

**Metabolism:**  
**Cytochrome C in Humans Compared to Other Species Using Bioinformatics**  
*Instructor Guide*

**Introduction:**

**Course:** This activity is designed for Human Physiology.

**Time:** ~3 hours, although it can be shortened to 1.5 hours.

**Materials:** activity documents, computers with internet connection

**Student preparation:** knowledge of metabolic process in humans, translation and proteins, computer literacy

**Summary:** This activity compares the role of cytochrome C in metabolism for different species using bioinformatics.

**Purpose:**

1. Understand and use bioinformatics with the programs BLAST and Seaview.
2. Compare and contrast amino acid sequences of cytochrome C in humans, other animals and bacteria.
3. Relate amino acid sequences of cytochrome C from various species to genome evolution & protein function.

**Resources:**

PPT (for instructor): Introduction, results and conclusion of the activity

Student Activity: handout for student

Student Activity with answers (for instructor)

Appendix: handout for student needed to complete activity

Videos (embedded in PPT):

- C-DEBI introduction:  
<https://www.youtube.com/watch?v=wiYzGL4iTY8&feature=youtu.be>
- Exercise 1 demonstration: <http://youtu.be/yv7Tbo3XyOw>
- Exercise 2 demonstration: [http://youtu.be/xY\\_FOkSfhu0](http://youtu.be/xY_FOkSfhu0)
- Exercise 3 demonstration: <http://youtu.be/-XfF8sJaZ-c>

**Activity Outline**

1. Instructor introduces the activity (~20 min)
  - a. Use PPT as a guideline to introduce metabolism and bioinformatics
  - b. Video introduction of C-DEBI:
2. Students complete activity (~50 – 120 min)
  - a. Divide students into groups of 2 per computer
  - b. Have students follow the appropriate youtube video as they complete each of the 3 exercises. It is best if they watch a part of the video, pause it, complete that task, then continue to the next part of the video.
    - i. Exercise 1 demonstration: <http://youtu.be/yv7Tbo3XyOw>
    - ii. Exercise 2 demonstration: [http://youtu.be/xY\\_FOkSfhu0](http://youtu.be/xY_FOkSfhu0)
    - iii. Exercise 3 demonstration: <http://youtu.be/-XfF8sJaZ-c>
  - c. Students complete the 3 exercises in the activity

Note: To reduce time, you may group 2 pairs of students together for a larger group of 4. Both pairs of students complete exercise 1. Then one pair completes exercise 2. The other pair completes exercise 3. All 4 students then

explain their exercise to each other. All 4 students complete conclusion together.

3. Instructor reviews activity with the students (~20 min)
  - a. Use PPT to review results and discussion

**TOOLKIT CREDITS:**

Developed by Angela Gee, (Los Angeles Trade Tech Community College, CA) and Marissa Pantastico-Caldas, Los Angeles Trade Tech Community College (CA) with data and guidance by John Kirkpatrick (University of Rhode Island, RI) with and support by the rest of the C-DEBI Collaborative Toolkit Team.

**WEBSITE:**

[http://www.coexploration.org/C-DEBI/toolkits\\_biology.html](http://www.coexploration.org/C-DEBI/toolkits_biology.html)