

# Supplemental Material

*CBE—Life Sciences Education*

Esquibel *et al.*

# Supplemental Material

## 1. QB@CC Leadership Structure:

- [Eight Steering Committee and seven Advisory Board members](#)
- [Institutional and Organizational Partners](#)

## 2. An example of a published Incubator module page is included below as screenshots.

The screenshot shows the top portion of a resource page on the QUBES website. The header includes the QUBES logo and navigation links for Resources, Community, and Services. The main title of the resource is "Sizes, Scales and Specialization: Using Relative Proportions and Scientific Notation to Highlight the Diversity of Cell Types". The author(s) listed are Heather Seitz<sup>1</sup>, Jillian Marie Miller<sup>2</sup>, and Joseph Esquibel<sup>3</sup>. The authors' affiliations are: 1. Johnson County Community College, 2. Roane State Community College, and 3. Lansing Community College. The page includes a "Collect" button, a "Watch resource" button, and social media sharing options for Facebook, Twitter, LinkedIn, and Pinterest. A summary states: "This module explores how cell size and shape varies across cell types in the human body by having students calculate relative proportions of numbers in scientific notation." The license is CC Attribution-ShareAlike 4.0 International. The version is 2.0, published on 15 Apr 2021. A list of tags includes: Publication, Article, Audience Level, High School, Undergraduate, Introductory, Non-majors, Majors, Instructional Setting, Lecture, Lab, Activity Length, 1 Hour, More than 1 hour, Accessibility, Exponents, Ratios, Cells, qbcc, manipulate equations, and Cellular and Molecular Biology. On the right side, there are statistics: 2396 total view(s), 339 download(s), and 0 comment(s). There are buttons for "Download" and "Adapt" (1).

This screenshot shows a section of the resource page focusing on visual accommodations. It lists "Visual Accommodations" as "converting units" and "changing scales". Below this, a blue box contains a note: "from project QB@CC Module 1 Final. This is a live resource with the page and content publicly available. Manage this resource." The top of the page is partially visible, showing the title and author information.

This screenshot shows the "Description" section of the resource page. On the left, there is a sidebar with navigation links: Description, Version History, File Contents, Views/Downloads, Adaptations, and Comments. The main content area is titled "Description" and contains the following text: "Size, Scales, and Specialization was developed as part of an effort by the Quantitative Biology at Community Colleges group to provide materials that incorporate mathematical concepts into biology courses. The activity uses published estimates of cell type numbers in the human body along with size, density and weight as a lens to have students calculate ratios, explore exponents, and better understand how the various cell types contribute to an average human's total weight and size. The activity is applicable for majors and non-majors biology courses, and maps to Chapter 4 of the OpenStax Biology 2e textbook. This activity could also be used in a mathematics course as a biologically relevant example. The activity contains a pre-assessment to gauge student understanding of the material and provides an opportunity for students to predict the number of various cell types, as well as the mass of various cell types, in the human body. This prediction activity is followed with a guided approach to calculating these values. After guiding the students in this activity, students will then have a chance to practice the

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Sizes, Scales and Specialization: Using Relative Proportions and Scientific Notation to Highlight the Diversity of Cell Types

Download Adapt 1

Author(s): Heather Seitz<sup>1</sup>, Jillian Marie Miller<sup>2</sup>, Joseph Esquibel<sup>3</sup>

1. Johnson County Community College 2. Roane State Community College 3. Lansing Community College

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activity, students will then have a chance to practice the activity on a new set of cell data provided.

After completing this module students should be able to:

- Compare and contrast the structure and function of different cell types.
  - List the largest and the smallest cells in the body based on number.
  - List the largest and the smallest cells in the body based on mass.
- Describe the advantages of specialization in eukaryotic cells.
  - Give examples of how specialization in cell types affects cell size (volume) and shape.
- Perform measurements and conversions using the metric system.
  - Measure the scale of cell size variation in the human body
  - Calculate the relative proportions of cell types in the human body by mass and frequency

Notes

This version has an updated title to highlight the math topics more appropriately to entice math faculty to use the resource.

Cite this work

Researchers should cite this work as follows:

Heather Seitz, Jillian Marie Miller, Joseph Esquibel (2021). Sizes, Scales and Specialization: Using Relative Proportions and Scientific Notation to Highlight the Diversity of Cell Types. QB@CC Incubator Pilot, (Version 2.0). QUBES Educational Resources. doi:10.25334/9AS3-YP24

BibTex | EndNote

a. Link to the [QB@CC Modules page](#)

### 3. Survey Questions

#### INCUBATOR Survey Spring/Fall 2020

Q2 Thank you for taking a moment to provide us with your feedback about your experiences as a member of a Quantitative Biology at Community College (QB@CC) Incubator. Your responses are essential to improving future program experiences.

- Yes, take me to the survey
- No, I would like to exit the survey

*Skip To: End of Survey If Thank you for taking a moment to provide us with your feedback about your experiences as a member... = No, I would like to exit the survey*

Q3 Please rate your level of agreement to the following statements before and after participating in the QB@CC Incubator:

**Scale (SAANDSD):** Strongly Agree/Agree/Neutral/Disagree/Strongly Disagree

	Before Incubator	After Incubator
I can find useful OER materials for teaching quantitative skills online.	<b>SAANDSD</b>	<b>SAANDSD</b>

I can adapt OER materials for my classes.	<i>SAANDSD</i>	<i>SAANDSD</i>
I am willing to share teaching resources I have developed or adapted with the participants in this Incubator.	<i>SAANDSD</i>	<i>SAANDSD</i>
I am willing to share teaching resources I have personally developed or adapted publicly for anyone to use.	<i>SAANDSD</i>	<i>SAANDSD</i>

Q4 Now that you have completed, or nearly completed, your Incubator experience, please rate your level of agreement to the following statements.

**Scale (SAANDSD):** Strongly Agree/Agree/Neutral/Disagree/Strongly Disagree

- Participating in this Incubator allowed me to work with colleagues whom I would not otherwise have an opportunity to meet.
- Having pedagogical conversations during our synchronous meetings is valuable.
- Working with peers from a variety of instructional settings is valuable.
- Participating in this Incubator enhanced my ability to teach a quantitative biology concept in my classroom.
- Participating in this Incubator increased my knowledge of quantitative teaching resources.

Q5 Please give an example of how your thinking about teaching has changed since participating in the QB@CC Incubator:

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Q6 Do you plan to use the lesson created in the incubator in your classroom?

- Yes
- No

*Skip To: Q8 If Do you plan to use the lesson created in the incubator in your classroom? = No*

*Skip To: Q7 If Do you plan to use the lesson created in the incubator in your classroom? = Yes*

Q7 How easy do you think it will be to implement your Incubator lesson in your classroom?

- Difficulty to implement
- Moderately difficult to implement
- Easy to implement
- Very easy to implement
- Not sure.

*Skip To: Q9 If How easy do you think it will be to implement your Incubator lesson in your classroom? = Difficulty to implement*

*Skip To: Q9 If How easy do you think it will be to implement your Incubator lesson in your classroom? = Moderately difficult to implement*

*Skip To: Q9 If How easy do you think it will be to implement your Incubator lesson in your classroom? = Easy to implement*

*Skip To: Q9 If How easy do you think it will be to implement your Incubator lesson in your classroom? = Very easy to implement*

*Skip To: Q9 If How easy do you think it will be to implement your Incubator lesson in your classroom? = Not sure.*

Q8 Why will you not be implementing your lesson in your classroom?

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Q9 Which of the following describes your institution's format for Summer 2020 classes? (Check all that apply)

- Online synchronous classes
- Online asynchronous classes
- Hybrid model (combination of face-to-face & distance education)
- Face-to-face
- Other: \_\_\_\_\_

Q10 If known, which of the following describes your institution's format for Fall 2020 classes? (Check all that apply)

- Decisions have not been made for fall classes yet
- Online synchronous classes
- Online asynchronous classes
- Hybrid model (combination of face-to-face & distance education)
- Face-to-face
- Other: \_\_\_\_\_

Q11 As a result of participating in the February 2020 workshop and/or your Incubator group, how will you be using or developing open education resources (OER) in your classroom?

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Q12 In what ways have the global pandemic impacted your teaching (including participation in this Incubator group)?

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Q13 Please share any suggestions for future Incubator/workshop topics.

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## **Incomplete INCUBATOR Survey**

Q2 We realize that participating in an Incubator is a substantial time commitment and that unforeseen circumstances can make completion difficult. Please help us reduce barriers to completion by sharing your experience, and we hope you will participate in future QB@CC events as you are able. Your responses are essential to improving future program experiences.

- Yes, take me to the survey
- No, I would like to exit the survey

Q3 What would you say were the main reasons you were not able to continue with the Incubator?

- Lack of time
- Unforeseen changes to your work/schedule
- Group dynamics (other participants not responding)
- Ambiguous instructions/leadership/goals
- Changes in home/family obligations
- Health issues
- Other: \_\_\_\_\_

Q4 Would you consider joining an Incubator in the future?

- Yes
- No
- Maybe

Q5 What, if anything, would make that possible for you?

\_\_\_\_\_

Q6 What advice would you give someone else who was considering joining an Incubator?

\_\_\_\_\_

Q7 Please add any additional comments:

\_\_\_\_\_

Q8 Thank you for your time.

## **FMN Survey Spring 2021**

Q1 QB@CC Graphic

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Q2 Thank you for taking a moment to provide us with your feedback about your experiences as a member of the QB@CC Bridging Mathematics and Biology Faculty Mentoring Network (FMN)

on the QUBES hub led by John Starnes. The feedback you provide is essential to improving future program experiences. Your responses are anonymous and shared only in aggregate with the leadership team.

- o Yes, take me to the survey
- o No, I would like to exit the survey

*Skip To: End of Survey If Thank you for taking a moment to provide us with your feedback about your experience as a member...=No, I would like to exit the survey*

Q3 Which module(s) did you teach/modify/implement while participating in the FMN? (Please select all that apply)

- Sizes, Scales and Specialization: Using Relative Proportions and Scientific Notation to Highlight the Diversity of Cell Types
- Graphing bacterial growth rates: semi-log graphs v linear graphs
- Big Data, Graphs, and Prediction
- Why Cells Change Weight: Demonstrating Linear Regression Through an Osmosis Experiment
- The Perfect Brew: An Activity Demonstrating Cell Counting and Hemocytometer Use
- Using Linear Regression to Explore Environmental Factors Affecting Vector-borne Diseases
- Why does Blood Flow Change? Investigating the Math of Blood Flow Dynamics
- Why are Cells Small? Surface Area to Volume Ratio
- Other: \_\_\_\_\_

Q4 Please rate your level of agreement to the following statements before and after participating in the FMN:

**Scale (SAANDSD):** Strongly Agree/Agree/Neutral/Disagree/Strongly Disagree

	Before FMN	After FMN
I can find useful OER materials for teaching quantitative skills online.	<b>SAANDSD</b>	<b>SAANDSD</b>
I can adapt OER materials for my classes.	<b>SAANDSD</b>	<b>SAANDSD</b>
I am willing to share teaching resources I have developed or adapted with the participants in this FMN.	<b>SAANDSD</b>	<b>SAANDSD</b>
I am willing to share teaching resources I have personally developed or adapted publicly for anyone to use.	<b>SAANDSD</b>	<b>SAANDSD</b>

Q5 Now that you have completed, or nearly completed, your FMN experience, please rate your level of agreement to the following statements.

**Scale (SAANDSD):** Strongly Agree/Agree/Neutral/Disagree/Strongly Disagree

- Participating in this FMN allowed me to work with colleagues whom I would not otherwise have an opportunity to meet.
- Having pedagogical conversations during our synchronous meetings is valuable.
- Working with peers from a variety of instructional settings is valuable.
- Participating in this FMN enhanced my ability to teach a quantitative biology concept in my classroom.
- Participating in this FMN increased my knowledge of quantitative teaching resources.

Q5 Please give an example of how your thinking about teaching has changed since participating in the FMN:

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Q6 In the future, do you plan to use the lesson you adapted in the FMN in your classroom?

- Yes
- No

*Skip To: Q8 If In the future, do you plan to use the lesson you adapted in the FMN in your classroom? = No*

*Skip To: Q7 If In the future, do you plan to use the lesson you adapted in the FMN in your classroom? = Yes*

Q7 How easy do you think it will be to implement your adapted FMN lesson in your classroom?

- Difficulty to implement
- Moderately difficult to implement
- Easy to implement
- Very easy to implement
- Not sure.

*Skip To: Q9 If How easy do you think it will be to implement your adapted FMN lesson in your classroom? = Difficulty to implement*

*Skip To: Q9 If How easy do you think it will be to implement your adapted FMN lesson in your classroom? = Moderately difficult to implement*

*Skip To: Q9 If How easy do you think it will be to implement your adapted FMN lesson in your classroom? = Easy to implement*

*Skip To: Q9 If How easy do you think it will be to implement your adapted FMN lesson in your classroom? = Very easy to implement*



*Skip To: Q9 If How easy do you think it will be to implement your adapted FMN lesson in your classroom? = Not sure.*

Q8 Why will you not be implementing your adapted FMN lesson in your classroom?

---

Q9 Which of the following best describes your institution's format for **Summer** 2021 classes?  
(Check all that apply)

- Decisions have not been made for classes yet
- Online synchronous classes
- Online asynchronous classes
- Hybrid model (combination of face-to-face & distance education)
- Face-to-face, in-person
- Other: \_\_\_\_\_

Q10 If known, which of the following describes your institution's format for **Fall** 2021 classes?  
(Check all that apply)

- Decisions have not been made for classes yet
- Online synchronous classes
- Online asynchronous classes
- Hybrid model (combination of face-to-face & distance education)
- Face-to-face, in-person
- Other: \_\_\_\_\_

Q11 As a result of participating in the FMN, how will you be using, adapting, or developing open education resources (OER) in your classroom?

Q12 In what ways have the global pandemic impacted your teaching (including participation in this FMN)?

---

Q13 Please share any suggestions for future FMN topics.

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**4. List of QB@CC Community Colleges and four-year institutions** (until Spring 2022)

Biology and Mathematics faculty from thirty-four community colleges and six 4Y institutions participated in the Incubators and the FMNs since February 2020.

1.	Arkansas State University Newport, AR
2.	Baton Rouge Community College, LA
3.	Blue Ridge Community College, VA
4.	Central New Mexico Community College, NM
5.	Collin College, TX*
6.	Christopher Newport University, VA
7.	Dyersburg State Community College, TN
8.	Everett Community College, WA*
9.	Evergreen Valley College, CA*
10.	Florida Polytechnic University, FL*
11.	Fox Valley Technical College, WI**
12.	GateWay Community College, AZ
13.	Harford Community College, MD
14.	Harold Washington College, IL
15.	Horry-Georgetown Technical College, SC
16.	Kansas City Kansas Community College, KS
17.	Lake Washington Institute of Technology, WA*
18.	Lansing Community College, MI
19.	Loyola Marymount University, CA*
20.	Maysville Community & Technical College, KY
21.	Montgomery College, MD
22.	Nashville State Community College, TN
23.	NMSU Carlsbad, NM
24.	Norfolk State University, VA
25.	Northshore Technical Community College, LA
26.	Northwestern State University of Louisiana, LA*
27.	Passaic County Community College, NJ
28.	Pennsylvania College of Health Sciences, PA
29.	Perimeter College at Georgia State University, GA**
30.	Pierce College, WA
31.	Raritan Valley Community College, NJ
32.	Roane State Community College, TN
33.	Santa Fe College, FL**
34.	Sinclair Community College, OH*
35.	South Puget Sound Community College, WA*
36.	South Central Kentucky Community & Technical College, KY
37.	Truman State University, MO
38.	Union County College, NJ*
39.	University of the Fraser Valley, BC, Canada <sup>#</sup>
40.	Waubensee College, IL

\* FMN participant

\*\* Incubator and FMN participant

# formerly a 2-year college and the only participant in the network outside of the United States.

## 5. Additional quotes from the survey about Changes to Teaching

Quote 1: “Working with Math faculty at my institution to use similar language when discussing quantitative concepts”

Quote 2: “I have learned the importance of collaborating with math faculty to strengthen a biological concept/exercise”

Quote 3: “Participation in QB@CC has reaffirmed by thought that cross-collaboration across different subject matter is important. When working with a colleague from your college/school, we all teach the same students. Being able to convey the same learning outcomes in the same way is important for student growth and advancement”

Quote 4: “My thinking about teaching hasn't really changed. I have always thought that there should be more connection between math skills and where they are used in other disciplines. I am much more aware of language differences between fields of study than I was prior to this experience. I am much more confident in my ability to find, adapt, and implement oer resources as a result of participating in this project”

Quote 5: “I have a better understanding of how the math that I teach is used in a real world science application. I also understand the importance of showing students connections between math and science”

Quote 6: “I find it easier to give context to the resources I used, participating forces me to adapt them for my class and use them. I would not have taught that content in the same manner had I not participated”


## 6. Table with a list of quantitative skills valued by biology faculty.

Distribution of faculty valued quantitative skills (LoRe, 2019) addressed in the QB@CC Modules. The quantitative skills covered in each module were determined by the module's authors and by the SC members.


	Topic	Resources
Quantitative Skills	Interpret Graphs	10
	Create Graphs	8
	Manipulate Equations	6

	Find and modify scale	5
	Convert units of measure	5
	Interpret Tables	5
	Understand rates of change	4
	Use statistics to test when....	2
	Use elementary functions	2
	Choose an appropriate model	2
	Explain descriptive statistics	2
	Make probability calculations	1
	Estimate accuracy of answer/calculation	1


## 7. Sample list of supporting resources to implement a published Incubator module.



[Resources](#) [Community](#) [Services](#)

[About](#) [News & Activities](#) [Help](#) [Q](#) 

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### Sizes, Scales and Specialization: Using Relative Proportions and Scientific Notation to Highlight the Diversity of Cell Types

Author(s): Heather Seitz<sup>1</sup>, Jillian Marie Miller<sup>2</sup>, Joseph Esquibel<sup>3</sup>

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Download

Adapt 1

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- Description
- Version History
- ▶ File Contents
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- Adaptations
- Comments

### Supporting Docs

-  Copy of SSS Activity - Part 3 Cards.docx (DOCX | 7 KB)
-  Final Background Information for SSS Activity.docx (DOCX | 24 KB)
-  Final Facilitation Guide and Answer Key for SSS activity.docx (DOCX | 29 KB)
-  Final SSS Discussion and Data Slides.pptx (PPTX | 524 KB)
-  Final Student Handout for SSS activity.docx (DOCX | 18 KB)
-  SSS Activity - Part 1 Cards.docx (DOCX | 14 KB)
-  SSS Activity - Part 2 Cards.docx (DOCX | 14 KB)