

HUN 6305 (Nutritional Aspects of Carbohydrates) (3 credits) Spring Semester 2022

Mondays, Wednesdays / 3:00-4:15 p.m.; MAEB, room 0234

FOCUS: Characteristics, absorption, and metabolism of common carbohydrates (CHOs) in the human food chain; regulation of carbohydrate metabolism; carbohydrate metabolism in disease states

LEARNING OBJECTIVES:

- 1) Explain how dietary CHOs are digested and absorbed, or metabolized by gut bacteria (e.g., fibers)
- 2) Illustrate hormonal and non-hormonal regulation of CHO metabolism
- 3) Review the roles of glucose and other sugar transporters in CHO homeostasis
- 4) Summarize the relationship between CHO intake/metabolism and chronic disease in humans
- 5) Evaluate CHO-related research as it relates to mammalian (and human) physiology/pathophysiology
- 6) Design a CHO-based research project with physiological/pathophysiological significance

Instructor: James F. Collins, Ph.D., Professor; Food Science & Human Nutrition Department

Location/Contact Info: FSHN Bldg., Rm 441A; phone: 294-3749; email: jfcollins@ufl.edu

Office Hours: By prior arrangement (email is fine)

Textbook: None required. Instead, Power Point slides and reading assignments from various sources (e.g., textbook chapters, current review articles, etc.) will be posted for students' perusal.

Class Meetings: Classes will be discussion oriented, relating to posted PPT files and associated reading assignments, or to translational or basic-science papers from the primary literature. Dr. Collins will make the materials available to the students in advance and will also select the research papers to be covered. Attendance is encouraged and expected. **No makeup exams or quizzes will be given** (unless an emergency can be documented by the student; in this case, giving a makeup will be at the discretion of the instructor). No late assignments will be accepted. All missed assignments will be given a score of '0'.

<u>Assessment</u>	<u>Points</u>
Exam 1	100
Exam 2	100
Research Project	100 (Aims pg. [15]; presentation [25]; write up [60])
Quizzes	50 (5 x 10 points each)
Leading Research Paper Discussion	25 points
In-class Participation	25 points
<u>TOTAL POINTS AVAILABLE</u>	<u>400</u>

Grade Determination: A = 90-100%; B+ = 88-89.99%; B = 80-87.99%; C+ = 78-79.99%; C = 70-77.99%

Exams: Exams will be taken in class and will consist of a series of free response/discussion questions. The topics covered on exams will relate to the material discussed in class (in PPTs), assigned readings and research articles reviewed. The scope of answers to exam questions is at the discretion of each individual student, but they should be of sufficient length and rigor to adequately address the topic.

Research Project: Each student will select a **CHO-related research topic** of interest and prepare a mock grant application. The topic may (or may not) directly relate to the students' thesis/dissertation research topic. It would, however, be advantageous to model the proposal after the student's research project

(e.g., using similar experimental techniques and models). The focus of the project should have relevance to human health and disease. Investigations using animal models of human disease will be considered acceptable, if a strong and cogent rationale is provided (i.e., why is this species [e.g., mice] a good model for this human condition?). It is advisable that each student meet with Dr. Collins to discuss potentially acceptable topics. The scope of the project should allow completion in 2 years, and it should be conceptually modeled after an R21 grant application to the NIH ([R21 Grant Info](#)). This is an exploratory type of grant (i.e., high risk, high reward) that does not require preliminary data; just a good idea. Project topics will initially be discussed in class on Jan. 12th and specific aim pages will be peer reviewed on Jan. 31st. The research proposals will be presented by students on the last 4 days of class.

Proposal Formatting Requirements: Arial, 11-point font; margins 0.5 inches on all sides; single spaced; printed on one side. The paper must include the following sections:

- 1) Cover page with student's name, UF ID and title of grant proposal
- 2) Specific Aims page (pg. 1)- format will be discussed in class
- 3) Background and Significance (pg. 2)
- 4) Approach (pgs. 3-5), should include the following sections:
 - i) Experimental approaches and models used utilized to test central hypothesis
 - ii) Anticipated results (be thoughtful)
 - iii) Potential pitfalls (what could go wrong? - something usually does!)
 - iv) Alternative hypotheses and related experimental approaches (if, for example, the central hypothesis is disproven)
- 5) References (pg. 6)- no more than 20

Research Paper Presentation: Each student will present their research project to the class on the designated days. Each student will have 20 minutes for their presentation with 5-10 minutes for questions/discussion. The presentations should include the following elements: rationale for choosing topic; background and significance leading to the central hypothesis to be tested; the experimental approach, including methods and the model systems to be utilized; anticipated results and possible alternative hypotheses/approaches; and potential impact and future studies.

Quizzes: Five quizzes will be given on random days throughout the semester. Topics of quizzes may include information provided on PowerPoint slides, assigned readings or research papers being reviewed.

Class Schedule (subject to change)

<u>DATE</u>	<u>TOPIC/ ACTIVITY</u>
JAN	
5 (W) †	Course Intro
10 (M)	CHOs: Basic Biochemical, Metabolic and Nutritional Aspects
12 (W)	Writing Research Grants / Discussion of Research Project Topics
17 (M)	Holiday- No Class
19 (W)	GI Tract Physiology / CHO Digestion and Absorption
24 (M)	Regulation of CHO Metabolism
26 (W)	Paper Discussion (1) (Afrin)
31 (M)	Peer review of Specific Aims pages / In-class workday
FEB	
2 (W)	Paper Discussion (2) (He)
7 (M)	Glucose Transporters
9 (W)	Paper Discussion (3) (Badoloto)
14 (M)	Animal Models of CHO Metabolism
16 (W)	Paper Discussion (4) (Alshahwan) / ***Specific AIMS pages due by 3:00 p.m.***
21 (M)	Exam 1
23 (W)	Bariatric Surgery and CHO Metabolism
28 (M)	Paper Discussion (5) (Garrison)
MAR	
2 (W)	CHOs and the Gut Microbiome
7 (M)	NO CLASS (SPRING BREAK)
9 (W)	NO CLASS (SPRING BREAK)
14 (M)	Paper Discussion (6) (Eguiguren)
16 (W)	CHOs and Diabetes
21 (M)	Paper Discussion (7) (Theophilus)
23 (W)	CHOs and Cardiovascular Disease
28 (M)	Paper Discussion (8) (Krenek)
30 (W)	CHOs and Cancer
APRIL	
4 (M)	NO CLASS- EB meeting / ***Grant Proposals due by 3:00 p.m.***
6 (W)	Paper Discussion (9) (Moreno)
11 (M)	Exam 2
13 (W)	Student Grant Proposal Presentations (Afrin, He, Badoloto)
15 (W)	Student Grant Proposal Presentations (Alshahwan, Garrison)
18 (M)	Student Grant Proposal Presentations (Eguiguren, Theophilus)
20 (W)	Student Grant Proposal Presentations (Krenek, Moreno)

†M = Monday; W = Wednesday

Papers to be reviewed:

- 1) Irf2 regulates insulin production through iron-mediated Cdkal1-catalyzed tRNA modification. **Nature Comm.** doi.org/10.1038/s41467-019-14004-5.
- 2) Orally administered saccharide-sequestering nanocomplex to manage carbohydrate metabolism disorders. **Science** 7:14, 2021; DOI: 10.1126/sciadv.abf7311
- 3) Metformin Alters Upper Small Intestinal Microbiota that Impact a Glucose-SGLT1-Sensing Glucoregulatory Pathway. **Cell Metabolism** 27:101-117, 2017; <https://doi.org/10.1016/j.cmet.2017.09.019>
- 4) Dietary fructose feeds hepatic lipogenesis via microbiota-derived acetate. **Nature** 579, 2020; <https://doi.org/10.1038/s41586-020-2101-7>
- 5) Non-insulin determinant pathways maintain glucose homeostasis upon metabolic surgery. **Cell Discovery** (2018) 4:58; DOI 10.1038/s41421-018-0062-x
- 6) Precision Microbiome Modulation with Discrete Dietary Fiber Structures Directs Short-Chain Fatty Acid Production. **Cell Host & Microbe** 27, 389–404, 2020; <https://doi.org/10.1016/j.chom.2020.01.006>
- 7) Dietary sugar restriction reduces hepatic de novo lipogenesis in adolescent boys with fatty liver disease. **J Clin Invest.** 2021;131(24): e150996. <https://doi.org/10.1172/JCI150996>.
- 8) Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study. **Lancet** 390: 2050-62, 2017.
- 9) Dietary fructose improves intestinal cell survival and nutrient absorption. **Nature** 597: 263-274, 2021; <https://doi.org/10.1038/s41586-021-03827-2>

