**Stem cells and Intestine workshop delivery instructions**

**Levels**

Green: Easiest level designed for students aged 9-11 or weaker 10-12 year olds.

* Focus is on the intestine with a brief overview of what stem cells are and how they can be used to help build an intestine for patients with damaged/missing intestine.

Orange: Medium level designed for students aged 10-12 or weaker 11-13

* Focus is balanced between the intestine and stem cells. Go into more detail about what a stem cell is and how they can be used as therapy for specific disease such as short bowel syndrome.

Red: Hardest level designed for students aged 11-13.

* Brief overview of the intestine as content and then focus workshop on stem cells, explaining more about their properties and the ways they can be manipulate to produce an intestine as a therapy for patients with short bowel syndrome.

**Plickers set up**

Non-essential – other methods of delivery available such as using white boards or getting students to vote by putting their hands up.

If you have decided not to use plickers the question can be found in Word document 3 and can then be added to PowerPoint where needed.

1. Log into plickers site <https://www.plickers.com/signin>

Username: intestineandstemcellsworkshop@gmail.com

Password: INTENS2018

1. Print off number of plickers card (top right hand corner of website) for the number of students taking part in workshop
2. Create a new class and assign questions corresponding to the level of workshop to that class (see questions sheets).
3. Download plickers app to mobile device – to ask a question click on your class and specific question you wish to ask.

**Before workshop buy/find**

* large marshmallows
* mini marshmallows
* block of icing
* wine gums
* spaghetti
* food dye
* paper plates
* A bowl
* Masking tape
* Tape measure
* Name tags (optional)

**Pre-workshop**

1. Print off document with coloured dots and cut out individual dots (Word document 1)
2. Print off intestine cell names and function sheets (Word document 2)
3. Cut block of icing into smaller blocks enough for one each (step can be done at school as part of classroom set up)

**Set up (before workshop) – 10 mins**

* Measure out an 8.5m meter strip of masking tape and place it along the floor.
* At each desk place a paper plate, plickers card, coloured dot and name tag.
* Along a side bench or on a separate table set up the cells station with the cells cards and the corresponding colour or wine gum (see PowerPoint).
* At the front have two marshmallows of the same colour ready and a bowl with a little bit of food colouring.

Note: slide 1 is the title slide

**Part 1: The intestine**

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| **Materials** | **Group organisation** | **Time** |
| * Masking tape * Tape measure/meter rulers * Plickers cards (non-essential) | Whole class | Green-10/15 mins  Orange-10 mins  Red-5 mins |

**Instructions** :

|  |  |  |
| --- | --- | --- |
| Green: | Orange: | Red: |
| 1. Slide 2: Ask students to think about where in the body their intestine might be. Using the plickers app scan each students opinion at this stage (you do not need to be on the website at this stage stay on the PowerPoint). This allows you to gauge the level of students. 2. Slide 3: talk to the students about how you have two sizes of intestine and ask students if they know which one is ‘BIGGER’ – most students will say the large intestine but you are looking for them to identify that the smaller one is actually longer. 3. Slide 4: using the plickers cards get them to think about how long the two intestine together might be 4. Slide 5: ACTIVITY – get all the students to stand along the piece of masking tape on the floor. Now ask them again how long they think the intestine might be (just shout out answers). Using an assistant from the class get them to measure how long the intestine is. 5. Slide 6: get all the students to sit back down and give them the two analogies on slide 6 to help them remember the length of the intestine. 6. Slide 7: explain to the students what the function of the intestine is in our bodies and relate this to the students by asking if they have had a snack/lunch and then if they feel more energetic afterwards. 7. Slide 8: get the students to think about which of the structures might mean they take up their food more quickly – this often causes a little confusion at first so you can ask which of the structures is longer and this helps them to see that A will be able to absorb more quickly than B. | Same as for green – with these students you will not have to go into as much detail at every stage as their prior knowledge will be higher | 1. Slide 2-5 are to give students a general reminder of where the intestine is and what it does. On slide 3 get students to participate in the activity outlined in green step 4. 2. Slide 6: Go into more detail about what absorption is – explaining to students how food is broken down initially in the stomach and then taken up through the intestine cells and passed into the blood. |

**Part 2: Intestinal stem cells**

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| **Materials** | **Group organisation** | **Time** |
| * 2 large marshmallows * bowl with food dye * different coloured wine gums * coloured dots | Whole class demonstration  Activity done individually | Green-5-10 mins  Orange-10 mins  Red-15 mins |

**Instructions:**

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| Green: | Orange: | Red: |
| 1. Slide 9: explain to students that the intestine has a wall but instead of the wall being made up of bricks the wall is being made up of cells 2. Slide 10: introduce that all the cells in our intestine start off as a stem cell 3. Slide 11: DEMONSTRATION – show students that stem cells can either produce a copy of themselves by having one marshmallow which then produce a second marshmallow (of the same colour). Then explain to students that stem cells can also divide and then ‘change’ into different cells – shown by dipping the second marshmallow into the bowl with food dye and showing the students that the marshmallow had changed colour.   ACTIVITY – stem cells can produce 4 different cells in the intestine. Get each student to open up their folded colour dot and then go and retrieve their ‘cell’. Get students to hold onto their cell and place it on their plate at their desk.   1. Slide 12: Explain that your stem cells are at the bottom of the villi in the intestine and they send all the other cells upwards. 2. Slide 13: Ask students to think about what might happen if their intestine gets damaged (if the school allows them to eat in the classroom they can now eat their wine gum to demonstrate that sometimes cells get destroyed). For younger students ask how many of them like to run about at play time or participate in sport and then explain that if part of their intestine was missing they might not be able to do this because they wouldn’t have the energy. | Same as green. In step (3) go into more detail about what each of the cells do in the intestine and how they are need to work together in order for the intestine to function efficiently. | 1. Slide 7: explain that the intestine has a wall like a brick wall and that this wall is made up of cells. Ask the students if they can name any other cell types in the body and explain that you have made different cell types throughout the body. 2. Slide 8: before showing this slide see if students know what cells start off as – then explain that all the cells in the intestine start off as an intestinal stem cell. (With particularly able classes you can go into more detail about different types of stem cells in different parts of the body). 3. Slide 9: DEMONSTRATION – show students that stem cells can either produce a copy of themselves by having one marshmallow which then produce a second marshmallow (of the same colour). Then explain to students that stem cells can produce differentiated daughter cells and demonstrate this by dipping the second marshmallow into the bowl with food dye and showing the students that the marshmallow had differentiate your model stem cell.   ACTIVITY - stem cells can produce 4 different cells in the intestine. Explain how each of the colour dots represents the different genes and condition which cause the stem cells to differentiate into all the intestinal cells. Get each student to open up their folded colour dot and then go and retrieve their ‘cell’. Get students to hold onto their cell and place it on their plate at their desk.   1. Slide 10: show the students the video of how different cells types are produce from one stem cell 2. Slide 11: Explain to students that this occurs in the intestine to produce villi and that the stem cells are at the bottom of the villi and then the differentiate cells are pushed to the top of the villi to perform their function. 3. Slide 12: Get students to think about what might happen if the intestine cells become damaged or if a section is removed. Simulate this by getting students to eat their ‘cell’ (if the school allows). Ask students how life might be affected if their intestine was damaged. (This has been left very open to allow for description of SBS or addition of more detail by deliver depending on their level of knowledge). |

**Part 3: Building an intestine**

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| **Materials** | **Group organisation** | **Time** |
| * Mini white and pink marshmallows * Block of white icing * Spaghetti * Paper plates * Measuring tape | Activity done individually | Green-20 mins  Orange-20 mins  Red-20 mins |

**Steps:**

All: Each student needs a block of icing, 15 white marshmallows which represent the intestine cells, and 5 pink marshmallows. The objective of this activity is to try and create villi structures with pink marshmallows at the bottom of the villi and white marshmallows along the sides and at the top. On the final slide is an example of the structure students are trying to create – this activity is the same for all 3 levels but has a slightly different focus

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| Green: | Orange: | Red: |
| Get students to imagine that their intestine has become damaged somehow and they must create a new stretch of their intestine. | Explain to students how the intestine might become damaged due to surgery and get them to imagine their intestine has been damaged and they are going to create a new stretch of intestine to replace what has been lost. | Explain how the intestine becomes damaged in short bowel syndrome and get them to imagine they are the scientist trying to create a new stretch of intestine for transplant into patients starting off with the patients specific stem cells. |

Optional: make this activity into a challenge to see who can create the longest intestine or the intestine with the highest number of villi. In the last 5 minutes measure the intestine and award a prize (extra wine gum/ marshmallow) to the winner.

* This activity has been left very open to allow each researcher to add in information about their research either at the start of the activity or during the activity.

**Part 4: Quiz**

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| **Materials** | **Group organisation** | **Time** |
| * Plickers cards | Whole class | Green-10 mins  Orange-10 mins  Red-10 mins |

**Instruction:**

At the end of the workshop switch from the PowerPoint to the plickers site and click on live view – this will allow students to see if they are getting the correct answer. Using the plickers app ask the following questions:

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| Green: | Orange: | Red: |
| * Where in the body is our intestine? * How long is the intestine? * What does the intestine do? * Which of these will absorb our food faster? * What happens if our intestine gets damaged? | * How long is the intestine? * What does the intestine do? * Which of these will absorb our food faster? * All our cells start off as: * A stem cell can generate: * Do we find stem cells at the top or bottom of the villi? * What happens if the intestine gets damaged? | * How long is the intestine? * Which of these will absorb our food faster? * All our cells start off as: * A stem cell can generate: * How many cell types do we have in our intestine (including our stem cells)? * Do we find stem cells at the top or bottom of the villi? * What happens if the intestine gets damaged? |

* Alternatively add these questions to the end of the PowerPoint and either use white boards for students to vote for their answer or get them to put their hands up.
* Any additional questions you may want to ask please feel free to add them to the plickers site or to the PowerPoint

**Word document 1**

**Word Document 2 (Intestine cell types)**

**ENTEROENDOCRINE CELLS**

AID THE DIGESTION AND HELP PROTECT THE INTESTINE

**PANETH CELLS**

SUPPORT THE STEM CELLS PROTECTING THEM FROM BACTERIA

**GOBLET CELLS**

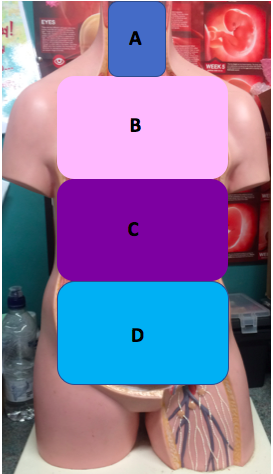
PROTECT THE INTESTINE FROM STRESS

**ENTEROCYTES**

TAKE IN (ABSORB) NUTRIENTS FROM FOOD

**Multiple choice questions**

1. **Where in the body is our intestine?**



1. **How long is the intestine?**
2. 2.5m
3. 5.5m
4. 8.5m
5. 11.5m
6. **What does the intestine do?**
7. Takes in oxygen from our blood
8. Absorbs nutrients from our food
9. Protects us from bacteria and harmful substances
10. **Which of these structures will absorb our food faster?**

**A B**



1. **All our cells start off as:**
2. Blood cells
3. Stem cells
4. Brain cells
5. Intestine cells
6. **How many cell types do we have in our intestine (including our stem cells)?**
7. 2
8. 3
9. 4
10. 5
11. **A stem cell can generate:**
12. Just copies of itself
13. Differentiated daughter cells
14. Both differentiated daughter cells
15. **Do we find stem cells at the top or the bottom of the villi?**
16. Top
17. Bottom
18. **What happens if the intestine gets damaged?**
19. It has no effect on our body
20. It effects us as we cannot absorb as many nutrients
21. It effects us because we cannot take up oxygen in our blood
22. It effects us by giving us more energy

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| Question | During workshop | | | Quiz at the end of workshop | | |
| Green | Orange | Red | Green | Orange | Red |
| Where in the body is our intestine? |  |  |  |  |  |  |
| How long is the intestine? |  |  |  |  |  |  |
| What does the intestine do? |  |  |  |  |  |  |
| Which of these will absorb our food faster? |  |  |  |  |  |  |
| All our cells start off as: |  |  |  |  |  |  |
| A stem cell can generate: |  |  |  |  |  |  |
| How many cell types do we have in our intestine? |  |  |  |  |  |  |
| Do we find stem cells at the top or bottom of the villi? |  |  |  |  |  |  |
| What happens when the intestine gets damaged? |  |  |  |  |  |  |

**Template email**

To Whom It May Concern:

INTENS are offering the opportunity for students from the age of 9-14 to experience a workshop about the intestine, stem cells and their uses as a therapy for short bowel syndrome. The workshop is fun and interactive. It takes about an hour to deliver and has been designed to cater for all abilities.

The workshop consists of activities such as working out the length of the intestine, a demonstration of how a stem cell can generate every type of cell in the intestine using marshmallows and sweets, and an activity where students get to build their own section of the intestine using icing and marshmallows. The workshop delivers information on the intestine, the cells in the intestine and how they are produced, and what happens when the intestine becomes damaged.

For more information please contact……….

Yours sincerely,

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