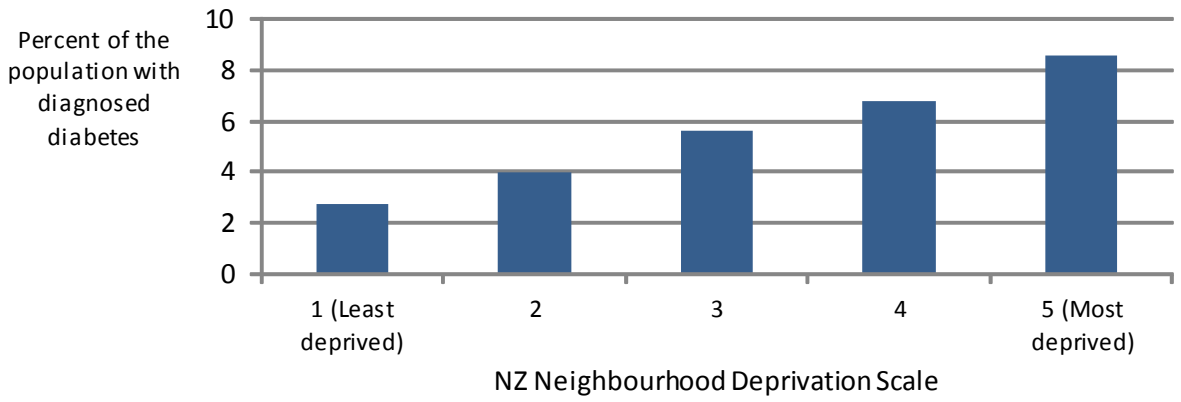
SLR 2

Diabetes Prevalence in New Zealand: Neighbourhood

- Neighborhood deprivation is a measurement of the socio-economic resources in a particular area.
- During the 2006 New Zealand census nine factors were measured and combined to create a Neighborhood Deprivation scale going from 1 (least deprived) to 5 (most deprived).
- This is similar to school deciles which tell us about the socio-economic status of the community in which a school sits, except in this case 1 is high, where as in the case of school deciles 1 is low.
- Evidence from the World Health Organisation tells us that around the world low-income countries and low socio-economic communities are affected more by Type 2 diabetes and other noncommunicable diseases than high-income countries and high socio-economic communities.

New Zealand adults diagnosed with diabetes, by neighbourhood deprivation, 2011-2012

Redrawn from Ministry of Health. 2012. The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey. Wellington: Ministry of Health.



1. What percentage of adult New Zealanders living in low-socioeconomic neighbourhoods are likely to have been diagnosed with diabetes?

2. What percentage of adult New Zealanders living in high-socioeconomic neighbourhoods are likely to have been diagnosed with diabetes?

3. How many times more likely to have diabetes are people in the most-deprived neighbourhoods compared to people in the least-deprived neighbourhoods?

4. Describe the overall pattern shown in the graph.

5. Can you suggest at least three reasons why we see this pattern occurring.

SLR 3

Diabetes Prevalence in New Zealand: Ethnicity

- Around the world, some ethnic groups are more likely to be affected by Type 2 diabetes than others. For instance India and China have some of the highest rates of Type 2 diabetes in the world. The Pacific Islands is another region where there are very high rates of Type 2 diabetes.
- Within New Zealand there are also differences in the rate of diabetes between ethnic groups.

Diagnosed diabetes in New Zealand, by ethnic group and gender
Data Source: Ministry of Health 2012 The Health of New Zealand Adults 2011/12.

	% Adults with Diagnosed Diabetes			Estimated number of adults with diagnosed diabetes
	Total	Men	Women	
Total NZ Population	5.5	6.0	5.0	193,000
Māori	7.3	7.9	6.8	33.000
Pacific	10.2	10.6	9.9	21,000
Asian	6.2	8.4	4.2	23,000
European/Other	4.7	4.9	4.5	130,000

1. Which ethnic groups in New Zealand are more likely to suffer from diabetes than the total population?
2. Which ethnic group showed the largest difference between men and women diagnosed with diabetes?
3. Which ethnic group showed the smallest difference between men and women diagnosed with diabetes?

- When comparing one ethnic group with another, we cannot just compare the percentage of people with diabetes. This is because there are different age-structures in different ethnic groups within our total population.
  - For instance there are more younger people in the New Zealand Pacific population than the total New Zealand population.
  - Statisticians can adjust the rates according to age and sex so that differences such as those created by the fact that one population is on average younger than another are removed.

Age-adjusted rate ratios for diagnosed diabetes in New Zealand
Data Source: Ministry of Health 2012 The Health of New Zealand Adults 2011/12.

Age-adjusted comparisons of each ethnic group with people not in that ethnic group				
Group of Interest	Comparison Group	Total	Men	Women
Māori	Non-Māori	2.1	2.0	2.1
Pacific	Non-Pacific	3.4	3.3	3.5
Asian	Non-Asian	1.7	2.2	1.2

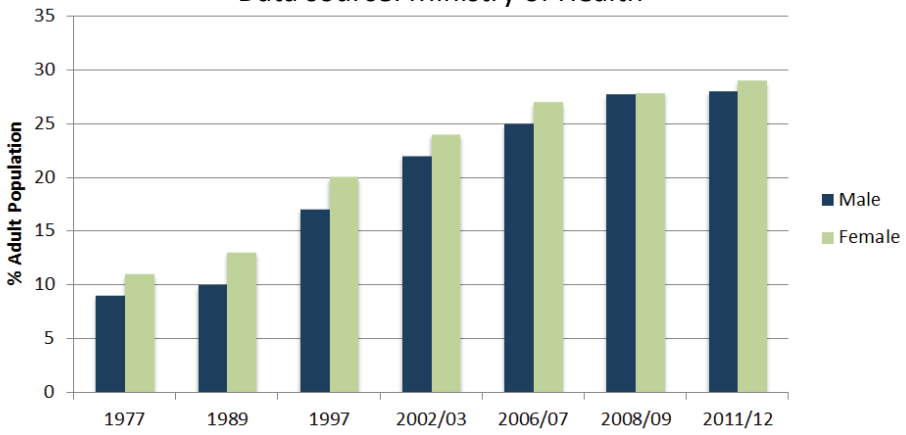
4. Is the difference between the rate of diabetes for these three ethnic groups and the total population larger or smaller when it is adjusted for age?
5. Using the information in both tables, write a summary statement about the relationship between ethnicity and rates of diagnosed diabetes in the New Zealand population.

SLR 4

Obesity: A Diabetes Risk Factor in New Zealand

- Type 1 diabetes is not preventable BUT Type 2 diabetes **risk can be reduced**, contributing towards prevention of this disease.
- In New Zealand and around the world, the increase in Type 2 diabetes is directly linked to increasing rates of overweight and obesity, and decreasing rates of physical activity in our communities.
- We say that a person is obese if their body mass (weight) puts them at increased risk of disease.
- 80% of premature deaths caused by heart disease, stroke, and Type 2 diabetes could be postponed through changes to behaviours around tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol.
- What has happened to the rate of obesity in New Zealand over the past 30-years?

Prevalence of obesity in the New Zealand adult population
(15-years and over) from 1977 to 2012
Data source: Ministry of Health



1. What percentage of New Zealand females were obese in 1977? How has this changed by 2012?

2. What percentage of New Zealand males were obese in 1989? How does this compare with the percentage of New Zealand females who were obese in 1989?

3. If there were 1000 New Zealand males at a rugby match in 1997, how many of these men would you expect to have been obese? If you attended the same event 12 years later, how many men at the event would you expect to have been obese?

4. Write a short summary paragraph to describe the trends or patterns shown in this graph. Your summary should talk about patterns related to time and gender (sex).

5. Using the information in the graph, make a prediction about what we might expect the data to look like by 2016. Give a reason for your predictions.

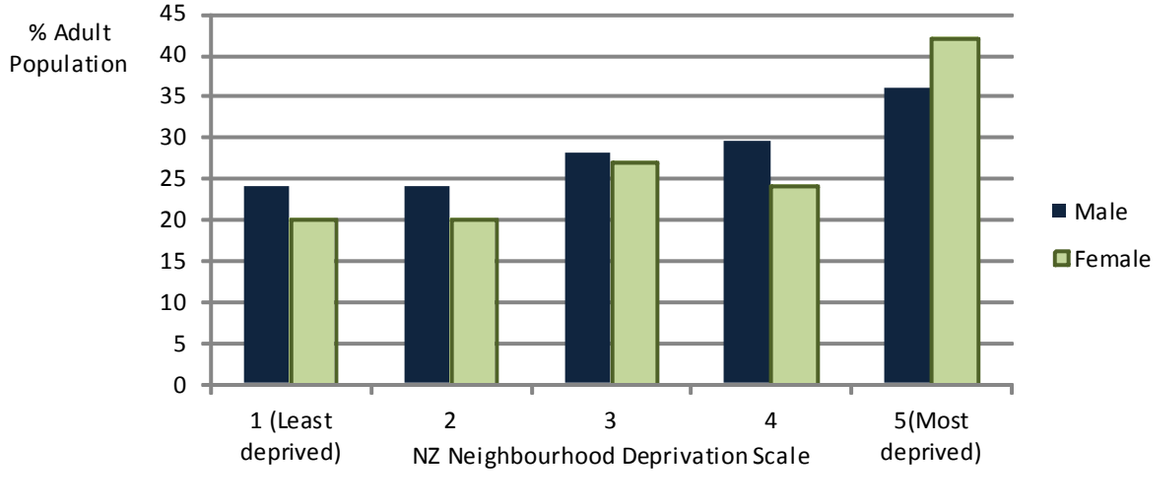
SLR 5

Obesity & Neighbourhood: A Diabetes Risk Factor in NZ

- Neighborhood deprivation is a measurement of the socio-economic resources in a particular area.
- During the 2006 New Zealand census nine factors were measured and combined to create a Neighborhood Deprivation scale going from 1 (least deprived) to 5 (most deprived).
- This is similar to school deciles which tell us about the socio-economic status of the community in which a school sits, except in this case 1 is high, where as in the case of school deciles 1 is low.
- Evidence from the World Health Organisation tells us that around the world low-income countries and low socio-economic communities are affected more by Type 2 diabetes and other noncommunicable diseases than high-income countries and high socio-economic communities.

Prevalence of obesity in New Zealand adults, by gender (sex) and neighborhood deprivation, 2011-2012

Redrawn from Ministry of Health. 2012. The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey. Wellington: Ministry of Health.



1. What percentage of adult New Zealanders living in a low-socioeconomic neighborhoods are likely to be obese?

2. What percentage of adult New Zealanders living in a high-socioeconomic neighborhoods are likely to be obese?

3. In the total New Zealand population in 2011/12, 28% of males and 29% of females were suffering from obesity. How does the trend shown in this graph for males and females differ from the overall obesity pattern for males and females in New Zealand communities?

4. Describe the overall pattern shown in the graph.

5. Can you suggest at least three reasons why we see this pattern occurring?

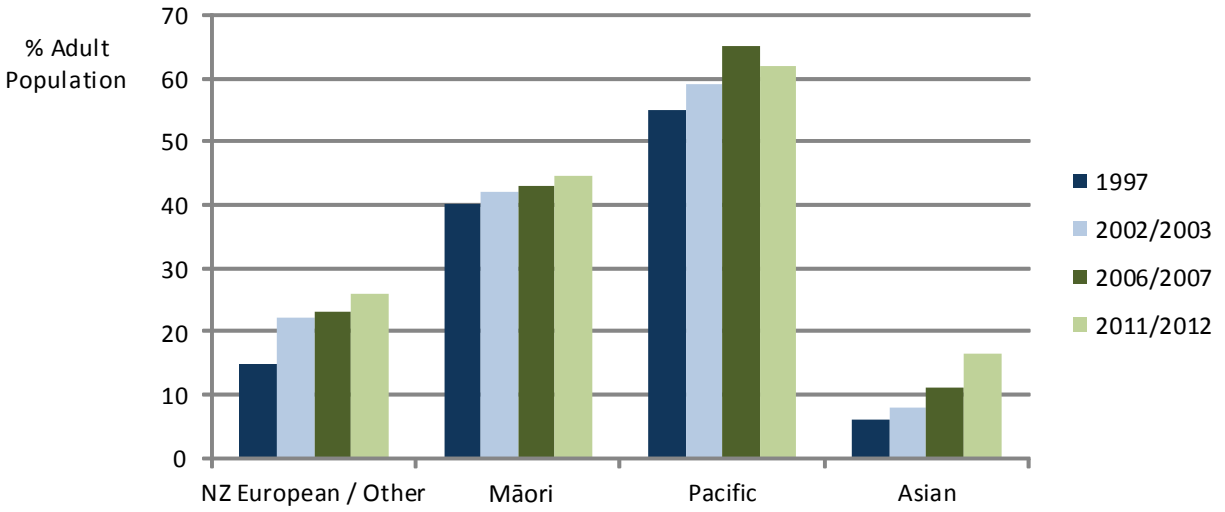
SLR 6

Obesity & Ethnicity: A Diabetes Risk Factor in New Zealand

- Being overweight or obese is a significant risk factor associated with Type 2 diabetes.
- In New Zealand around 64% of the population are overweight or obese.
- The reasons why people become overweight or obese are not simple.
- The chart below presents data about obesity for the main ethnic groups in New Zealand.

Prevalence of obesity in New Zealand adults (15 years and over) by ethnicity.

Redrawn from New Zealand Ministry of Health data, 1997-2012



1. Were there any ethnic groups that **did not show an increase** in the incidence of obesity between 1997 to 2012?

2. Which ethnic group had the highest proportion of obese adults over all four sampling periods?

3. Which ethnic group had the **smallest increase** in obesity during the period 1997-2012?

4. Which two ethnic groups had the **largest percentage increase** in obesity during the period 1997-2012?

5. Write a short summary paragraph to describe the trends or patterns shown in this graph for all ethnic groups in New Zealand from 1997—2012.

6. Using the information in the graph, make a prediction about what we might expect the data to look like for each ethnic group by 2016. Give a reason for your predictions.

7. How confident are you that the data shown in the graph is accurate?
Give a reason for your answer.

SLR 7

Diabetes Overview

Peer - to - Peer Review

Professionals in all fields of work use PEER REVIEW to check whether their thinking is in agreement with other people who work in the same area as they do. When a scientist or a health professional establishes new information about the diabetes epidemic, it needs to be REVIEWED by PEERS before it can be published.

Your PEERS are other people in your class and your YEAR GROUP at your school.

When you REVIEW work done by your peers you should be able to offer them FEEDBACK that may help them to improve their work.

Instructions

1. Team up with another group. SWAP overview charts (and questions if you have these).

2. Working with YOUR GROUP, review the overview chart of the OTHER group and give them feedback.

   a. Are their key words / statements clear?

   b. Do you agree with the way they have organised the words into the 5 categories?

   c. Are there any ideas that you disagree with? If so, you need to be able to explain why.

   d. Are there any important ideas that you think they have left out? Be prepared to explain why you think these are important ideas.

3. Meet back with the other group to give them your feedback and hear their feedback about your work.

4. MOST IMPORTANTLY: Review your chart following the feedback and decide on a final version. You do not have to make changes that have been suggested by your peers, but if you disagree with their feedback, it is important to think about WHY they have suggested those changes and why you are not going to take their suggestion on board.

SLR 8

Carbohydrates: An energy source

Carbohydrates

Carbohydrates are the most common foods in our diet. They can be divided into two groups - complex carbohydrates and simple carbohydrates. During digestion, most carbohydrates can be broken down into simple sugars (mainly **glucose**), to provide energy for our cells.

Complex carbohydrates such as starch and cellulose are made up of long-chains of glucose molecules. They are found in whole-grain foods, vegetables and fruit.

Cellulose is an important component in the cell walls of plants. It cannot be digested by humans however foods rich in cellulose provide fibre, an essential component in a healthy diet.

Starch is found in foods such as cereals or grains (e.g. oats, wheat, rice, maize, barley), pasta, green vegetables, fruits and root vegetables. Starch forms the largest component of the diet of most humans.

Foods rich in complex carbohydrates are digested slowly, providing a sustained release of glucose over time.

Simple carbohydrates or sugars are made up of di– or monosaccharaides and are found in both natural and processed (or refined) foods.

Fruits are high in simple sugars (the monosaccharide fructose in particular), however the fibre found in fruits slows down digestion, prolonging the release of energy.

Foods that contain processed or **refined sugars** such as fruit-flavoured cordials, soft-drinks, biscuits, sweets (candy), muesli bars and cakes are digested very rapidly, releasing large amounts of glucose in a very short period of time.

The Glycemic Index (GI)

The Glycemic Index measures how quickly or slowly carbohydrates are broken down to glucose. The faster a carbohydrate is digested, the sooner glucose will enter the blood stream. Carbohydrate rich foods are ranked on a scale from 1 (Low GI) to 100 (High GI).

High GI foods are digested quickly, releasing lots of glucose into the blood stream all at once.

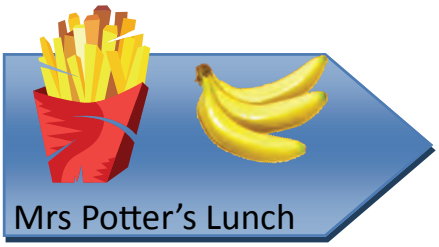
Low GI foods are digested slowly, gradually releasing glucose into the blood stream over a long period of time. A diet rich in LOW GI foods is better for you than a diet rich in high GI foods.

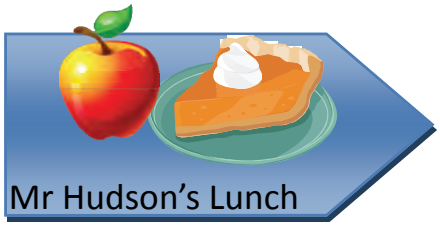
SLR 8

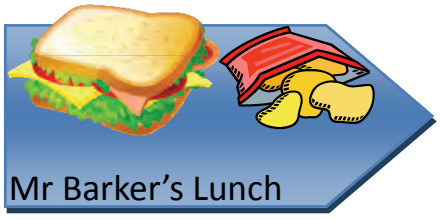
Carbohydrates: An energy source

Instructions

1. The boxes contain pictures of the lunch of five staff members at 'Carbo High School'. Your job is to label the lunch in each 'lunch box' according to the type of **carbohydrates** that are contained in the food items. C = complex; S = simple sugars SF = simple with fibre
2. Once you have labelled the food items, you need to rank the overall lunch on a scale in terms of whether you think it will provide the teachers with **sustained energy** through the afternoon to quick release energy food. (If you are aware of the importance of other food groups you may like to mention this in your overall reasons).







Carb. Label	Overall Rank	Your reasons for ranking

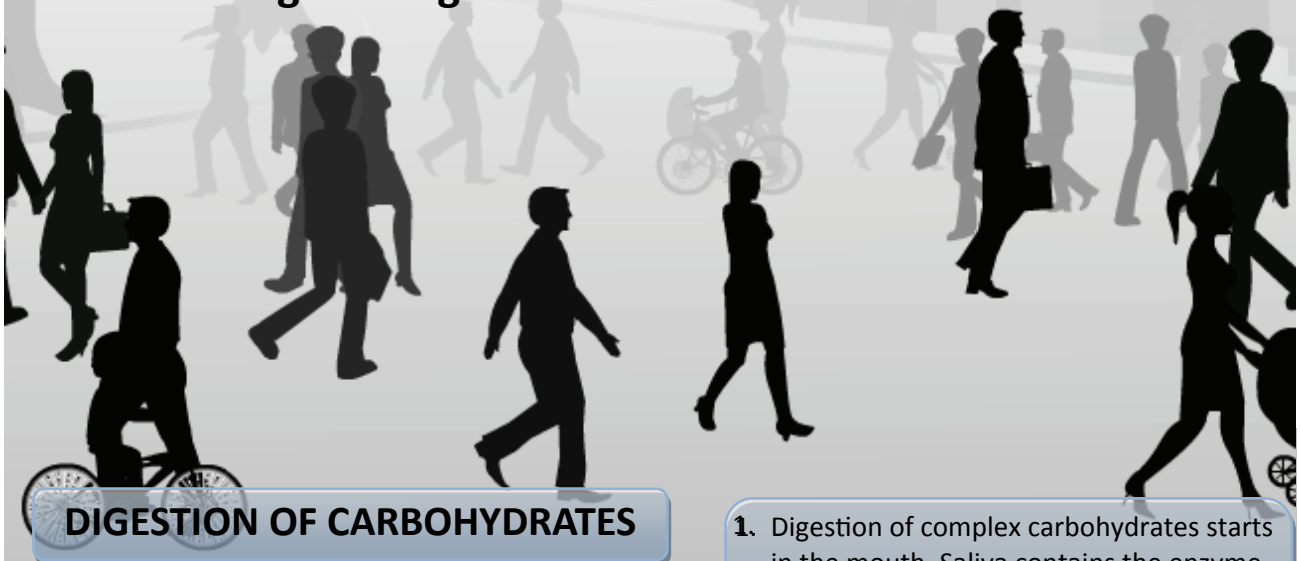
SLR 9A

Glucose: A journey from plate to cell

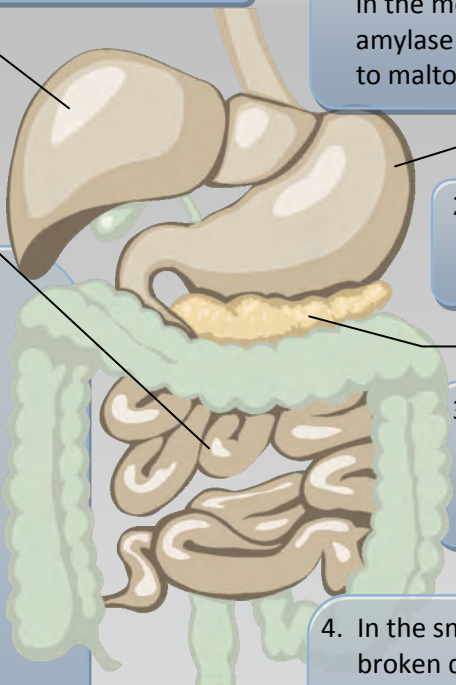
Humans need energy

- Humans need a constant source of **GLUCOSE** to provide energy for cells
- **Carbohydrate** rich foods such as whole-grains, vegetables and fruits are the main source of energy for humans.
- When we eat a meal, carbohydrates are broken down into **glucose** which is transported in the blood stream to our cells.

How does glucose get from the food we eat into our cells?



DIGESTION OF CARBOHYDRATES



1. Digestion of complex carbohydrates starts in the mouth. Saliva contains the enzyme amylase that breaks carbohydrates down to maltose .

2. Carbohydrates move through the stomach into the small intestine.

3. The pancreas secretes juice into the small intestine. This contains amylase for the digestion of carbohydrates.

4. In the small intestine carbohydrates are broken down to glucose by enzymes (maltase, sucrose, lactase) which digest different types of sugars.
Glucose is absorbed through the walls of the small intestine into the blood stream.

5. Glucose is carried in the blood to the liver from where it can:
   - circulate in the blood stream to supply cells with energy
   - travel via the blood stream to muscles where it is stored as glycogen
   - be converted to glycogen and stored in the liver
   - be converted to fat

Glucose that is stored as glycogen can be converted back to glucose when required.

SLR 9A

Glucose: A journey from plate to cell

A constant supply of energy

- Humans need 80 - 90mg of glucose per 100mL of blood to survive.
- After a meal the concentration of glucose in the blood rises.
- When we don't eat the concentration of glucose in the blood falls.
- The pancreas produces two hormones that work to keep our blood glucose concentration steady.

How do blood glucose levels stay steady?

INSTRUCTIONS

Your task is to create a STORY BOARD to explain two ideas to your peers

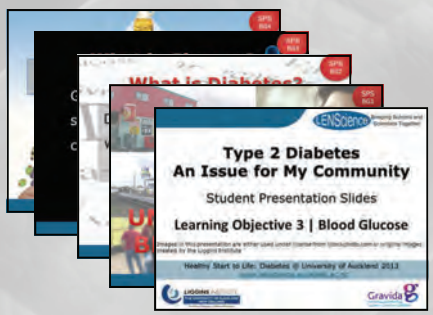
1. How does glucose get from the food we eat into our body cells?
2. How do blood glucose levels stay steady?

Work with a PARTNER

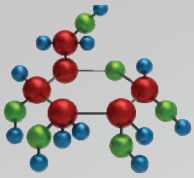
Resources you can use:

- The information on this worksheet
- The student presentation "BLOOD GLUCOSE"
- The KEYWORD list
- The STORYBOARD template

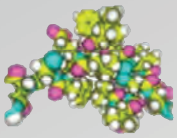
Think about **W**'s – **w**hat, **w**here, **w**hen, **w**hy and **h**ow



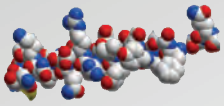
KEY WORD LIST



GLUCOSE

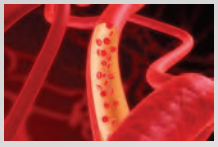


INSULIN



GLUCAGON

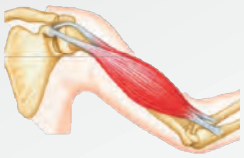
GLYCOGEN



BLOOD

PANCREAS

LIVER



MUSCLE

SLR 9A

Glucose: A journey from plate to cell

STORYBOARD

1.

2.

3.

4.

5.

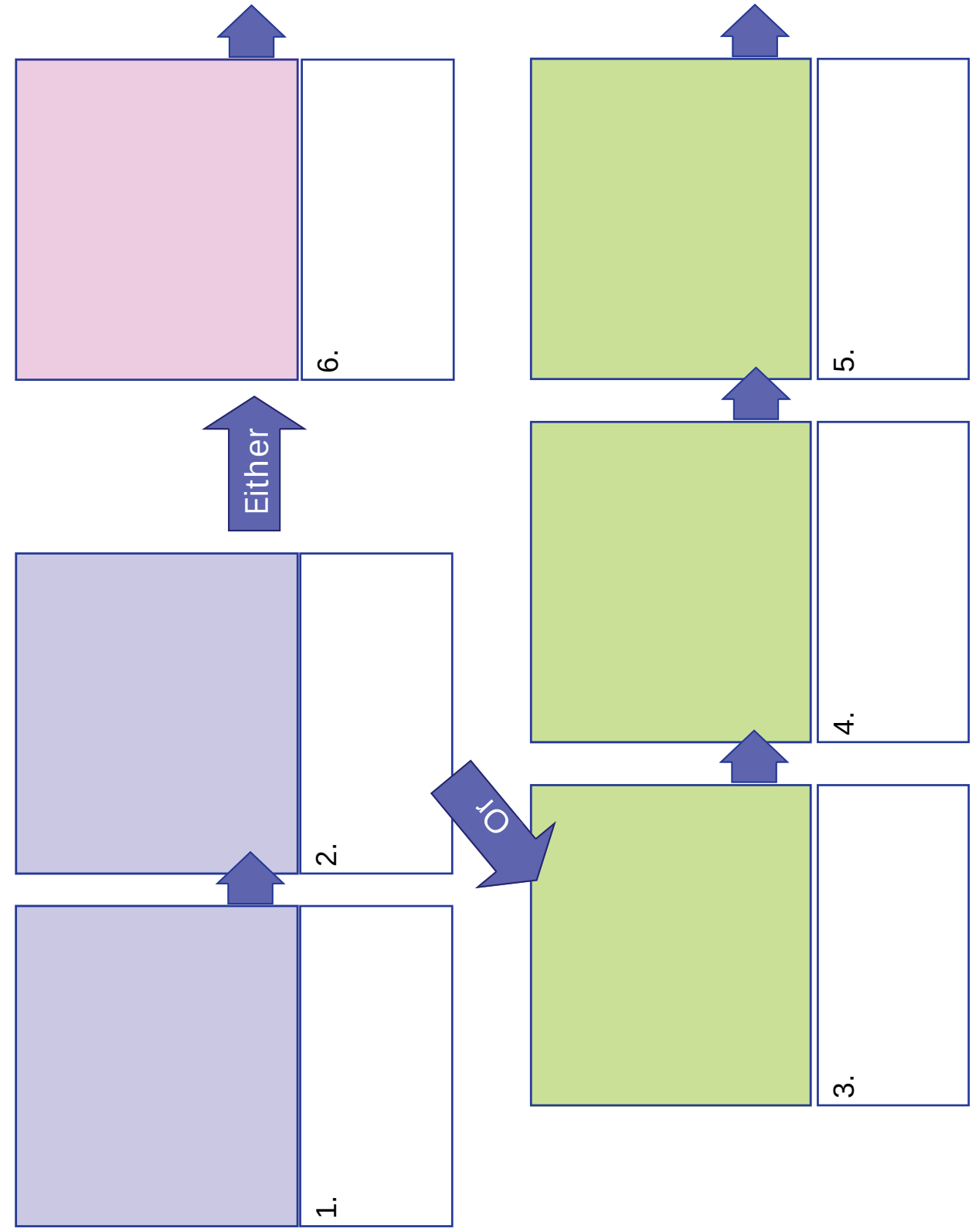
6.

SLR 9B

Glucose: A journey from plate to cell

PICTURE DICTATION

Now the blood glucose levels fall



SLR 9C

Glucose: A journey from plate to cell

Humans need energy

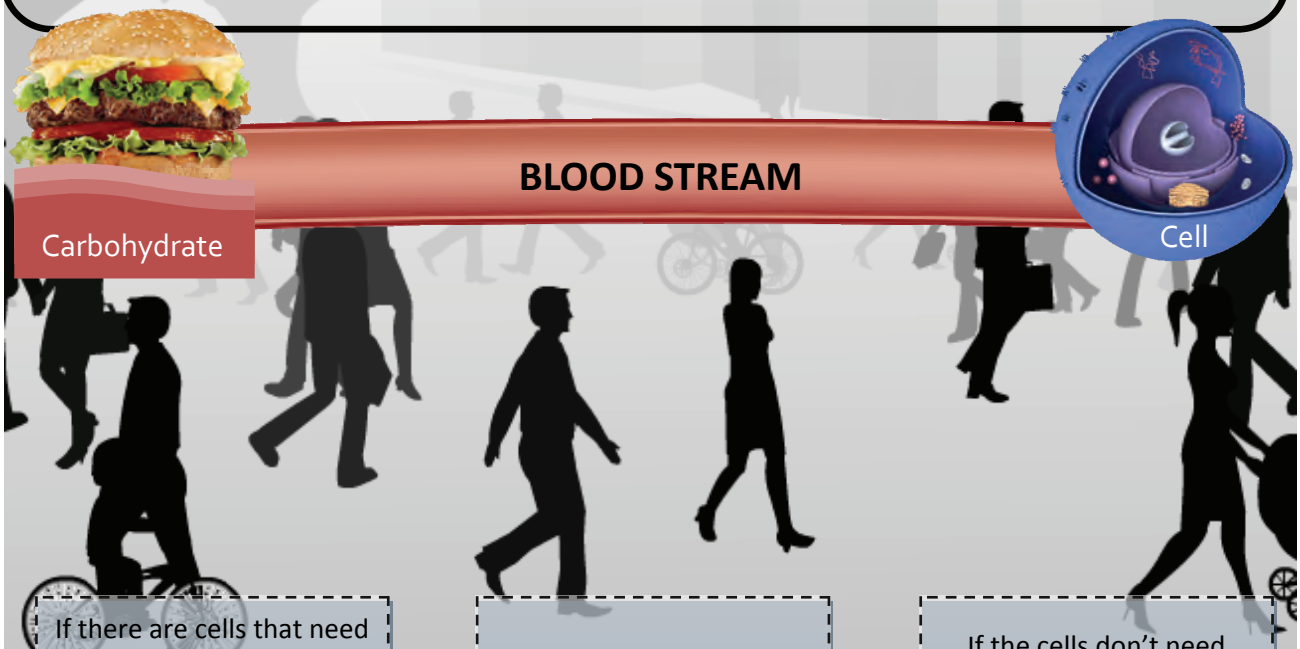
- Humans need a constant source of **GLUCOSE** to provide energy for living
- **Carbohydrate** rich foods such as whole-grains, vegetables and fruits are the main source of energy for humans.
- When we eat a meal, carbohydrates are broken down into **glucose**
- Glucose is a very small molecule. It can travel around the body in our blood stream

How does glucose get from the food we eat into our cells?

INSTRUCTIONS: Work in pairs

You will find information to complete this task from the Student Presentation Slides: Blood Glucose.

1. Read the statements in the boxes below.
2. Decide which order they should be in.
3. Copy each statement into the 'Sequencing Activity' template or cut and paste them in.
4. Draw a diagram to represent each stage. (Quick and neat is good)
5. Join up with another pair and share your work. Compare your work and explain



If there are cells that need glucose for energy (e.g. muscle cells) insulin moves to these cells and attaches to the surface of the cell.

This allows the glucose to move into the cell where it can be used for energy.

If the cells don't need glucose for energy the glucose moves to the liver where it is stored.

When the pancreas receives a message that there are higher levels of glucose in the blood it releases insulin into the bloodstream.

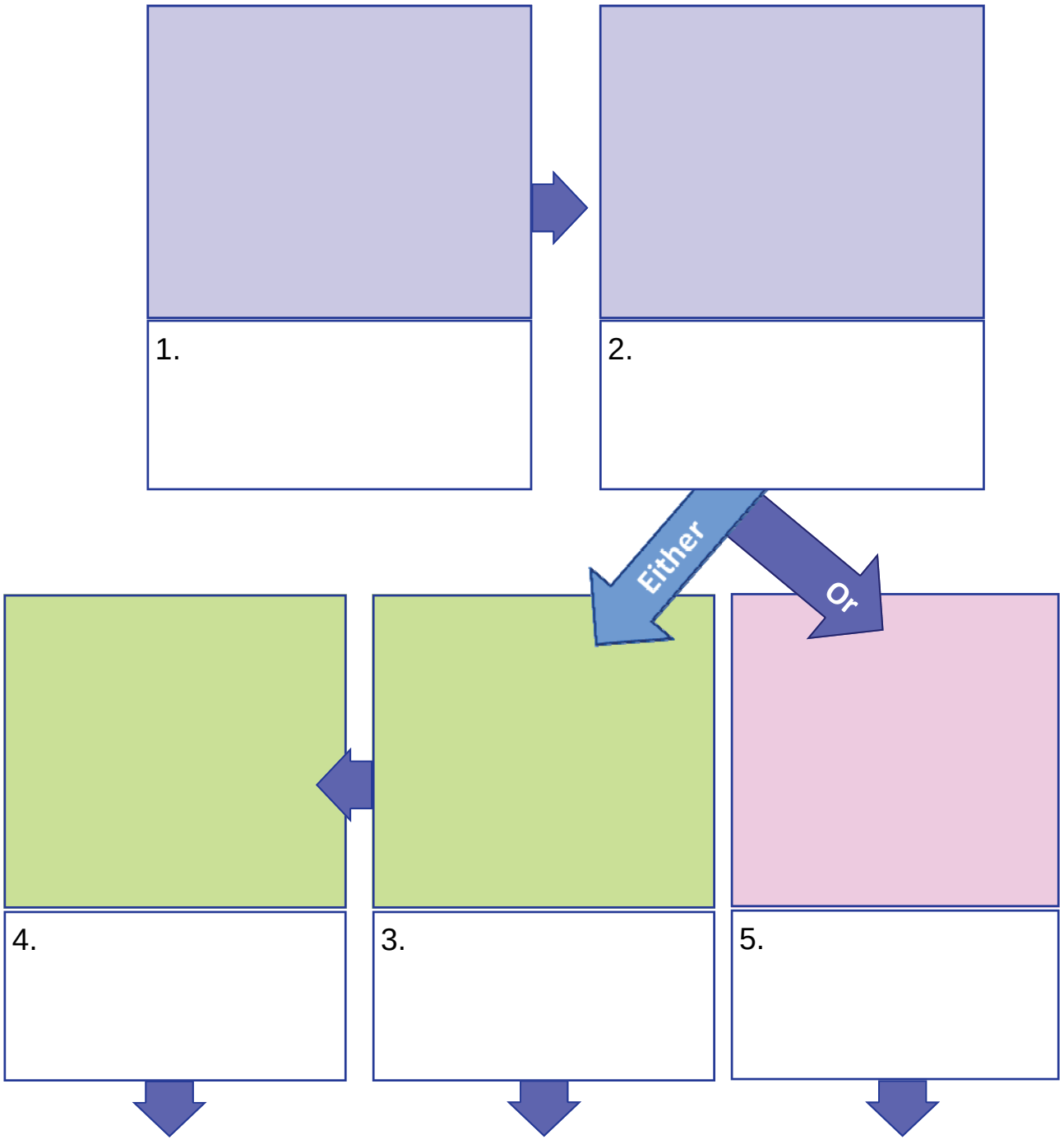
After the food we eat is broken down into glucose in the small intestine it can move out into the bloodstream.

SLR 9

Glucose: A journey from plate to cell

SEQUENCING ACTIVITY

Place the statements in the correct place to show the journey of glucose from the plate to a muscle cell.



SLR 10A

Insulin Resistance: Role Play

Insulin resistance leads to Type 2 diabetes

Your task is to develop a 3-5 minute role play to explain what insulin resistance is. The play is in 2 Acts.

SPS IR: Insulin Resistance

You will find useful information to complete this task in the Student Presentation Slides: Insulin Resistance.

Act 1

Glucose, having been released from its bonds within starch, finds itself inside the small intestine of a human being ….wondering how it will find a muscle cell that will appreciate a burst of energy.

Glucose is sucked through the wall of the small intestine into the blood stream where it finds other molecules, including insulin……..

As it is swept along the narrow winding blood vessels glucose finds a needy muscle cell and with the help of insulin glucose eventually finds its way into the muscle cell to deliver its package of energy……..

Act 2

Meantime……inside another human being belonging to the same family, another glucose molecule has struck trouble! Having found its way to a muscle cell it cannot get inside to deliver its package of energy…….

Organisation of your group

Decide on the roles that you will need and assign these to people in your group.
Roles could include:

Director	Narrator	Glucose Molecule
Pancreas	Insulin Molecule	Cell Membrane
Insulin Receptor	Glucose Transporter	

WRITE AND REHEARSE YOUR PLAY READY TO PRESENT TO THE CLASS

Peer Assessment Your play will be assessed by your peers using the following criteria……

	Always	Mostly	Sometime	Not at all
1. Correct use of biological terminology				
2. Correct explanations provided for each step along the way				
Write a 1-2 sentence comment about how useful the play could be in helping people learn about diabetes				

SLR 10B

Insulin Resistance: Extended writing task

Instructions

Insulin Resistance Leads to Type 2 Diabetes

Write a series of short paragraphs that…
***describe* what insulin resistance is and *explain* the effect of insulin resistance on the control of blood glucose in a person with Type 2 diabetes.**

Use the following resources to prepare your ideas before you start writing:

1. SPS: Insulin Resistance
   Read through this resource to find out important information about insulin resistance

2. SLR 9: Glucose: A journey from plate to cell
   Review your completed work from this activity and use it to help you with this task

3. Insulin Resistance: Comparison table
   Using the information from 1 and 2 above, complete the table to compare and contrast the response of a healthy individual to glucose entering the blood stream with that of someone who has insulin resistance.

4. Insulin Resistance: Writing Frame
   a) Referring to the information from 1, 2 and 3 above, use the writing frame to develop your paragraphs.

   b) Review your paragraphs, reading them aloud to yourself and/or to a partner.

   c) Edit your paragraphs in response to feedback you receive from your partner.

   d) When you are satisfied that your writing is complete and of a high standard, submit it to your teacher for evaluation.

SLR 10B

Insulin Resistance: Extended writing task

COMPARISON TABLE

Complete the table to compare and contrast the effects of normal and abnormal insulin behaviour on glucose in the blood, glucose in the cells, insulin levels in the blood and pancreas action.

Word bank: increases, decreases

❶ Concept: Insulin Resistance

	❷ **Normally** ...insulin can attach to the insulin receptors on the cell?	❸ **In a person with Type 2 diabetes** ...insulin cannot attach to the cell, or there are less insulin receptors on the cell?
A) What happens to glucose levels in the blood when....		
B) What happens to glucose levels in the cell when....		
C) What happens to insulin levels in the blood when....		
D) What happens to the actions of the pancreas when....		

SLR 10B

Insulin Resistance: Extended writing task

Writing Frame

Title ❶ _____

Introduction: *What does insulin do (in 10 words or less)?*

What is insulin resistance (in 10 words or less)?

Paragraph ❷:

Explain how insulin helps glucose move from the blood into the cells.

❷ ***A,B,C and D*** *from your comparison table.*

Connective words to use…..

Explaining how:
When, Next, Then…

Explaining why:
Because, So, This leads to…

Key terms:
Glucose, Insulin,
Insulin receptors

Other useful connective words:

- consequently
- however
- as well as
- due to
- because of
- hence the effect of
- therefore
- accordingly
- as a result of
- although

Paragraph ❸:

Explain why body cells may not respond normally to insulin (insulin resistance) ❸

Explain what happens when this occurs? ❸ ***A, B, C and D*** *from the table above.*

Concluding statement: *Write one sentence to describe the effect of insulin resistance.*

SLR 11

Testing Urine for Glucose

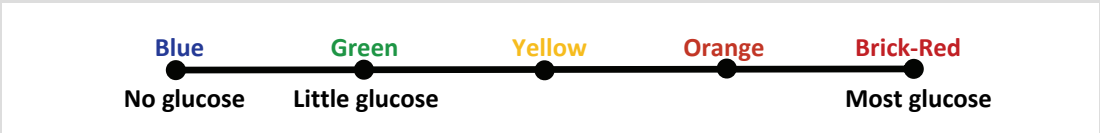
Background Information

Sugar (glucose) is not normally found in urine. However, when blood sugar levels rise above a safe level (above 180 mg per 100 cm^3) the kidneys often release some of the excess glucose from the blood into the urine. This occurs when people have diabetes.

In the past, doctors tasted the urine of patients to test for diabetes, as 'sweet tasting urine' has high amounts of glucose present. In more modern times, doctors use blood tests. Urine testing gives a preliminary, but not final diagnosis.

Urine testing includes:
1) Testing for the presence of glucose
2) Smelling the urine to detect any odour
3) Testing the pH

- The Benedict's test is used to test for the presence of glucose.
  A small sample of urine is mixed with Benedict's solution and heated. If glucose is present a chemical reaction will occur. Colour change provides evidence of this chemical reaction. The different colour the mixture changes to, can indicate how much sugar is in the urine.



- The odour of normal urine varies between people and is affected by a number of factors such as diet. Abnormal smells include "fruity" like acetone or fingernail polish remover, putrid (faecal smelling) or like ammonia.

- The pH of normal urine is between 5 and 7.

Your Task:

Urine samples have been obtained from three 'patients' who may have the disease diabetes.

Your task is to analyse each sample, record your observations and give a preliminary diagnosis for each patient.

SAFETY NOTE:
You should wear eye protection during this practical.

Aim: To analyse samples of urine to give a preliminary diagnosis for the potential of diabetes.

Equipment: Each group will need

- 30mL of Benedicts' solution
- 1 x 200mL beaker
- 200mL of boiling water
- 4 x plastic droppers
- Safety glasses
- 1 x test tube rack and 7 test tubes
- 1 x pen for labelling test tubes and recording results
- 1 x spotting tile
- 5mL of universal indicator solution or 3 strips of pH test paper
- Universal indicator chart

SLR 11

Testing Urine for Glucose

Method:

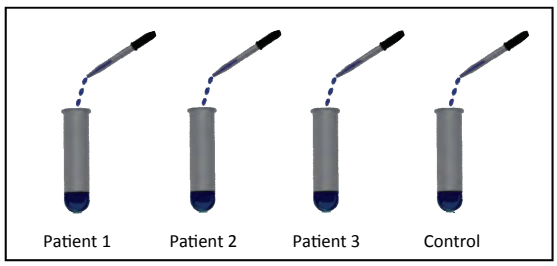
1. Collect 10 mL of each urine sample provided and put into 3 separate test tubes.
2. Label each tube clearly with the patient number.
3. Carry out the following tests for each sample collected:

- **Smell/odour:** Wave your hand across the top of the test tube towards your nose. Keep your face away from the test tube and DO NOT put your nose right over the sample.

  Note down your observation in the chart below.

- **pH:** Place a strip of universal indicator paper in each of the samples, compare the colours against a universal indicator chart and record your results on the table below
  OR
  Using a pipette, place 3 drops of each of the samples into a clean spotting tile and one drop of universal indicator into each sample. Compare the colours against a universal indicator chart and record the result on the table below.

- **Glucose:**



1. Using a clean pipette, add 5mL of Benedict's solution (blue colour) to the 4 remaining test tubes.
2. Label three of the test tubes with each patient number and the fourth test tube is your control.
3. Taking a clean pipette each time, add 2mL of the urine samples to their labelled test tube.
4. Place the four test tubes in a 200mL beaker of boiling water (you may use a water bath Watch for a colour change. NB: It may take about 10 minutes to see a colour change.
5. Note down the colour change on the table below for each patient.

	Patient 1	Patient 2	Patient 3
Smell/Odour			
pH			
Glucose			
Result: Abnormal/Normal			

Discussion Questions:

1. What does a positive test for glucose indicate?
2. If a patient has glucose in their urine, can you explain how this has happened?
3. What advice would you give to a patient with an abnormal glucose urine test?

SLR 12A

Cause and Effect Flow Diagram

Instructions

1. *View the Student Presentation Slides 'Symptoms of Diabetes' (SPS SD)*
2. *In the first box, describe what Type 2 diabetes is. (10 words or less)*
3. *In the next 6 boxes below, identify and describe the various effects Type 2 diabetes has to the different parts of the body.*

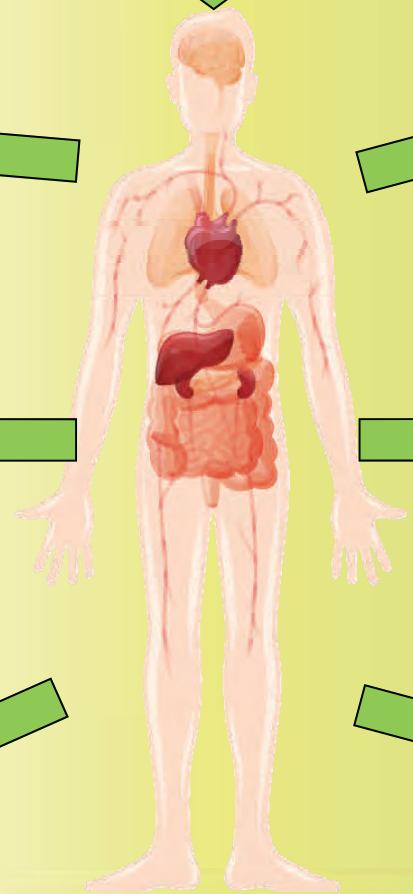
The effects of Type 2 diabetes on the body

The Biological Cause

Type 2 Diabetes

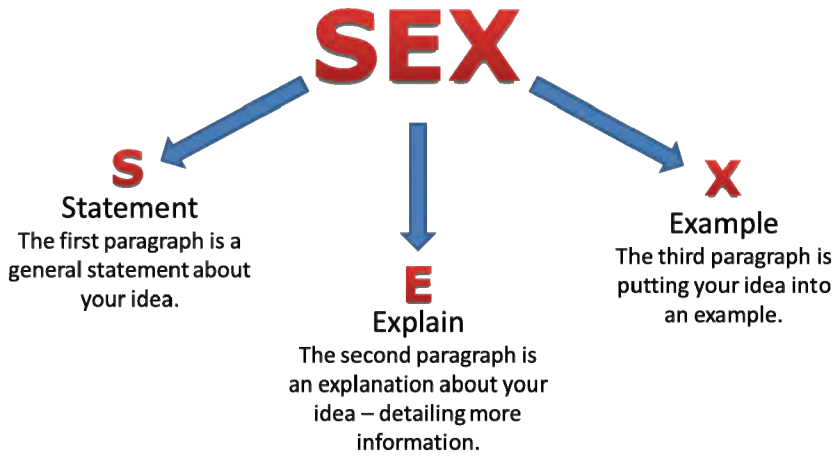
Possible Effects

Possible Effects



SLR 12B

Paragraph Writing



"Diabetes causes half of all heart attacks, amputations, blindness and kidney failure in New Zealand" (Diabetes New Zealand)

Using the **SEX** writing strategy, write **THREE** paragraphs to describe the possible effects or complications arising from Type 2 diabetes for a person with this disease. Explain why these effects or complications occur.

Key words to use…..

- risk
- cells
- blood vessels
- glucose
- cardiovascular
- stroke
- urinary tract
- damage
- insulin
- nervous system
- gangrene
- vision

Linking Words:

As a result of…
If this happens…
As a consequence of…
Because…
Is caused by...

Paragraph 1

S*tatement*

Paragraph 2

E*xplanation*

Paragraph 3

*E**X**ample*

SLR 13

Anticipatory Reading Guide

Children Programmed for Obesity

During the next week you will be using the resource "Children Programmed for Obesity" to explore issues related to diabetes risk.

BEFORE you start the activities, read through each statement below and mark the LEFT hand side of the table with a ✓ to show whether you AGREE, DISAGREE or are UNSURE for each statement

After you have completed the reading and activities, return to this sheet and confirm or revise your choices by marking the RIGHT hand side of the with a ✓ to show whether you AGREE, DISAGREE or are UNSURE for each statement. You ALSO need to note down evidence from the reading that supports your choice.

BEFORE reading the booklet				AFTER completing the reading and activities		
Agree	**Disagree**	**Unsure**	**Statement**	**Agree**	**Disagree**	**Evidence**
			In 2006 over 25% of New Zealand adults were obese.			
			The rate of obesity for children in New Zealand is the same as the rate for adults.			
			Children who are obese when they are young are at greater risk of being obese as adults.			
			Diet and lifestyle do not impact on Type 2 diabetes risk.			
			Body Mass Index (BMI) gives a very accurate measurement of the amount of fat on a person.			
			Scientists have all the answers to questions about obesity and Type 2 diabetes.			
			Obesity and Type 2 diabetes affect all communities to the same extent.			
			Our PHENOTYPE can be altered by our environment but our GENOTYPE cannot			
			A mother's diet during pregnancy has no impact on the health of the baby when it becomes an adult.			
			Animal models can help scientists understand what is causing a disease at the molecular level.			
			There are many different factors that contribute to diabetes risk			

SLR 14

What is Obesity ?

Children Programmed for Obesity

Maintaining a **HEALTHY WEIGHT** is not about how thin you look. A healthy weight is the weight that gives you the lowest health risk. Storage of too much body fat results in a person being overweight or obese, increasing their risk of serious health problems.

Recognising Obesity.

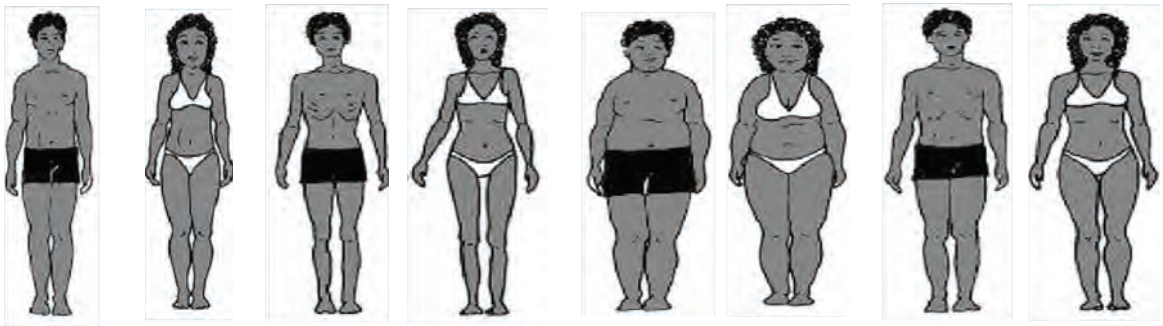
For each of the pairs below do you think they are:

A. Underweight
B. Healthy weight
C. Over weight
D. Obese

Obesity FACTS

Globally, more than **40 million** children under the age of five were overweight in 2011.

Find more facts from the World Health Organisation



Pair 1 **Pair 2** **Pair 3** **Pair 4**

Mitola et al (2007) Agreement with Satisfaction in Adolescent Body Size between Female Caregivers and Teens from a Low-income African-American Community *Journal of Pediatric Psychology* 32(1) pp. 42–51, 2007 (with permission)

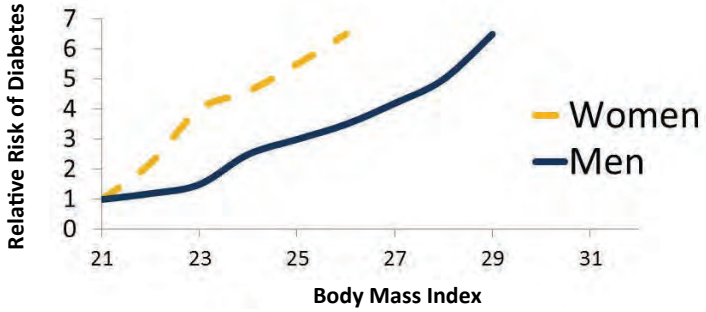
How did you go?

Many people, including doctors, underestimate actual body size. Research has shown that most people in the healthy weight range select their correct body size, but about half of overweight people incorrectly describe themselves as having a healthy weight. Only 10% of those that were obese accurately described their body size.

Calculate your BMI:

$$BMI = \frac{\text{your mass in kg}}{\text{your height (m) x your height (m)}}$$

Risk of Diabetes is linked to BMI



Redrawn with permission from Kopelman P. (2000) *Nature*: Vol 404, (635-643)

- Using the information from the graph, estimate your risk of Type 2 diabetes?
- Doctors do not have BMI charts for people under 14 years of age. Why do you think this might be?

SLR 15

The Cost of Diabetes

In 2010 the economic cost of diabetes globally was US$ 500 billion.

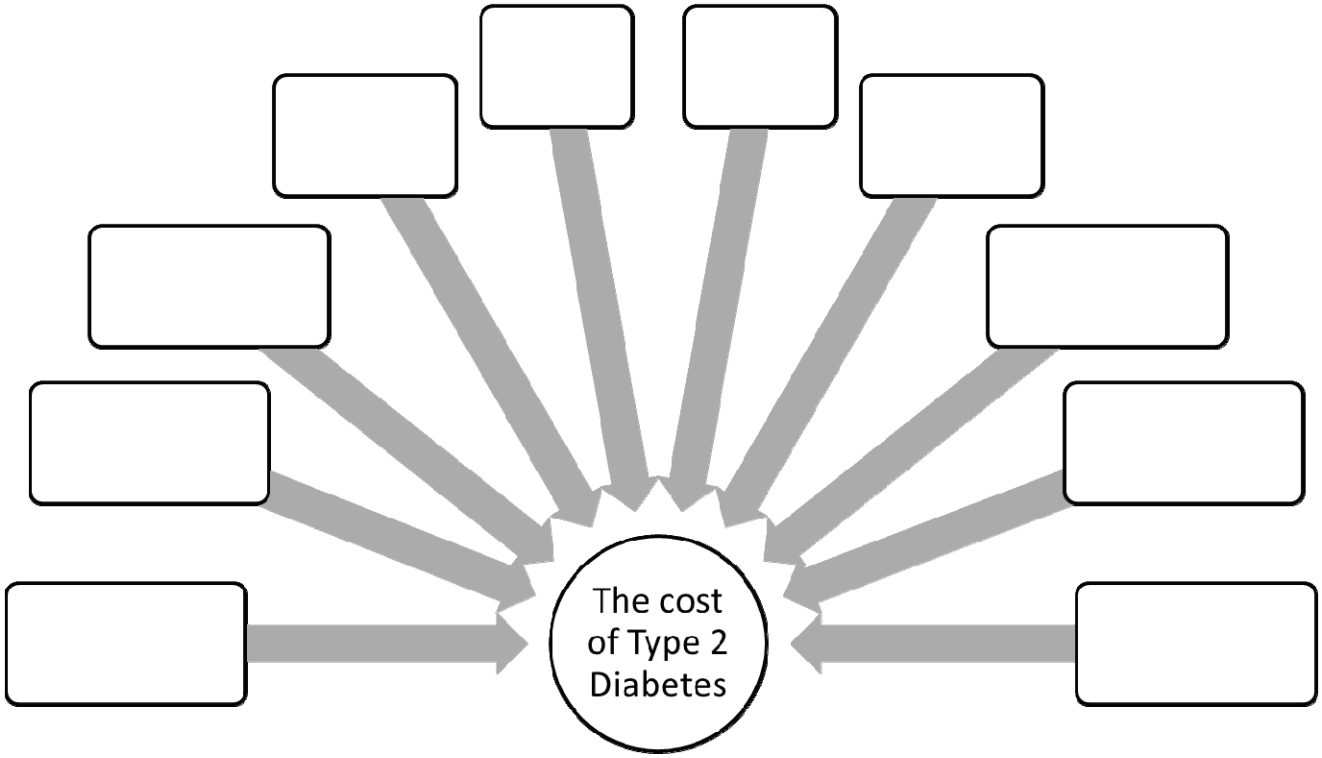
The projected cost for 2030 is at least US$ 745 billion.

What factors contribute to this cost for an individual, their family, their community, health-care systems, and society?

Think about the costs related to:

- the needs of the person who has the disease;
- the people who help meet these needs of the individual with diabetes (their family and friends, community workers and volunteers, health professionals);
- what the person who has the disease can no longer do;
- what the person who has the disease can no longer contribute to their family and their community.

Working with your group, record your ideas in the diagram below. Add more boxes if you need to.
Share your ideas with others to build a map of the factors that contribute to the costs of Type 2 diabetes.



SLR 16

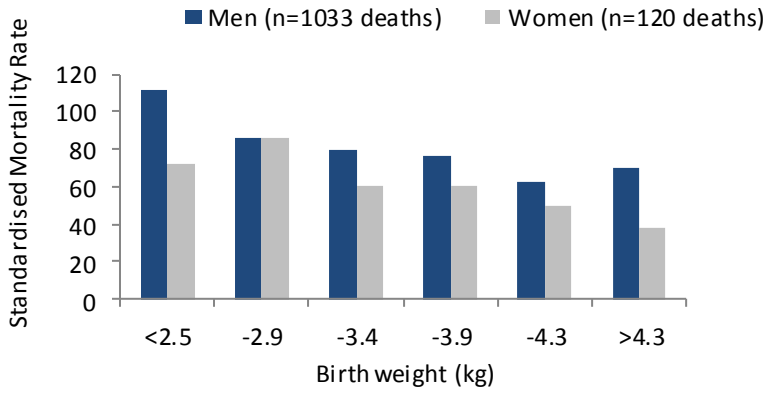
Population-level Data

Over the last thirty years medical research scientists and doctors have made observations on the development of the global NCD epidemic. This has generated questions about what is driving this epidemic and the need to search for evidence.

Professors David Barker and Clive Osmond developed a hypothesis that there was a relationship between infant mortality rates and heart disease in adults.

1. In three sentences summarise the key evidence found by Professors David Barker and Clive Osmond.

Barker and his team collected data about a range of health indicators.
The graph below contains data that explored the association between birth weight and death from coronary heart disease in the Hertfordshire cohort.



The association between birth weight and death from coronary heart disease, (expressed as a standardised mortality ratio) in 10,141 men and 5,585 women born in Hertfordshire, United Kingdom, from 1911 to 1930.

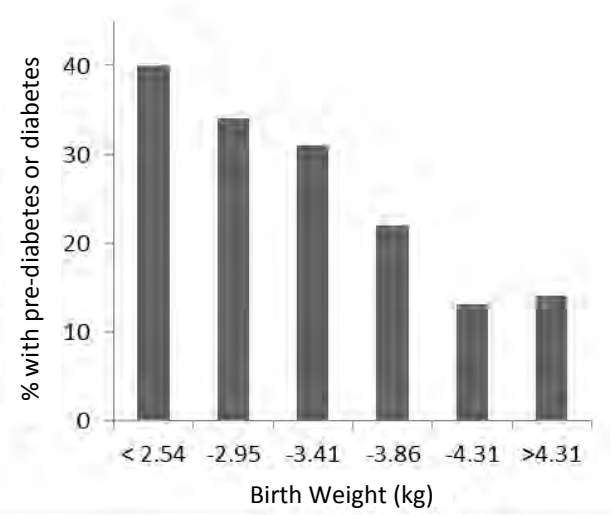
Modified from Godfrey K.M and Barker D.J.P (2000) *Am J Clin Nutr* 2000;71(suppl):1344S–52S (with permission)

2. Describe the pattern shown in the graph above (a) for men (b) for women.

3. How does this pattern compare to the patterns that they observed with respect to diabetes?

4. Given what you know about the risk factors for heart disease and diabetes, what associations apart from birth weight do you think the scientists might have investigated?

   Think about what other data they may have collected about the people. What other trends would you expect they may have seen linked to disease risk.



Birth weight vs Type 2 diabetes risk at age 60-70 years for men born in Hertfordshire, UK from 1911 to 1930.
Modified from Godfrey K.M and Barker D.J.P (2000) *Am J Clin Nutr* 2000;71(suppl):1344S–52S (with permission)

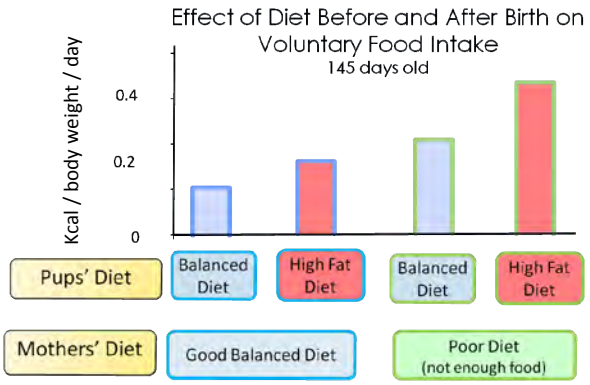
SLR 17

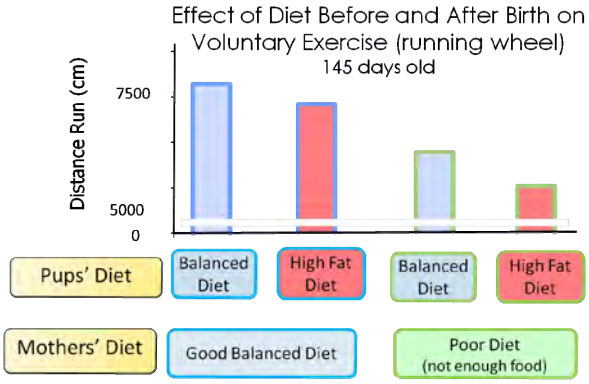
Analysing the Evidence

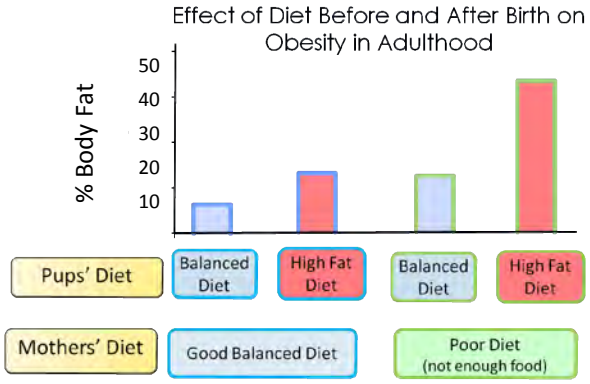
Children Programmed for Obesity

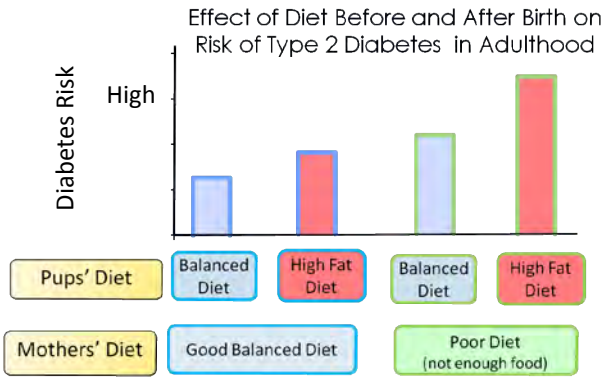
Use the information on pages 124 and 125 of the reading "Children Programmed for Obesity" to answer these questions.

The aim of the experiment was to find out whether diet during pregnancy has an effect on risk of obesity and Type 2 diabetes in adulthood. The experiments were carried out using a small-animal model.









What does the evidence tell us?

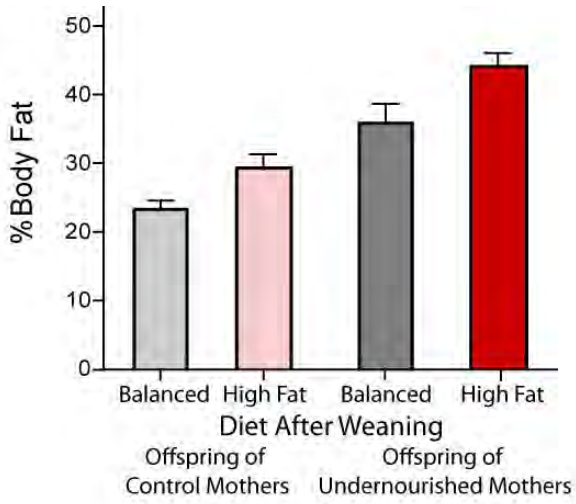
1. What does the information in the graphs tell us about the effect of diet in the womb on the RISK of obesity in adulthood in the rat model?
2. What does the information in the graphs tell us about the effect of diet after weaning on the RISK of obesity in adulthood in the rat model?
3. What does the information in the graphs tell us about the effect of diet in the womb on the RISK of Type 2 Diabetes in adulthood in the rat model?
4. What does the information in the graphs tell us about the effect of diet after weaning on the RISK of Type 2 Diabetes in adulthood in the rat model?
5. Did the scientists collect any evidence that may provide some reasons why these patterns are seen?
6. Did the environment in the womb affect the phenotype of the animals when they were adults?
7. Is the evidence similar or different to that collected by Professor Barker's team in the human population? Explain how it is similar or different.
8. Write a conclusion for the experiment.

SLR 17

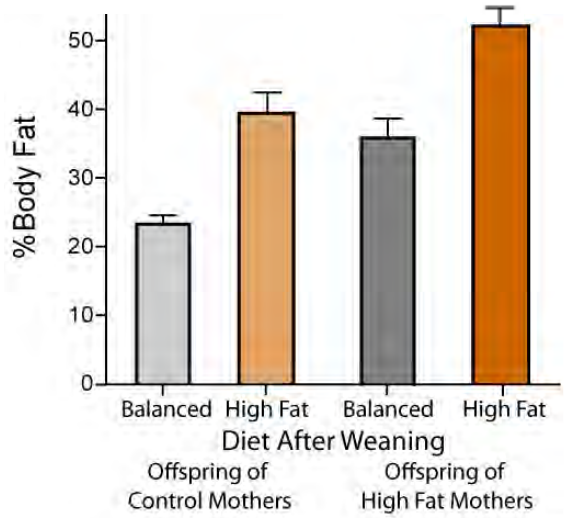
Analysing the Evidence

The aim of the second set of experiments was to find out whether a high-fat diet during pregnancy has a similar or different effect on risk of obesity and Type 2 diabetes in adulthood as under-nourishment during pregnancy. The experiments were carried out using a small-animal model.

Effect of maternal under-nourishment on body-fat in the offspring at adulthood in a rat-model



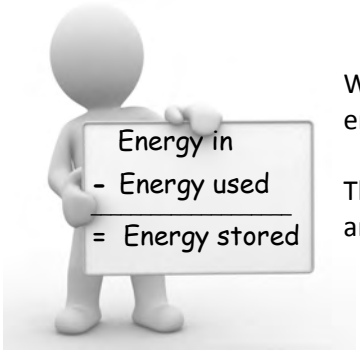
Effect of maternal high-fat diet on body-fat in the offspring at adulthood in a rat-model



What do these graphs tell us?

1. What does the information in the graphs tell us about the effect of under-nutrition in the womb on the risk of obesity in adulthood in the rat model? Are these results the same or different to the previous experiment?
2. What does the information in the graphs these data tell us about the effect of a high-fat diet in the womb on the risk of obesity in adulthood in the rat model?
3. Why do you think the scientists have chosen balanced and high-fat as the diets that they provide for the rat-pups after weaning?
4. Why do you think the scientists repeated the experiments with under-nutrition again when they developed this model?
5. From the evidence that you have, can you predict what the effect of a high-fat diet during pregnancy might be on Type 2 diabetes risk in adulthood.

SLR 18 Keeping in Balance!



When the amount of energy **consumed** is **greater than** the amount of energy **used**, we **gain weight**. Excess energy is stored in the body as fat.

The rate at which we use energy varies depending on how active we are, and on our individual metabolism.

Are your energy consumption and activity in balance?

Think about your physical activity and your diet over the past week.

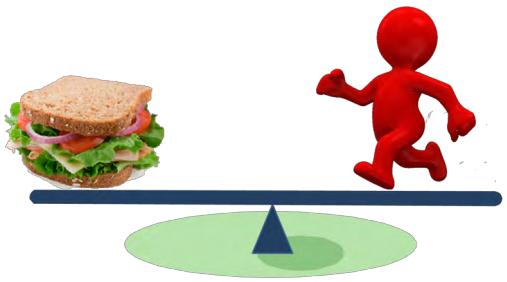
- Do you know what the recommended food and activity guidelines are for a person of your age?
- Do you think you are eating well and doing enough physical activity?
- How do you think you compare with other teenagers in New Zealand?

Question	Options	Your Answer	What do you think the guidelines for health would be?	What do you think a typical NZ teenager would be doing/eating?
1. How many servings of fruit and vegetables (fresh, frozen or canned) do you eat on an average day?	A. None B. 1-2 servings C. 3-4 servings D. 5 or more servings			
2. On average how many minutes do you spend (out of school time) watching TV or in front of a computer screen on an average day?	A. Under 60 minutes B. 60-90 minutes C. 90-120 minutes D. More than 120 minutes			
3. How much time, on average, do you spend doing moderate (brisk walk) to vigorous exercise each day?	A. 0-30 minutes B. 30-60 minutes C. 60-90 minutes D. Over 90 minutes			
4. How many cans of fizzy or soft drinks, on average, do you consume over a week?	A. None B. 1-3 cans C. 4-6 cans D. 7 or more cans			
5. How many days in an average week do you eat something for breakfast?	A. None B. 1-2 days C. 3-4 days D. 5-6 days E. Every morning			
6. Are you involved in growing vegetables at home or school?	A. Yes B. No			

SLR 18

Keeping in Balance!

Recommendations for Health



- The Ministry of Health has recommendations for food and physical activity for people of different ages.
- The recommendations are based on evidence and are designed to support health and wellbeing.
- Research conducted for the Ministry of Health explores the diet and lifestyle behaviours of New Zealanders at different stages of life: childhood, adolescence, adults and older adults.

Compare your typical diet and lifestyle behaviours with the Ministry of Health recommendations and the research evidence about the typical behaviour of 15-19 year old New Zealanders.

You may wish to record a comment or recommendation for your personal diet and lifestyle. (This is not for your teacher or peers unless you want to share and discuss it).

New Zealand Ministry of Heath recommendations for 13-18 year olds*	**Behaviours of 15-19 year old New Zealanders (Evidence from research*)**	**Personal assessment or recommendation**
1. Eat at least two servings of fruit and at least three servings of vegetables each day.	Just over 60% of young people meet the guidelines for fruit intake and just under 40% meet the intake for fruit each day.	
2. Spend less than two hours a day in front of TV or computer screens.	Only 30% of young people spend less than 2 hours a day in front of TV or computer screens.	
3. Each day do 60 minutes or more of moderate to vigorous physical activity.	Average daily time spent doing moderate to vigorous physical activity was 46 minutes.	
4. Limit sugary drinks, including fizzy soft drinks, fruit drinks, energy and sports drinks), to less than one serving per week.	11.5% of 15-19 years olds drink regular fizzy or soft drinks seven or more times a week. 3.7% had energy drinks five or more times a week.	
5. All age groups should eat breakfast every day	67.5% usually eat something for breakfast five or more times a week.	
6. All age groups are encouraged to help with growing food, as well as food shopping and cooking.	Just under half (48.4%) of 15-19 year olds were involved in growing vegetables at home or school. Of those involved in growing, nearly 93% ate these vegetables.	

*Data source:

Ministry of Health. 2012. *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) A background paper.* Wellington: Ministry of Health.

Clinical Trials Research Unit. 2010. *A National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand: 2008/09.* Auckland: The University of Auckland.

SLR 19

Exploring Risk

Children Programmed for Obesity

- Risk is the chance of something happening.
- Knowing what the risk is can help people make informed choices or decisions.
- For example, people who smoke are 15 to 30 times more likely to be affected by or die from lung cancer than people who do not smoke. Knowing this risk would you choose to smoke?

The table below shows the risks associated with participating in different activities for young people aged 10 - 19 years in New Zealand.
The data is reported as injuries per 100 people.
For example just under 2 out of every 100 teenagers living in New Zealand, playing soccer will experience some sort of injury that needs to be treated. Knowing these values helps to make informed decisions about the risks of carrying out certain activities.

Use the Information in the table to answer the questions below.

Injury Risk (per 100 people) for 10 -19 year olds in New Zealand for the period June 2010 to July 2011			
Activity	10-14 year olds	15-19 year olds	10-19 year olds
Touch rugby	0.6	0.7	0.6
Netball	1.7	1.4	1.5
Rugby	2.8	4.8	3.9
Soccer	1.9	2.0	1.9
Cycling	1.0	0.6	0.8
Scooter	0.3	0.0	0.2
Skateboarding	0.6	0.8	0.7
Driving related	0.6	1.0	0.8
Data retrieved from ACC Injury Statistics Tool and Statistics New Zealand—National Population Estimates: June 2011 quarter			

1. Which sport has the lowest risk of being injured?
2. Which sport has the highest risk of being injured?
3. What are some of the characteristics of this sport that would influence the level of risk?
4. Based on the risk factors given for cycling, scooting, skateboarding and driving, which of these methods of transport appears to be the safest way to get to school?
5. What other factors need to be taken into account before you make a decision about which type of transport to use to get to school?

SLR 19

Exploring Risk: Type 2 Diabetes

Children Programmed for Obesity

Risk is the chance of something happening. Risk assessment is based on evidence. Knowing what the risk is can help people make informed choices or decisions.

FACTS

- In 2012, the estimated number of people in NZ with diabetes was over 200,000
- Being overweight or obese increases the risk of Type 2 diabetes
- In New Zealand Type 2 diabetes and diabetes risk factors such as obesity are more common in people of Māori, Pacific and Asian ethnicity than in people of European/Caucasian ethnicity.
- Diabetes is more common in communities where poverty levels are greater.
- A healthy diet and regular physical activity throughout life reduces Type 2 diabetes risk.

Lifestyle factors can have a positive or negative impact on Type 2 diabetes risk. Risk is also influenced by family history (genetics), living conditions and early-life environment. Lifestyle choice can be limited by social and economic circumstances.

For each of the teenagers (aged 14) below consider their lifestyle and their family situations to predict their future risk of Type 2 diabetes. Place the predictions onto the **Type 2 Diabetes Future Timeline.**

Individual 1
Lifestyle: *Poor diet, does little exercise.*
Family situation: *Small, high income family with a history of diabetes. Doing well at school.*

Individual 2
Lifestyle: *Very active, good diet.*
Family situation: *Small, low income family. No family history of diabetes. Doing well at school.*

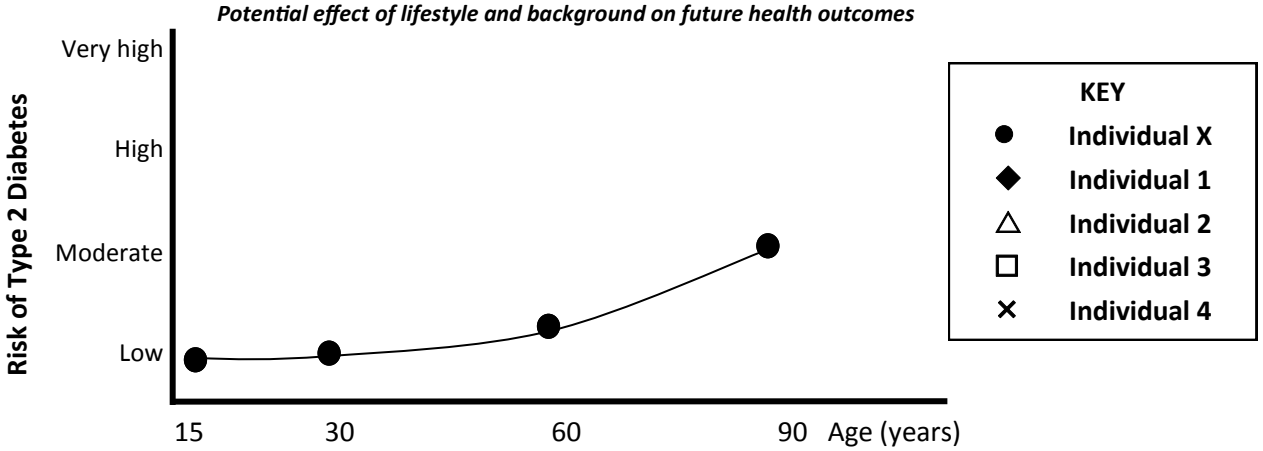
Individual 3
Lifestyle: *Moderate activity levels, good diet, smoker.*
Family situation: *Large, low income family. Achieving well at school.*

Individual 4
Lifestyle: *Moderate activity, poor diet.*
Family situation: *Small, family with a good income. Underachieving at school.*

Individual X
Lifestyle: *Very good diet. Does lots of exercise.*
Family situation: *Small family with a high income. Doing well at school.*

Type 2 Diabetes Future Timeline

Potential effect of lifestyle and background on future health outcomes



1. On the chart, for each individual, place their potential risk (low, moderate, high, very high) at age 15, 30, 60 and 90 (***Individual X*** *has been completed for you*). Give reasons (justify) for your decisions.
2. Will the individual with a high risk definitely develop Type 2 diabetes? Give a reason for your answer.
3. Will the individual with a low risk never develop Type 2 diabetes? Give a reason for your answer.

SLR 21

Letter to the Editor/ Blogpost

Writing Frame

Salutation ❶:

Dear Editor, Dear Sir/Madam...

Introduction ❷:

I am writing to you about…, Are people aware…,

Body of letter/blog ❸:

Paragraph 1: Which group is at risk in the community? Give relevant data.

Paragraph 2: What are the risk factors for this group? Give examples and reasons.

Conclusion ❹:

Give your opinion on appropriate action that should be taken.

What people need to know about….

Who is at risk?
Why are they at risk?
Action to be taken!

Key words:

- Concern
- Issue
- Impact
- Social
- Economic
- Health
- Wellbeing
- Justice
- Community
- Unjust

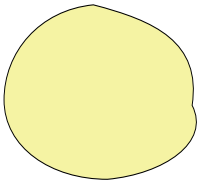
SLR 22

SLR 22: Background Biology

Genes and Chromosomes

3. **Draw** and **label** a nucleus in the human cell on the diagram.

Human Cell



4. **Draw** and **label** some chromosomes in the human cell.

5. **True or False** If the statement is not true please correct it.

- In humans chromosomes are found in the cytoplasm ____
- There is about 1 metre of DNA in each human cell ____
- In bacteria the chromosomes are found in the nucleus ____
- The shape of the DNA molecule is a double helix ____
- A gene is made up of many chromosomes ____
- Genes are switched on and making proteins all the time ____
- Chromosomes are made of DNA ____
- A gene codes for a particular protein ____

Bacteria – check your understanding

6. Draw a labelled diagram of a single bacterial cell in the box to show the key structures.

Bacterial Cell

7. Match up the list of terms with the correct descriptions.

(a) Binary fission	____	(1) To introduce bacteria to a culture medium.
(b) Plasmid	____	(2) Chemical which destroys bacteria
(c) Antibiotic	____	(3) Inherited instruction coding for a protein.
(d) Inoculate	____	(4) Small piece of circular DNA found in bacteria
(e) Gene	____	(5) Bacterial reproduction process

Plasmids – nature's genetic transformers!

- As well as having genetic information carried in a chromosome, bacteria have small rings of DNA called _____ that carry genetic information.
- Just like DNA in chromosomes, a plasmid carries _____ (lengths of DNA) that code for _____.
- Plasmids can be _____ from one bacterium to another bacterium.
  This process is called **BACTERIAL CONJUGATION.**

<u>What is antibiotic resistance?</u>
Bacteria with antibiotic resistance can survive the effects of an antibiotic, a chemical that can normally destroy it. The bacteria survives, it can grow and reproduce, passing on the resistance to the antibiotic to new bacteria.

Answers: On teacher notes

SLR 23

SLR 23: The biology behind transformations

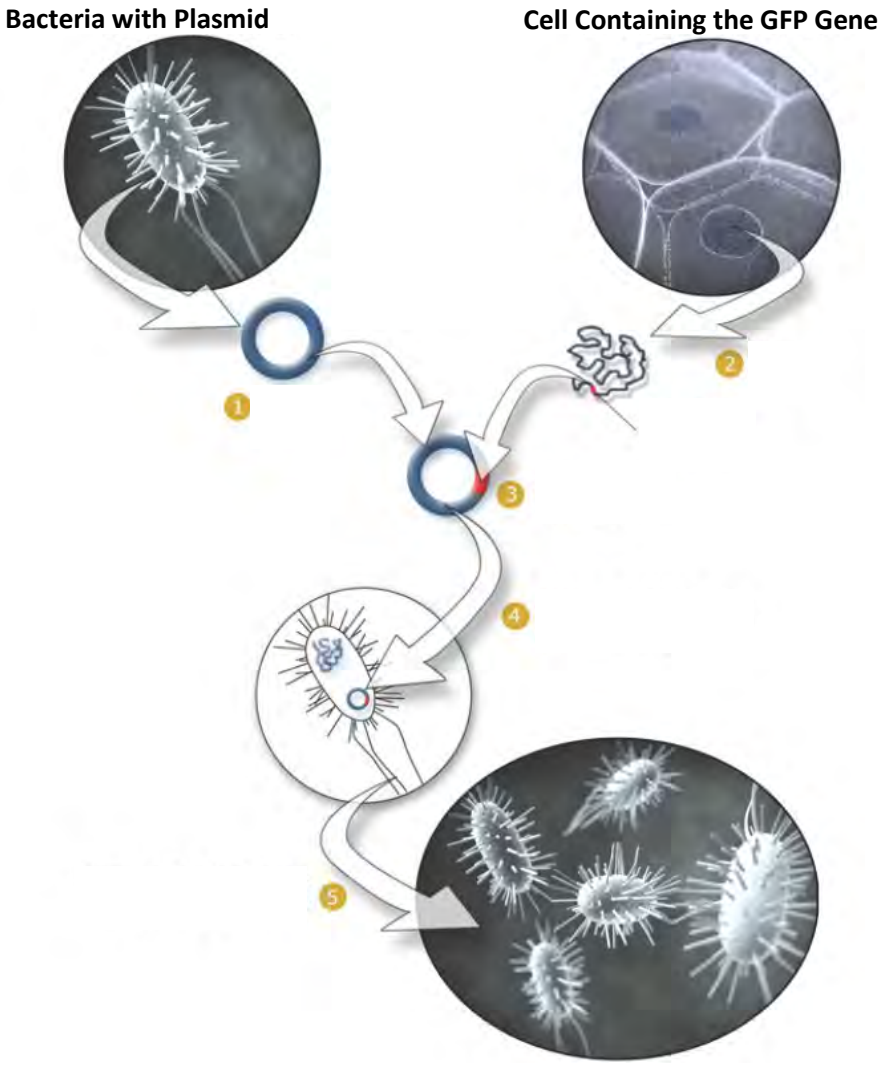
Genetic transformation occurs when a cell takes up (i.e. takes inside) and expresses a new piece of genetic material or DNA. Genetic transformation literally means change caused by genes and it involves the insertion of a gene(s) into an organism in order to change the organism's traits.

The flow diagram below summarises the transformation process used in this practical where the pGLO plasmid, developed by Bio-Rad Laboratories for use in the classroom, is used to transform a non-pathogenic (non-disease causing) *E. coli* bacteria.

Use the descriptions provided to label the steps carried out to produce genetically transformed bacteria.

Descriptions:

- The GFP gene put into the plasmid
- GFP gene removed from cell
- Plasmid removed from bacteria
- The plasmid carrying GFP gene is put in the bacteria
- Bacteria reproduces, many bacteria make the GFP protein



Information taken from BIORAD's Biotechnology Explorer pGLO Bacterial Transformation Kit Catalog Number 166-0003EDU.

SLR 24

SLR 24: Bacterial Transformations

Bacterial Transformations – the GFP Gene

In this practical you are going to learn how a gene from one organism (a jellyfish) can be transferred to another organism (a bacterium) using a genetically engineered plasmid. This models how the human insulin gene is transferred into bacterial cells, thus transforming the bacteria so that the human protein, insulin can be successfully produced for use in diabetics.

You will transfer a plasmid containing the Green Fluorescent Protein (GFP) gene into bacteria. When the gene is switched on in the bacteria, they will produce a protein that GLOWS GREEN!

Bacterial Transformations – Focus Questions

1. Use your starter plate of *E. coli* bacteria to make the following observations before the transformation is carried out. This will provide the **baseline data** to determine if the transformation has been successful.

a. Number of colonies:

b. Colour of the colonies:

c. Shape of the colonies:

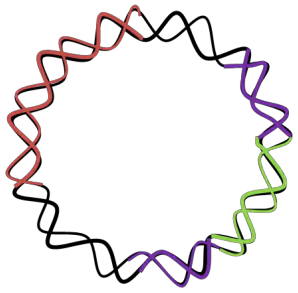
d. Visible appearance (does the colour change) when viewed with ultra violet (UV) light:

2. Use the information in the box to label the plasmid to show the genes needed for a bacteria to glow green.

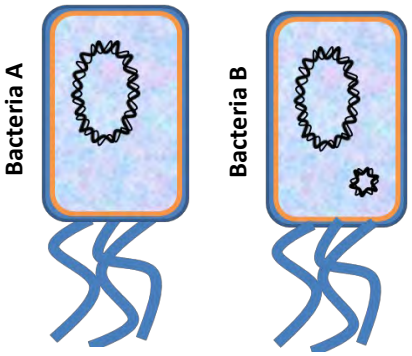
The pGLO plasmid is a ring of DNA from a bacterium that contains:

1. An antibiotic resistance gene. In this practical the antibiotic ampicillin will be used to observe that bacteria have taken up the plasmid.
2. The gene for Green Fluorescent Protein (GFP). In this practical, the GFP gene will demonstrate bacteria's ability to use a foreign gene.
3. A gene that gets switched on to produce an enzyme to digest arabinose sugar. In this practical, arabinose will be used to switch on the GFP gene.

pGLO plasmid



3. The diagrams below represent bacteria that may be found in the +pGLO tube.



a. Which bacteria will die if the antibiotic ampicillin is put into its surroundings or environment?

b. Which bacteria will be able to live and reproduce?

c. Which bacteria has a gene that will be switched on if arabinose is put in its food ?

d. Which bacteria, if the environment is right, has the genes to produce the protein that GLOWS GREEN?

Information taken from BIORAD's Biotechnology Explorer pGLO Bacterial Transformation Kit Catalog Number 166-0003EDU.

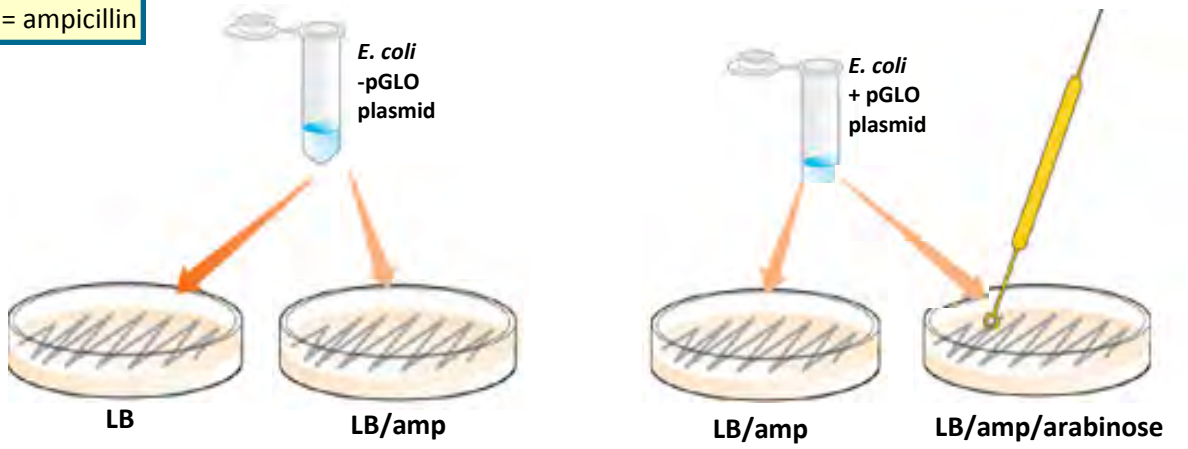
BIO-RAD

SLR 25

SLR 25: Making Predictions

The diagram below shows what you did with your plates. Make a **prediction** of the results that will be seen

Note:
LB = agar
amp = ampicillin



Predictions:

LB /-pGLO	LB/amp/-pGLO	LB/amp/+pGLO	LB/amp/arabinose/ +pGLO
Prediction:	Prediction:	Prediction:	Prediction:
Reason:	Reason:	Reason:	Reason:

Before collecting data and analyzing your results answer the following questions.

1. On which of the plates would you expect to find bacteria most like the original non-transformed *E. coli* colonies you initially observed on your started plates? Explain your predictions.

2. If there are any genetically transformed bacterial cells, on which plate(s) would they most likely be located? Explain your predictions.

3. Which plates should be compared to determine if any genetic transformation has occurred? Why?

4. What is meant by a control plate? What purpose does a control serve?

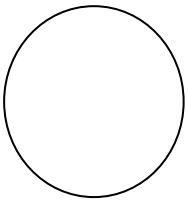
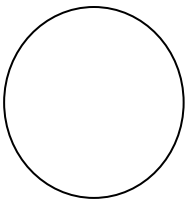
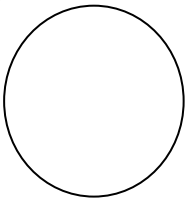
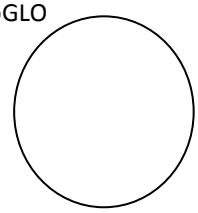
Information taken from BIORAD's Biotechnology Explorer pGLO Bacterial Transformation Kit Catalog Number 166-0003EDU.

SLR 26

SLR 26: Making Observations

Observe the results you obtained from the transformation lab under normal room lighting. Then turn out the lights and hold the ultraviolet light over the plates.

- Carefully observe and draw what you see on each of the four plates. Put your drawings in the data table in the column on the left.
- For each plate, write down the following observations:
  - ⇒ How much bacterial growth do you see on each plate, relatively speaking?
  - ⇒ What colour are the bacteria under UV light?
  - ⇒ How many bacterial colonies are on each plate (count the spots you see).
- Were your predictions correct? If not give a reason for this.

	Observations	Prediction
Control Plates	LB -pGLO 	
Control Plates	LB/amp -pGLO 	
Transformation Plates	LB/amp +pGLO 	
Transformation Plates	LB/amp/ara +pGLO 	

Information taken from BIORAD's Biotechnology Explorer pGLO Bacterial Transformation Kit Catalog Number 166-0003EDU.

SLR 27

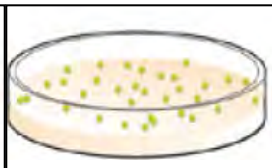
SLR 27: Explanations

1. Describe the evidence that indicates whether your attempt at performing a genetic transformation was successful or not.

2. Very often an organism's traits are caused by a combination of its genes and its environment. Think about the green colour you saw in the genetically transformed bacteria:

   a. What two factors must be present in the bacteria's environment for you to see the green colour? (Hint: one factor is in the plate and the other factor is in how you look at the bacteria).

   b. What advantage would there be for an organism to be able to turn on or off particular genes in response to certain conditions?

 White bacterial lawn	 No growth	 White colonies	 Fluorescent green colonies under UV light
Nutrient agar with NO antibiotics added. Bacteria that have no genetic modification.	Nutrient agar with the antibiotic – ampicillin. Bacteria that have no genetic modification.	Nutrient agar with the antibiotic – ampicillin. Bacteria with the GFP gene plus the antibiotic resistance gene.	Nutrient agar with arabinose sugar and the antibiotic – ampicillin. Bacteria with the GFP gene plus the antibiotic resistance gene.

Genetic Transformation: Application

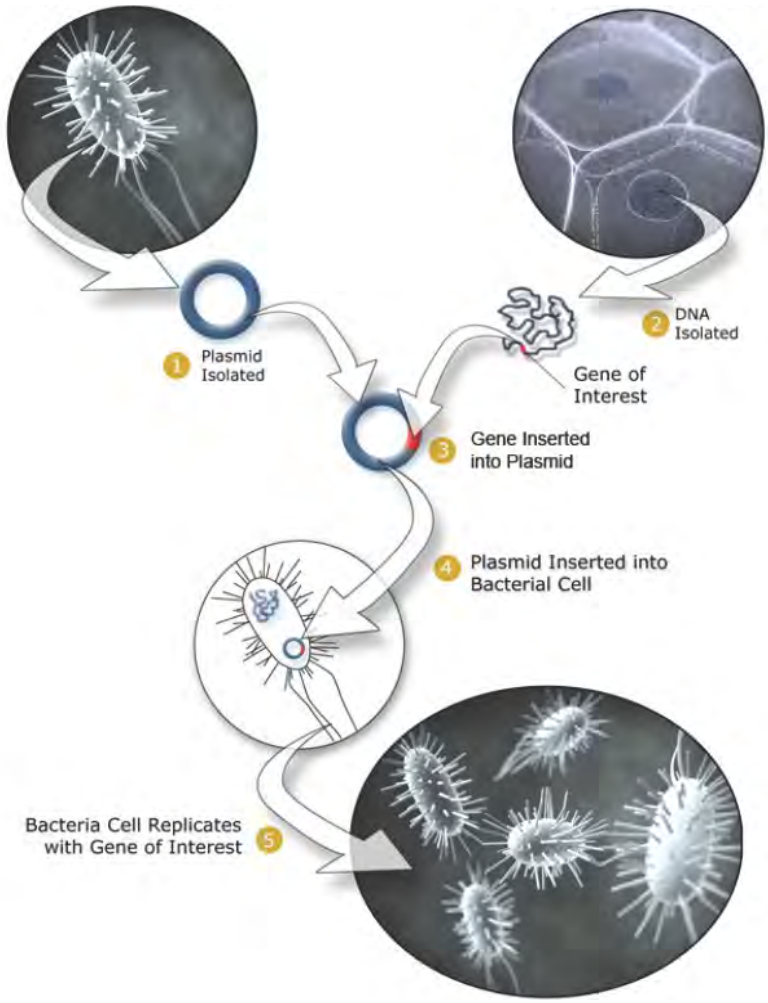
Type I diabetes is a disease that is caused by the destruction of cells in the pancreas that are responsible for making the hormone insulin which controls blood glucose levels. If the pancreas is not functioning properly, not enough insulin is produced and blood glucose levels can get out of control – soaring too high or sinking too low. By monitoring blood glucose levels and treating the patient with regular insulin injections, Type I diabetes can be managed.

Before genetic engineering was available, patients with Type I diabetes were given insulin that had been extracted from the pancreatic tissue of pigs or cattle. This was a very expensive process and because it was not human insulin, it was slightly different and caused side effects in some people. Since the early 1980's human insulin has been produced using genetically modified organisms (either bacteria or yeast) and is used to treat patients with Type I diabetes.

Information taken from BIORAD's Biotechnology Explorer pGLO Bacterial Transformation Kit Catalog Number 166-0003EDU.

SLR 28

SLR 28: Extension Questions



Extension Questions:

- What are the benefits of using bacteria to produce human insulin? Give a reason for the benefits.
- What are some of the problems that occur when using genetically transformed bacteria to produce insulin? Explain why these problems occur.
- New Zealand scientists have used a biotechnology called xenotransplantation to transplant or inject cells that can produce insulin from the pancreas of newborn piglets into people with Type 1 diabetes. This will reduce their need for regular insulin injections. Clinical trails are currently being carried out with a small number of people in New Zealand to test the effectiveness of this treatment.
    - What are the benefits of this treatment for Type 1 diabetics?
    - What are some of the concerns or problems that may occur with this treatment? Give reasons for these concerns or problems.

Information taken from BIORAD's Biotechnology Explorer pGLO Bacterial Transformation Kit Catalog Number 166-0003EDU.

SLR 29

SLR 29: Keyword List

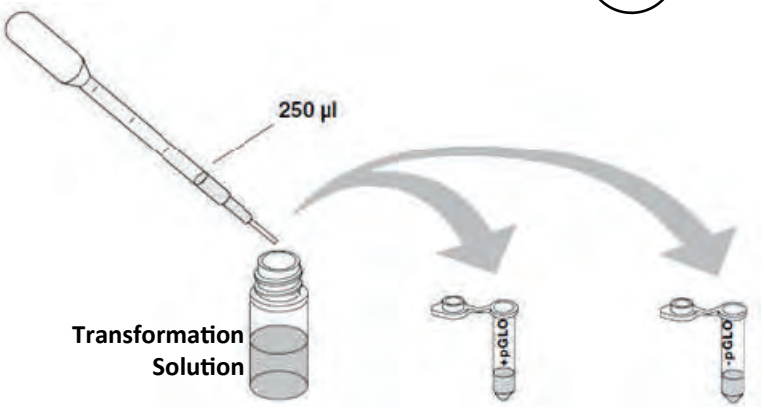
Agar	A seaweed extract that sets like a jelly. Agar plates are used to grow bacteria and contain nutrients for the bacteria to feed on.
Ampicillin	An antibiotic which reduces the growth of bacteria.
Arabinose	A sugar used by bacteria as a food source which is required for the GFP gene to be turned on in the transformed bacterium.
Chromosome	A structure in the nucleus of cells that carries genes.
DNA	The chemical that genes are made up of.
Gene	A length of DNA that codes for a particular characteristic or protein.
Gene transfer	Taking a gene from one organism and transferring it into another organism.
Green Fluorescent Protein (GFP)	A protein from the bioluminescent jellyfish, which when exposed to ultra-violet light, gives off energy in the form of visible green light - glows green!
Microbe	Micro-organism - bacteria, fungi or virus.
Mitosis	Cell division to make body cells for growth and repair.
pAMP	A plasmid that contains an ampicillin resistant gene.
pGLO	A plasmid that contains the GFP gene and an ampicillin-resistant gene.
Plasmid	A circular piece of DNA found in bacteria.
Transformation	Transfer of DNA from one organism to another, often using a vector (or carrier) such as a plasmid; this allows the receiving organism to produce the introduced gene product - the protein.

Information taken from BIORAD's Biotechnology Explorer pGLO Bacterial Transformation Kit Catalog Number 166-0003EDU.

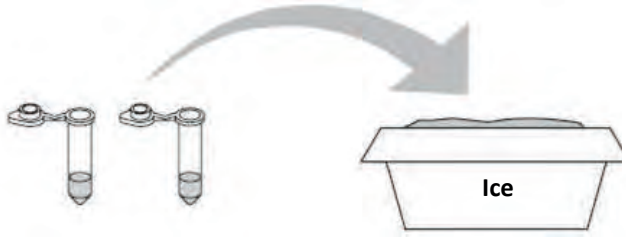
SLR 30

SLR 30: pGLO Student Instruction Card

1. Open the +pGLO and –pGLO tubes and add 250µL of transformation solution ($CaCl_2$) into each tube.



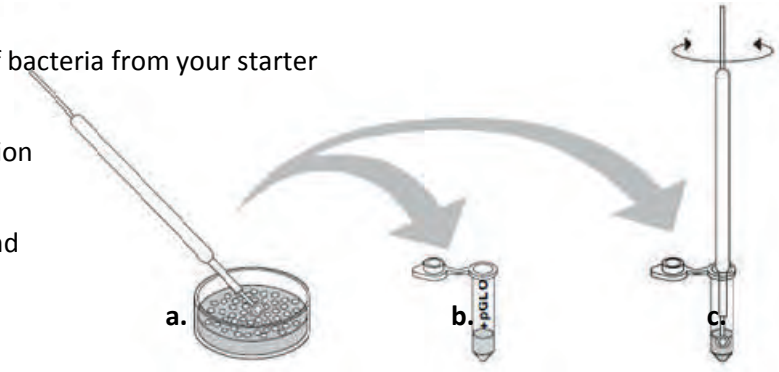
2. Place the tubes on ice.



3. a. Use a sterile loop to pick up 2-3 colonies of bacteria from your starter plate.

   b. Put the loop into the Transformation Solution at the bottom of the +pGLO tube.

   c. Spin the loop between your index finger and thumb until all the bacteria are spread through the Transformation Solution (no floating chunks). Place the tube back in the tube rack on ice.



Using a new sterile loop, repeat this again for the –pGLO tube.

4. Take a new sterile loop and your +pGLO tube to the technician.

   Collect a loop full of pGLO plasmid DNA – you must see a **film of plasmid** solution across the ring.

   Mix the plasmid into the cell suspension in the +pGLO tube.

   Close the tube and return it to the rack on ice.

SLR 24
Focus Questions

5. Put the tubes on ice for **10 minutes**. Make sure that you <u>push the tubes all the way down in the rack</u> so the bottom of the tubes stick out and make contact with the ice.

6. While the tubes are sitting on ice, label your four LB nutrient agar plates on the bottom (not on the lid):

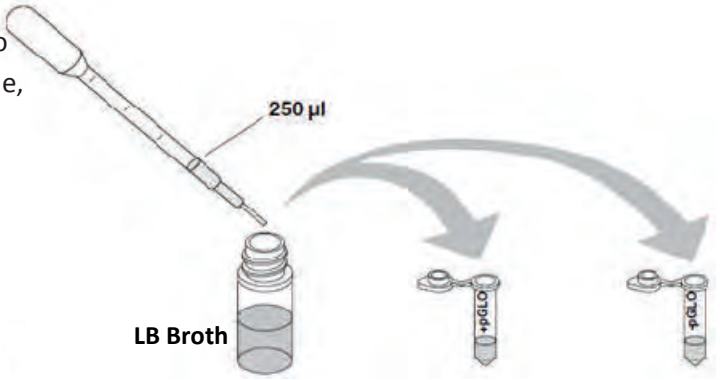
Label the **LB** plate:	**-pGLO**
Label one **LB/amp** plate:	**-pGLO**
Label the other **LB/amp** plate:	**+pGLO**
Label the **LB/amp/ara** plate:	**+pGLO**

SLR 30

SLR 30: pGLO Student Instruction Card

7. **Heat shock:** For the best transformation results, the transfer from the ice to the 42°C and then back to the ice must be **rapid**. When you have your tubes on ice at the water bath:
   - Transfer both the +pGLO and –pGLO tubes in the foam holder into a water bath at 42°C for **exactly 50 seconds.** Make sure the bottom of the tubes make contact with the warm water.
   - After 50 seconds, place both the tubes back on ice for **2 minutes.**

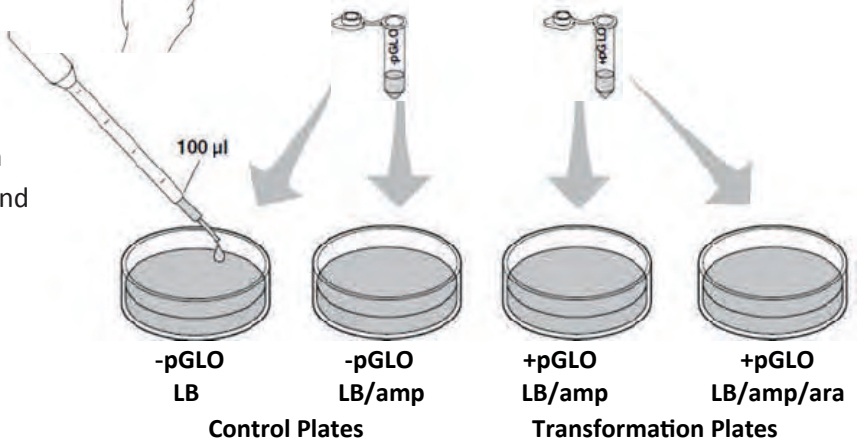
8. Place the rack containing the tubes from the ice onto the bench top. Using a <u>new</u> sterile dropper each time, add 250µL of LB nutrient broth to each tube. Leave on the bench at room temperature for **10 minutes**.



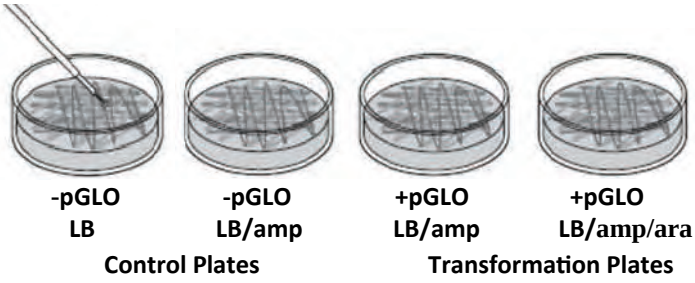
SLR 25 Making Predictions

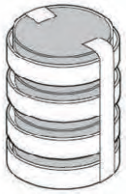
9. **After** the 10 minutes, tap the closed tubes with your finger to mix.

10. Using a new sterile dropper for each tube, transfer 100µL of the –pGLO and +pGLO suspensions onto the appropriate agar plates.



11. Using a **new sterile loop for each plate**, spread the suspensions by quickly sliding the flat surface of the loop back and forth over the plate surface.
DO NOT PRESS INTO THE AGAR!

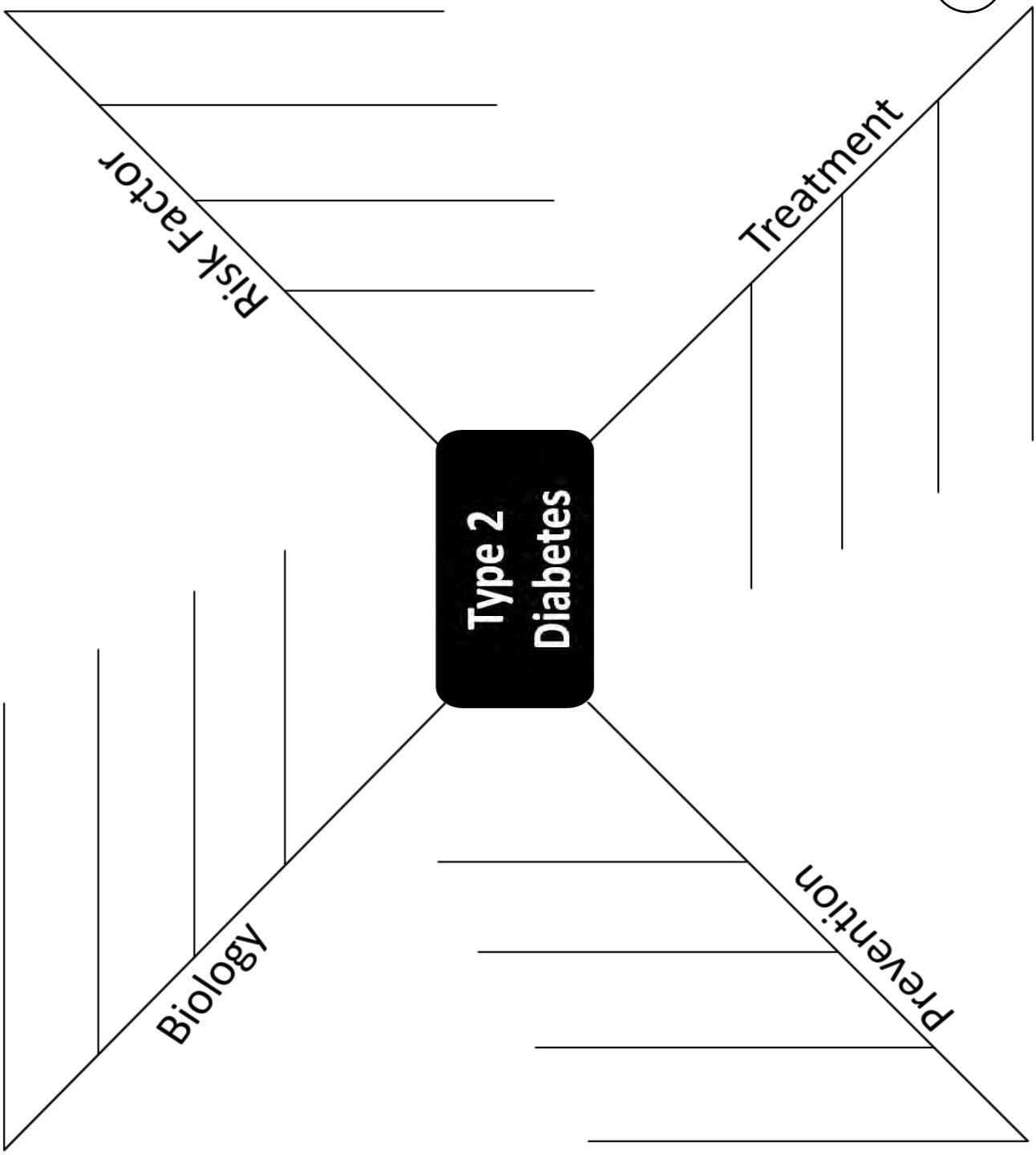




12. Stack up your plates and tape them together.
Write your group number on the tape and then place upside down in the 37°C incubator. They will be incubated upside down overnight.

SLR 31

Spider Diagram



Other useful information:

SLR 32

Diabetes Headlines (from Stuff.co.nz)

1. Spread of Diabetes—a smouldering fire
   http://www.stuff.co.nz/national/health/8376331/Spread-of-diabetes-smouldering-fire

2. Fast food gets grilling at diabetes seminar, 13/9/2012
   http://www.stuff.co.nz/dominion-post/news/7664675/Fast-food-gets-grilling-at-diabetes-seminar

3. Sharp rise in obesity surgery rate, 25/12/2012
   http://www.stuff.co.nz/national/health/8116990/Sharp-rise-in-obesity-surgery-rate

4. Obesity big issue for Kiwis—survey, 21/2/2013
   http://www.stuff.co.nz/manawatu-standard/news/8332744/Obesity-big-issue-for-Kiwis-survey

5. Dads' bad habits aid obesity, 11/3/2011
   http://www.stuff.co.nz/national/health/6555768/Dads-bad-habits-aid-obesity

6. Govt criticised for lack of action on obesity, 12/7/2010
   http://www.stuff.co.nz/national/health/3907978/Govt-criticised-for-lack-of-action-on-obesity

7. Govt defends efforts to tackle diabetes, 27/6/2011
   http://www.stuff.co.nz/national/health/5195213/Government-defends-efforts-to-tackle-diabetes

8. 'Diet, exercise fights diabetes', 16/11/2012
   http://www.stuff.co.nz/timaru-herald/news/7957818/Diet-exercise-fights-diabetes

9. Obesity Hike Puts Kiwis in Line for $1b Diabetes Bill, 12/6/2012
   http://www.stuff.co.nz/national/health/7082001/Obesity-hike-cues-1b-diabetes-bill

10. Staff work to tackle diabetes head on, 15/8/2011
    http://www.stuff.co.nz/southland-times/news/5443194/Staff-work-to-tackle-diabetes-head-on

11. Obesity at record high, 18/6/2008
    http://www.stuff.co.nz/auckland/493925

12. Ka mate, ka mate (Diet of Maori men), 7/9/2008
    http://www.stuff.co.nz/marlborough-express/features/focus/525853

13. Govt reveals plan to battle obesity, 1/1/2009
    http://www.stuff.co.nz/national/politics/138709

14. Good diet key to the future, 1/1/2009
    http://www.stuff.co.nz/national/55336

15. Adult Nutrition Survey—Not eating our greens 20/11/2011
    http://www.stuff.co.nz/life-style/wellbeing/5999967/Grow-up-and-eat-your-greens

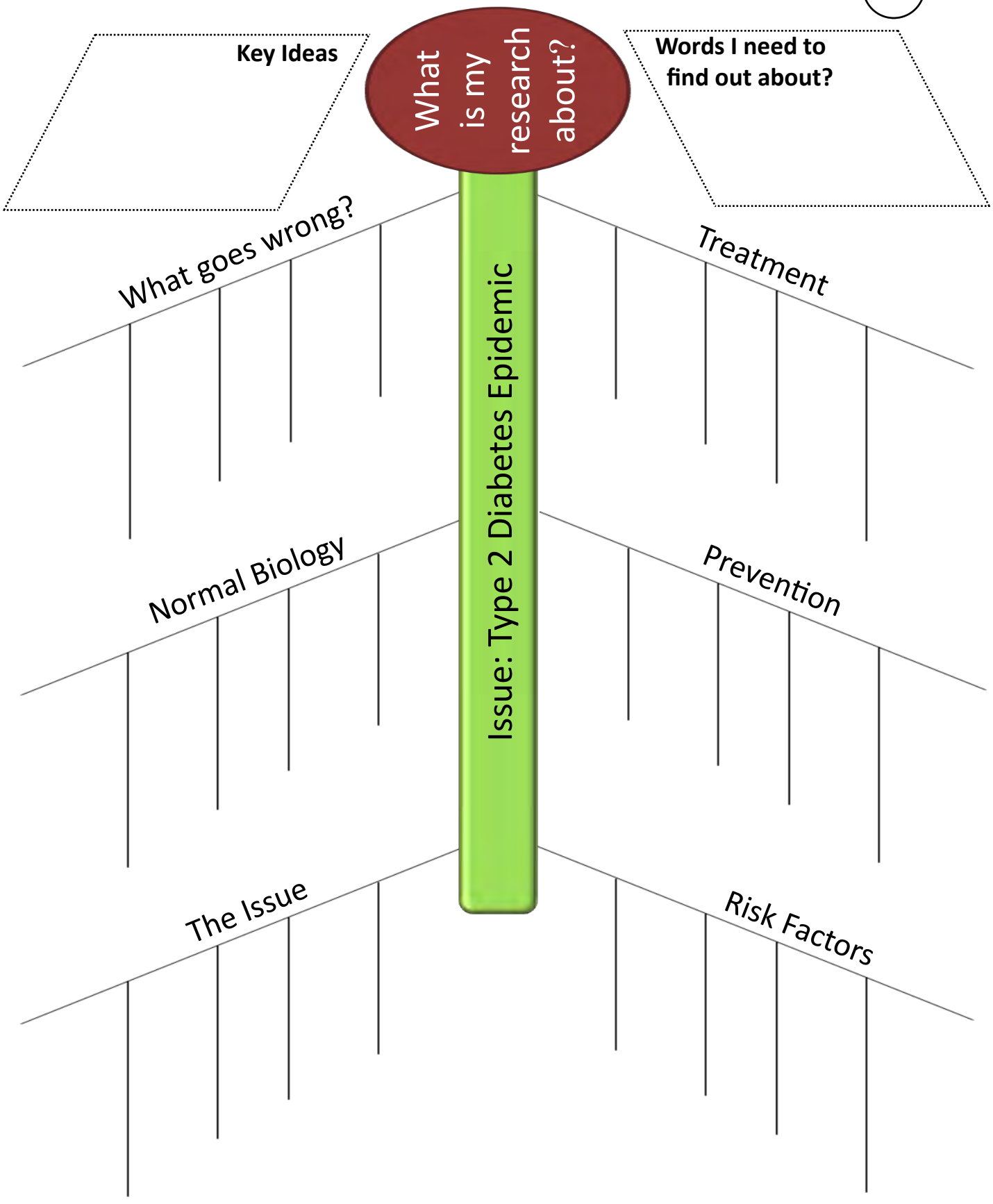
16. Surgery for diabetics 'part of planning', 26/1/2010
    http://www.stuff.co.nz/national/health/3260625/Surgery-for-diabetics-part-of-planning

17. Obese women tell of surgery let-down, 14/6/2010
    http://www.stuff.co.nz/national/health/3807245/Obese-women-tell-of-surgery-letdown

18. Obesity support faces the axe, 16/7/2010
    http://www.stuff.co.nz/marlborough-express/news/3926017/Obesity-support-faces-the-axe

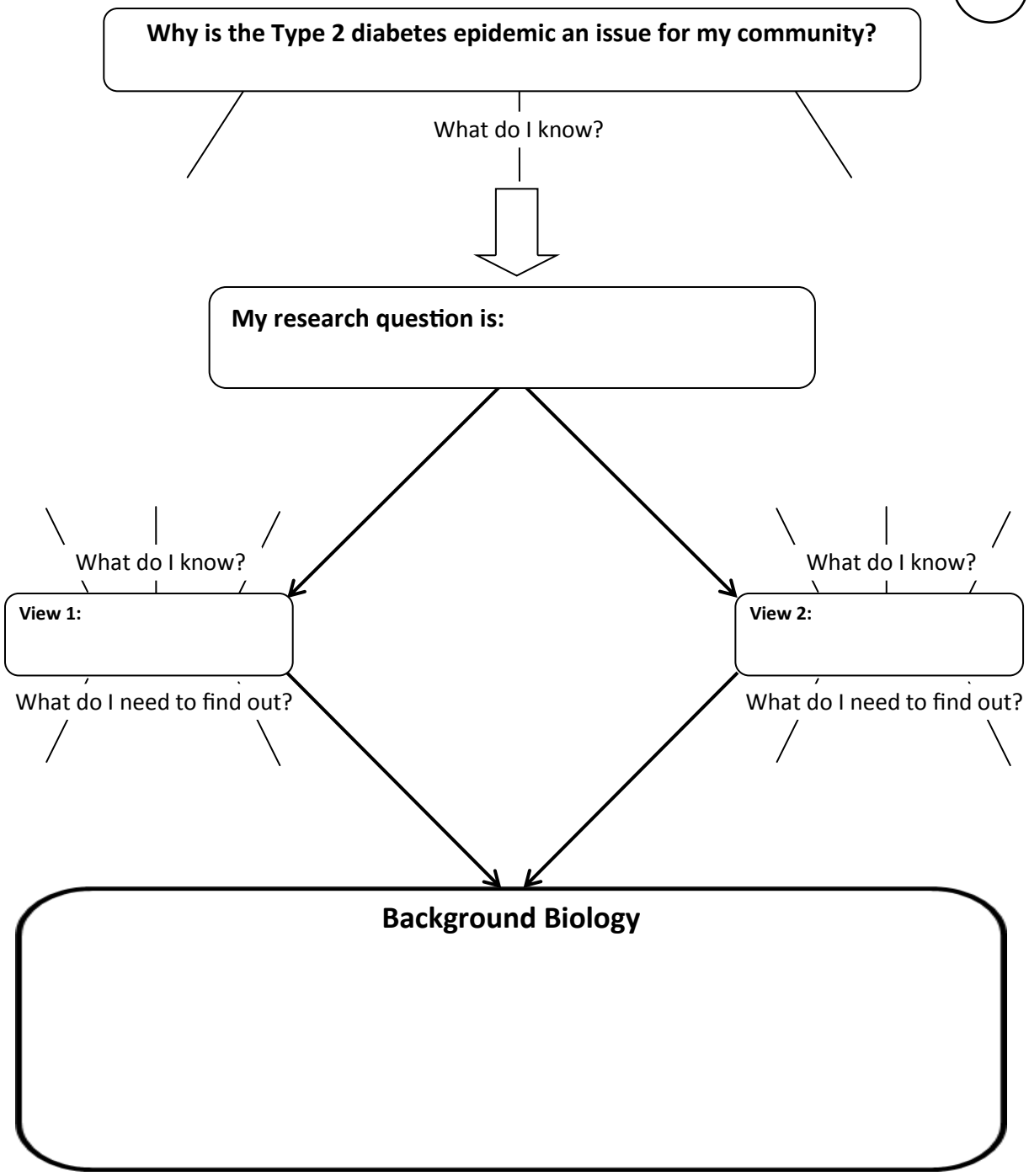
SLR 33

Herringbone Graphic Organiser



SLR 34

Developing My Research Map



Words I need to find out about:

Key questions to be answered:

-
-
-

SLR 35

Data Chart

My Research Topic: ______________________________ Does this relate to the Type 2 diabetes epidemic? Yes / No

	The biology behind my research	**Perspective 1**	**Perspective 2**	**Reliable Useful Source?** Yes – Why? No – Why not?
Source 1:				
Source 2:				
Source 3:				
Source 4:				
My opinion: **What is my evidence for this?**			**Possible Action:** **Is this based on my research?** Yes / No	

SLR 36

Dot-Jot-Evaluate

My Research Topic:

_____

Does this relate to the Type 2 diabetes epidemic? Yes / No

The biology behind my research question
Source (website, newspaper, book, interview) Title: Author: Publisher: Year of publication: URL: **Reliable/Useful Source?** Yes – Why? No – Why not?
Dot-jot Notes:

The biology behind my research question
Source (website, newspaper, book, interview) Title: Author: Publisher: Year of publication: URL: **Reliable/Useful Source?** Yes – Why? No – Why not?
Dot-Jot Notes:

SLR 36

Dot-Jot-Evaluate: Perspective 1

Perspective 1 / View 1:
Source (website, newspaper, book, interview) Title: Author: Publisher: Year of publication: URL: **Reliable/Useful Source?** Yes – Why? No – Why not?
Dot-jot Notes:

Perspective 1 / View 1:
Source (website, newspaper, book, interview) Title: Author: Publisher: Year of publication: URL: **Reliable/Useful Source?** Yes – Why? No – Why not?
Dot-jot Notes:

SLR 36

Dot-Jot-Evaluate: Perspective 2

Perspective 2 / View 2:
Source (website, newspaper, book, interview) Title: Author: Publisher: Year of publication: URL: **Reliable/Useful Source?** Yes – Why? No – Why not?
Dot-jot Notes:

Perspective 2 / View 2:
Source (website, newspaper, book, interview) Title: Author: Publisher: Year of publication: URL: **Reliable/Useful Source?** Yes – Why? No – Why not?
Dot-jot Notes: