the diet than is used in respiration

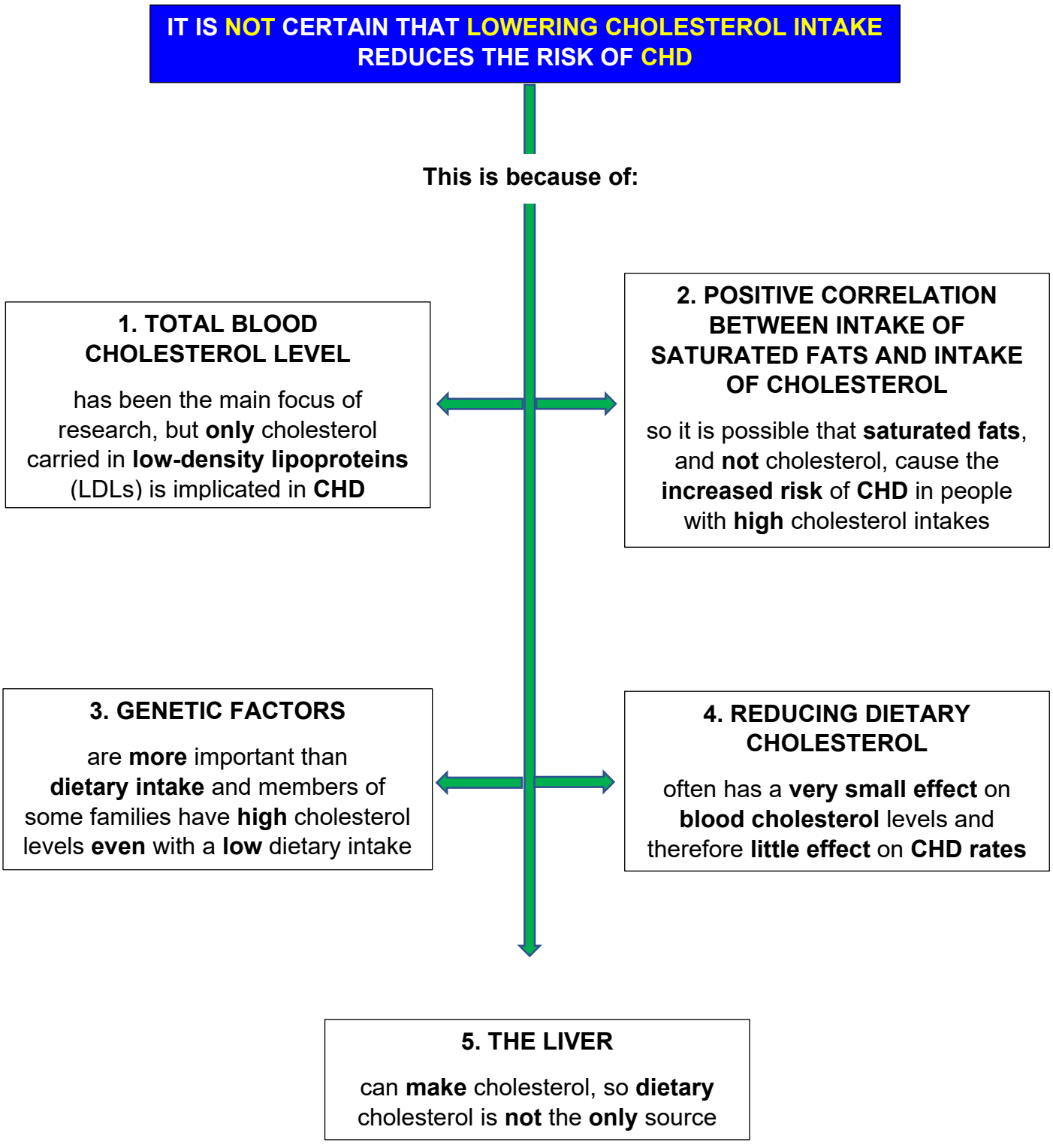
- Most people **do not** overeat because **leptin** is produced by **adipose tissue**, causing a **reduction** in appetite.

- A centre in the **hypothalamus** is responsible for **feelings** of appetite (wanting to eat food), or **saiety**.

- **Obese** or **overweight** people are more likely to suffer from **high blood pressure** (hypertension), and **type II diabetes**.

4. CHOLESTEROL AND HEART DISEASE

- There is a **positive correlation** between high levels of **cholesterol** in the **blood** and an **increased risk** of **coronary heart disease** (CHD). However:



5. USE OF NUTRITIONAL DATABASES

- Internet **databases** are available that show the typical **nutritional contents** of **foods**.
- They can be used to **estimate** the **overall content** of a **day's** diet.
- The **mass** of **each food** eaten during the day is needed.
- The nutritional **analysis** can be done easily using free software, such as http://www.myfoodrecord.com.
- The table below shows:
  - **different nutrients** in **50 g** of salted cashew nuts
  - the **recommended daily amount** (RDA) of **each** nutrient for a **14-18** year-old **boy**
  - the **percentage** of the RDA that these nuts contain

NUTRIENT	TOTAL	RDA	%RDA
Protein (g)	7.5	60.0	12.5
Saturated fat (g)	4.88	33.3	14.6
Cholesterol (mg)	0	300	0
Iron (mg)	2.5	12	20.8
Vitamin B1 thiamine (mg)	0.16	1.2	13.3

- By doing this analysis on a **whole day's** diet, we can determine if **enough** of **each** nutrient has been eaten.