**CODE/MOE/UOIT Makerspaces Project Lesson Plan: Grade 8 Science: Understanding Life Systems - Cells**

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| **BIG IDEAS:**  Cells organize into tissues, tissues into organs, organs into organ systems, and organ systems into organisms.  **Science and Technology Specific Curriculum Expectations:**  **3.2** identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each  **3.3** compare the structure and function of plant and animal cells  **3.6** describe the organization of cells into tissues, organs, and systems | |
| **Learning Goals:**  We are learning to identify the structures and organelles in both plants and animal cells through specimen analysis and model construction. | **Success Criteria:**  We will be successful when we assemble a model that accurately represents the structure and organelles of a plant or animal cell. |
| **Lesson Overview:**  Students will examine the basic structure and discuss the functions of plant and animal cells and cell processes using Easi-Scope. After collecting and examining various specimens from their local environment, students will be given the opportunity to demonstrate their understanding of the structure of plant and animals cells by printing and constructing cells using organelles made by a 3D printer.  Students will further develop their knowledge of organisms by focusing on the structure and function of cells in plants and animals. Opportunities will exist to explore plant and animal cell specimens using Easi-Scope and to construct a 3D model of a plant and/or animal cell that accurately represents the structure and organelles using components printed by a 3D printer. | |
| **Materials and Technology:**   * Easi-Scope * 3D printer * Specimens collected (supplied by teacher/student or collected as group “nature walk”) * Bio Digital Account (teacher and students required – Free) ([www.biodigital.com](http://www.biodigital.com)) * Cells & Organelles Match Diagnostic * Tinkercad Account (teacher and students required – Free) ([www.tinkercad.com](http://www.tinkercad.com)) * Thingiverse Account (teacher and students required - Free) ([www.thingiverse.com](http://www.thingiverse.com)) * Garden gloves, plastic bags (Ziploc) | |
| **Student Accommodations/Modifications:**   * One to one support * Quiet space * Extra time * Small group instruction * Modelling | **Lesson will be differentiated by:**   * **Content, specifically:** * Focus on structure only * Focus on one type of cell * Provide pre made photographs * **Process, specifically:** * The choice to label find photographs and then label * **Product, specifically:** * Cells can be made using Jell-O, mason jars, and other objects to represent organelles * **Environment, specifically:** * Students can be offered a quieter work space |
| **MINDS ON: Getting Started** | |
| The lesson will begin by displaying a virtual human on the whiteboard using [Bio Digital](https://human.biodigital.com/). The teacher will begin by asking a few general questions – “*What do you see?”* Student answers will be vague – “*A person, a human etc*.” The teacher should encourage students to use scientific terminology and be specific in their answers. The teacher will then remove the first layer of skin, revealing organs, bones, and major systems before asking again, “*What do you see?”* Students should identify bones, organs, and hopefully some systems. Again, the teacher will remove a few layers of the human body, revealing the heart. The teacher will ask, “*What do you see*?” The students will answer, “*the heart*.” The teacher will press and guide conversation until ultimately the students arrive at the conclusion that they are looking at cells – the basic unit of life.  The teacher will then show the “[Introductory to Cells](https://www.youtube.com/watch?v=gFuEo2ccTPA)” video. While students are watching the video, the teacher will pass *Cells & Organelles Match Diagnostic* sheet. When the video concludes, the teacher informs the students that they will be examining real cells, both plant and animal, using microscopes. They will be “*passing through the cell membrane to explore organelles and processes up close.”* | |
| **ACTION: Working on it** | |
| Inform students that they will be going on a nature walk to collect plant samples for their research. Discuss the importance of collecting a variety of samples (dead, alive, species). Have students wear appropriate gloves and footwear, remind them of poison ivy, and provide them with collection bags. When students return from the walk they will be broken into small groups and given a Chromebook and Easi-Scope**.** Their task is to photograph plant and animal (skin) cells and save them. Encourage students to experiment with different lighting.  When groups have collected a sufficient (3 of cell type) they are to label their pictures using Paint, Adobe, or any other photo editing program. To do so successfully, students will need to explore resources (text, online) to determine the proper organelles and physical features of the cell. Groups will leave their screens open with their labeled photographs on screen and engage in a gallery walk. The teacher will then guide a brief class discussion about some of the challenges photographing cells – *“How does lighting change the image, were any organelles harder to capture than others, what differences exist between animal and plant cells? How does the structure of the cell change if it is decomposed?”*  Inform students that they will be constructing a model that accurately represents all of the organelles in a plant or animal cell. In small groups, students will design the parts of a cell using Tinkercad. This can be an arduous process, therefore it’s encouraged that some organelles by downloaded and enabled for printing using Thingiverse. During this time, the teacher will offer technical help to those that require it, field any questions, and record anecdotal notes. | |
| **CONSOLIDATION: Reflecting and Connecting** | |
| After students have downloaded and created the necessary components for their respective cells, they will print them using the 3D printer. When the pieces have been printed, they will be assembled and labelled appropriately. Groups will then display their virtual model on the screen and present their printed 3D model to the class. During the presentations, the students will identify the parts of the cell. The teacher will ask questions regarding cell processes to gain insight of students understanding of osmosis, diffusion, and other cell processes. When all presentations have been done, the grade 5 class will be invited to walk around and discuss the models with the grade 8 creators. | |