

Researching Type I Diabetes

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Table of Contents

Teacher Guide

I. Overview	3
II. Science Background	4
III. Student Outcomes	5
IV. Learning Objective	5
V. Time Requirements	5
VI. Advance Preparation	6
VII. Materials and Equipment	6
VIII. Student Prior Knowledge and Skills	6
IX. What is Expected from Students	6
X. Anticipated Results	7
XI. Classroom Discussion	7
XII. Assessment	7
XIII. References	8

Student Section

I. Rationale	9
II. Materials	9
III. Procedure	10
IV. Data Collection	

TEACHER GUIDE

The following Quebec Ministry of Education, Leisure, and Sport (MELS) Competencies for Science and Technology courses are addressed in this unit:

COMPETENCY 1 (C1): Seeks answers or solutions to scientific or technological problems.

COMPETENCY 2 (C2): Makes the most of his/her knowledge of science and technology.

COMPETENCY 3 (C3): Communicates in the languages used in science and technology.

I. Overview

The scientific concepts covered in this unit include the immunoregulation of Type I Diabetes, the use of the non-obese diabetic (NOD) mouse animal model, major structures of the immune system and their dissection, and fundamental flow cytometry concepts. All of these concepts are chosen for instruction as a direct result of the summer laboratory experience in the Piccirillo Immunoregulation Laboratory at McGill University.

There are several lessons in this curriculum unit that can be incorporated into a number of different biology courses from general Biology to A.P. Biology. This unit begins with a roundhouse diagram activity that can be used u

Additionally, this laboratory activity will build upon prior dissecting experiences to further develop fine-motor skills. Then, the teacher demonstrates flow cytometry using a multi-media, internet-based resource. This activity reinforces the theory learned in the roundhouse diagram component of the unit presented at the beginning of this curriculum unit. Finally, the students synthesize all of the knowledge they acquired in the previous

prevent other immune cells from attacking and destroying the pancreatic beta cells. Dendritic cells are immune system cells that are antigen presenting, in the case of T1D they are thought to be involved in presenting the pancreatic beta cells to CD4+FoxP3- T cells for cell destruction.

As suggested by the name, flow cytometry, makes measurements of cells in a flow system. The cells in a flow cytometer are delivered singly past a light that is focused at the point of measurement. The cells scatter the light and different wavelengths and scattering patterns are recorded and analyzed by flow cytometry software. Cell size, complexity, health, and phenotype are just a few of the parameters that can be measured by this powerful tool. This is especially useful in the study of T1D because of the number of distinct cell populations involved in the disease.

III. Student Outcomes

approximately 3 hours including group work, research done in class, and PowerPoint preparation and presentation.

VI. Advanced Preparation

For the **Roundhouse Diagram** activity photocopy classroom sets of the Roundhouse Diagram template and assessment tool. See Student Section.

For the **Persuasive Writing** activity photocopy classroom sets of the NOD mouse handout and self-assessment rubric. See Student Section.

For the

flow cytometry. Students should be able to apply their knowledge of immune cell types and immune structures in interpreting basic flow cytometry data.

X. Anticipated Results

Answers to the **Mouse Dissection** Analysis and Conclusion questions and the **Flow Cytometry** postviewing questions are found in the Science Background Section.

XI. Classroom Discussion

Prior-Knowledge Questions

1. What is the name of the organ that produces insulin?

Answer: The Pancreas

2. What is the role of insulin in the body?

Answer: Insulin regulates the amount of glucose in the blood.

3. What is meant by antigenic specificity?

Answer: The ability of an antibody to distinguish between protein molecules that differ in only a single amino acid.

XIII. References

Murphy, K., Travers, P., and Walport, M.: (2008) Janeway's Immunobiology. 7th Ed. New York: Garland Science.

Sakaguchi, S., Yamaguchi, T., Nomura, T., and Ono, M.: Regulatory T Cells and Immune Tolerance. Cell. 2008.05.009.

Chatenoud, L., and Bach, J.F.: Regulatory T Cells in the Control of Autoimmune Diabetes: The Case of the NOD Mouse. International Reviews of Immunology, 24: 247-267, 2005.

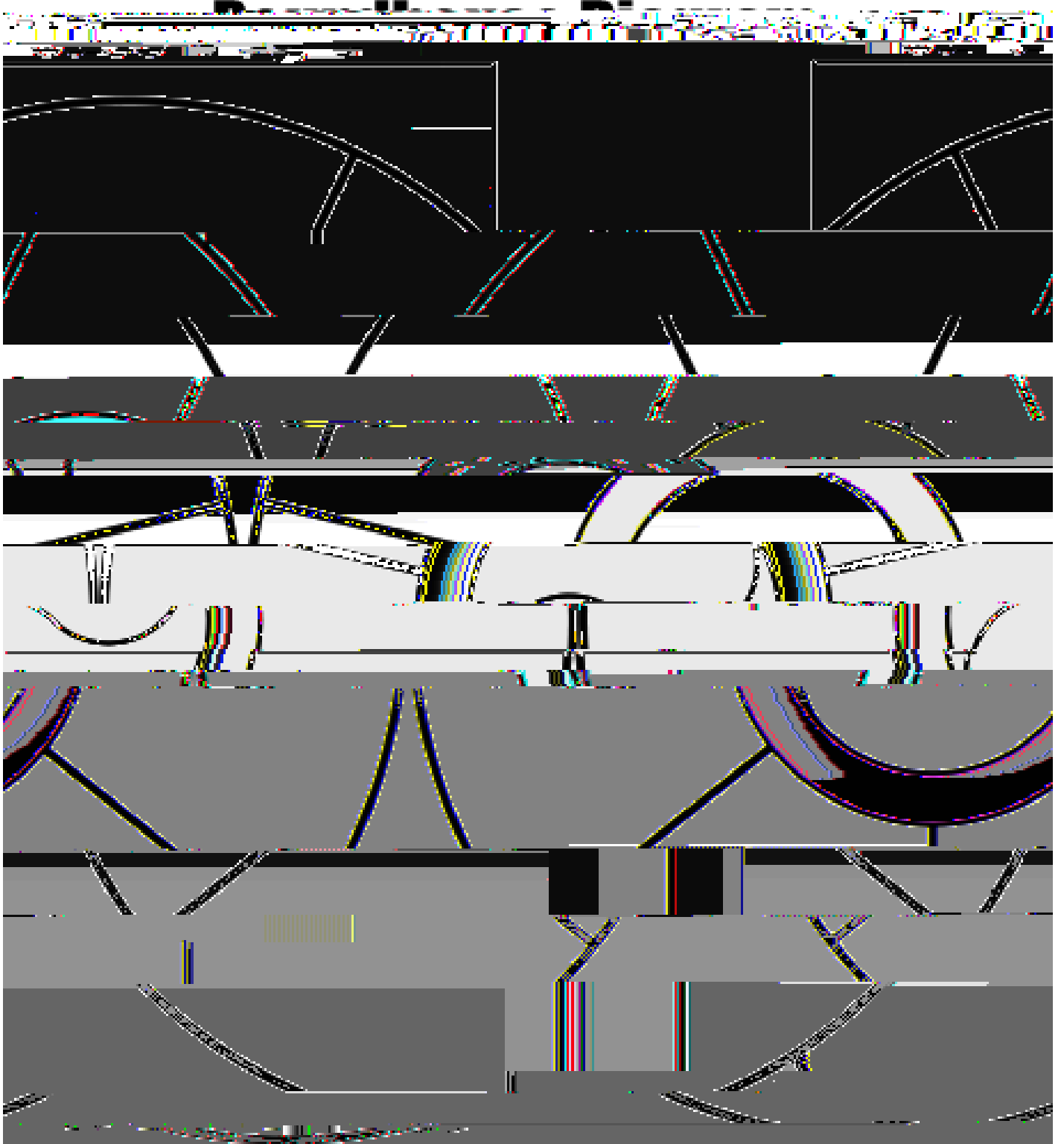
Hackney M.W. and Ward, R.E., How-To-Learn Biology via Roundhouse Diagrams, The American Biology Teacher, 64:7: 525-533, 2002.

Yashon, Ronnee., Case Studies in Bioethics, self-published, 2002.

<http://pzweb.harvard.edu/Research/RubricsSelfPE.htm>

http://www.jdrf.org/index.cfm?page_id=101982

Name: _____



Goals: _____

Name: _____

Marking Parameter	Roundhouse Diagram Marking Scale									
	1 missing	2 partially proficient	3 proficient	4 good	5 exemplary	6	7	8	9	10
Goals are clearly and neatly stated below the diagram	10 Marks									
The title clearly cover the concepts stated in the diagram	Use of the "and" and "of"									
The diagram includes the necessary key concepts	7 images and text chunks on the diagram									
There are seven clearly defined concepts in the diagram	7 cells involved in T1D are clearly presented									
The concepts are clearly and accurately stated	7 clearly and accurately written concepts on the diagram									
There is an image in each section of the diagram which clearly and accurately represents the concept	Image correlates to the function of the cell type									
The space is well used and the diagram is not too crowded	Text can be read, image can be understood.									
The overall design is aesthetically pleasing in terms of balance, clarity, technique	Use of colour, neatness, proportionality of text and image									
Creativity is evidenced	Artistic talent, humour, logic, organization									
Overall impression of student work	Evidence of effort, neatness, relative performance									
TOTAL MARKS	/100									

McGill University and affiliated hospitals follow the guidelines established by the Canadian Council on Animal Care. All research, testing, and teaching programs involving the use of animals must be reviewed prior to the start of any experimental work to ensure that the animals are humanely cared for and that the “3R” tenet is respected: **replacing**

Questions for discussion within your group

1. If you were Kelly, how would you respond to Mr. Judson?

**Persuasive Essay Rubric: Use of the NOD Mouse in Diabetes Research
Self-Evaluation a**

Criteria	4	3	2	1
The Claim				

Lesson 3: Mouse Dissection Lab

Procedure:

Part I: Initial incisions, location and dissection of inguinal lymph nodes

1. Obtain a mouse, dissecting tray, dissecting kit and gloves from your teacher.
2. Fix the mouse on a flat surface (dissecting tray) with belly facing up using dissection pins. See Figure 1 below.
3. Using your forceps, lift the skin near the groin area. Using your scissors, cut only the skin beginning from the groin area along the midline of the body

Lesson 4: Flow Cytometry Video

Instructions: Prior to viewing the video, please define the following vocabulary terms in the space provided. A starting point for your researching and defining these terms is:

http://en.wikipedia.org/wiki/Flow_cytometry

Flow	
Cyto	
Metry	

Lesson 5: T1D WebQuest

Instructions: After you have been placed you in a specific stakeholder group all the instructions for this activity are found at:

<http://questgarden.com/q/T1D>

IV. Data Collection

Lesson 3: Mouse Dissection Lab

As you isolate and remove the lymphatic structures (inguinal lymph node, spleen, pancreas, and thymus), make sketches of them in your lab notebook.

V. Discussion and Analysis

Lesson 3: Mouse Dissection Lab

You are to submit a complete lab report on for the mouse dissection.