***E.coli*Metabolic Core Model**

**Expectations**

***E.coli* core model** - Reconstruction and Use of Microbial Metabolic Networks: the Core Escherichia coli Metabolic Model as an Educational Guide by Orth, Fleming, and Palsson (2010)  
  
**Learning Objectives**Each student should be able to:

* Describe the glycolysis pathway in the core model.
* Describe the TCA cycle in the core model.
* Explain gluconeogenesis.
* Describe the pentose phosphate pathway in the core model.
* Describe the glycoxylate cycle and anapleurotic  pathways in the core model.
* Describe the oxidative phosphorylation and electron transport chain pathways in the core model.
* Describe the fermentation pathways in the core model.
* Describe the nitrogen metabolism pathways in the core model.

**Prerequisites**

* Course Introduction
* Matlab Tutorial
* Flux Balance Analysis Overview
* COBRA Tolbox

**Resources**

**Required Readings**

* [Reconstruction and Use of Microbial Metabolic Networks: the Core Escherichia coli Metabolic Model as an Educational Guide by Orth, Fleming, and Palsson (2010) - **Sections 1-4**](http://orbilu.uni.lu/bitstream/10993/16532/1/OrthFleming_2009_EcoSal_Reconstruction%20and%20use%20of%20microbial%20metabolic%20networks.pdf) *(“EcoSal\_chapter\_revised.pdf”)*
* Systems Biology: Constraint-based Reconstruction and Analysis, Bernhard O. Palsson, Cambridge University Press, 2015, Chapter 17, 18 and 19.

**Classroom Activities**

**Presentations**

* Lecture Presentation *(“Tutorial Files.zip” and “Ecoli Metabolic Core – 2021.pdf”*)
* Supporting Matlab Files (*“Metabolic Core Matlab Files – 2021.pdf”*)
* Picture of legacy *E.coli* core model (“*Orth-2010-What is flux balance-Supplementary Tutorial-Figure 1.pdf”*)
* Picture of Escher *E.coli* core model (“*Escher\_ecoli\_core\_map.pdf”*)

**Reinforcement Activities**

**Tutorials**

* *E.coli* beginner tutorial (updated)
  + “tutorial\_ecoliCoreModel\_complete.pdf
  + tutorial\_ecoliCoreModel\_part1.mlx
  + tutorial\_ecoliCoreModel\_part2.mlx
  + tutorial\_ecoliCoreModel\_part3.mlx
* OpenCobra Tutorials
  + [E.coli Core Model for Beginners (PART 1)](https://opencobra.github.io/cobratoolbox/stable/tutorials/tutorialEcoliCoreModel_part1.html)
  + [E.coli Core Model for Beginners (PART 2)](https://opencobra.github.io/cobratoolbox/stable/tutorials/tutorialEcoliCoreModel_part2.html)
  + [E.coli Core Model for Beginners (PART 3)](https://opencobra.github.io/cobratoolbox/stable/tutorials/tutorialEcoliCoreModel_part3.html)

**Assessment**

**Formative Assessment**

1. Reflective Questions (Metabolic Core)
2. What is the difference between glycolysis and gluconeogenesis?
3. What reactions make-up the glycolysis pathway?
4. What metabolites are created in the glycolysis pathway?
5. What is the final metabolite created by the glycolysis pathway?
6. What are the biosynthetic precursors created by the glycolysis pathway?
7. What are the biosynthetic precursors created by the pentose phosphate pathway?
8. What is the difference between the oxidative and non-oxidative pathways of the pentose phosphate pathway?
9. What reactions make-up the pentose phosphate pathway?
10. What metabolites are created in the pentose phosphate pathway?
11. What are the different names for the TCA cycle?
12. What are the biosynthetic precursors created by the TCA cycle?
13. What is the oxidative pathway in the TCA cycle?
14. What reactions make-up the TCA cycle?
15. What metabolites are created in the TCA cycle?
16. What is the anapleurotic pathway?
17. What is the glycoxylate cycle?
18. What reactions make-up the anapleurotic pathway and the glycoxylate cycle?
19. What metabolites are created in the anapleurotic pathway and the glycoxylate cycle?
20. What reactions make-up the core models oxidative phosphoylation and electron transfer chain?
21. What metabolites are created in the core models oxidative phosphoylation and electron transfer chain?
22. What reactions make-up the fermentation pathways?
23. What metabolites are created in the fermentation pathways?
24. What are the biosynthetic precursors created by the nitrogen metabolism?
25. What reactions make-up the nitrogen metabolism?
26. What metabolites are created in the nitrogen metabolism?

**References**

1. [Reconstruction and Use of Microbial Metabolic Networks: the Core Escherichia coli Metabolic Model as an Educational Guide by Orth, Fleming, and Palsson (2010)](http://orbilu.uni.lu/bitstream/10993/16532/1/OrthFleming_2009_EcoSal_Reconstruction%20and%20use%20of%20microbial%20metabolic%20networks.pdf)
2. [Jan Koolman and Klaus-Heinrich Roehm, "Color Atlas of Biochemistry", 2nd Edition, 2005.](http://web.uni-plovdiv.bg/plamenpenchev/mag/books/biochem/Color%20Atlas%20Of%20Biochemistry%202d%20ed%20-%20Jan%20Koolman,%20Klaus-Heinrich%20Rohm.pdf)