Instructor:
Donato Romagnolo, PhD, MSc
Department of Nutritional Sciences
Contact: 303 Shantz Bldg; 626-9108; donato@u.arizona.edu

Objective of Course:
Analysis of current knowledge regarding the interactions between the intake, absorption, transport, processing, storage, catabolism and excretion of nutrients and the regulation of metabolic homeostasis in the intact organism. Emphasis areas include interrelationships between protein, carbohydrate and fat metabolism and their regulation by dietary, hormonal and genetic factors in humans. Syllabus includes topics relevant to nutritional regulation of gene expression and impact on obesity, diabetes, and cancer.

Testing: There will be 8 small quizzes, 2 midterms and a final. Dates for Midterms will be discussed with students. Date for final is the one set by The University of Arizona.

Grading: Regular grades are awarded for this course: A (90% or more), B (80% to less than 90%), C (65% to less than 80%), D (from 55% to less than 65%). E (less than 55%).

Prerequisite(s): BIOC 460 or BIOC 462A - BIOC 462B. Concurrent NSC 408.

CLASS MATERIAL: Relevant papers, reviews selected by the instructor and students presentations. Students will select from a list of topics prepared by the instructor and prepare an in-class presentation of ~ 30-40 min followed by discussion. The presentation material presented by the students will be subject of testing and made available to all students. Presenters will hand out one-page summary of the material presented. The presentations will be scheduled for the second part of the semester. The Instructor and the students will participate in evaluating the quality of the presentation based on a number of criteria including scientific quality and organization.

ATTENDANCE: Mandatory

PART 1
METABOLIC PATHWAYS
1. Review of glycolysis and Krebs cycle. Integrate glycolysis with the Krebs cycle and gluconeogenesis
2. Integrate the urea cycle, the Krebs cycle, the alanine cycle, and the Cori cycle
3. Integrate the Krebs cycle with the pathways of fatty acid synthesis. Detail the steps of fatty acid synthesis from Acetyl-CoA. Detail the steps of βeta-oxidation of fatty acids and calculate the total number of ATP molecules that can be obtained from complete oxidation, this means all the way down to the Krebs cycle and respiratory chain. Be aware of differences in the oxidation of saturated and unsaturated fatty acids. Diagram how these pathways are regulated in diabetes, i.e. what happens to gluconeogenesis, urea cycle, fatty acid metabolism. Be aware of differences between diabetes I and II.
4. Detail the pathway of absorption of fatty acids in the intestine and transport of fatty acids across the mitochondrial membrane. Study the carnitine shuttle.
5. Diagram the mechanism of glucose uptake by active transport. Diagram how incomplete oxidation of fatty acids leads to formation of ketone bodies.
6. Learn the chemical structure of palmitic acid, stearic, oleic acid, linoleic acid, linolenic acid.
7. Diagram how ethanol is metabolized and how ethanol metabolism relates to the Krebs cycle.
8. Diagram how citrate exits the mitochondria and contributes to acetyl-CoA in the cytoplasm. List of compounds for which you need to know the chemical structure of: Alanine, acetyl-CoA, pyruvate, malonyl-CoA, OAA, acetone, urea, fatty acids mentioned above, acetoacetate (a ketone body).

**PART 2**
PRINCIPLES OF GENE STRUCTURE AND REGULATION
Gene structure, Promoter regulation, transcriptional activation, chromatin remodeling, genomic vs non-genomic regulation.

**PART 3**
MOLECULAR AND NUTRITIONAL REGULATION OF GLYCOSIS
Key enzymes
Glucose transport systems in the liver
Regulation of glucose production by the liver

STRUCTURE, FUNCTION AND REGULATION OF PYRUVATE CARBOXYLASE
Treatment of Pyruvate Carboxylase Deficient Patients

PHOSPHOENOL PYRUVATE CARBOXY KINASE (PEPCK)
cAMP response unit
The role of C/EBP in Nutrient and Hormonal Regulation of Gene Expression

NUTRITIONAL AND HORMONAL REGULATION OF ENZYMES INVOLVED IN FATTY ACID SYNTHESIS
Acetyl-CoA Carboxylase (ACC), Fatty Acid Synthetase (FAS), NADPH-isocitrate dehydrogenase.

MITOCHONDRIAL BETA-OXIDATION AND REGULATION

PPAR SYSTEM AND GLUCOSE HOMEOSTASIS/ADIPOGENESIS

ROLE OF PPAR IN REGULATION OF GENE EXPRESSION
The COX-2 system
Role of PPAR in Lipid Physiology

METABOLISM AND OBESITY

OBESITY AND DIABETES

OBESITY and CANCER

EPIGENETICS AND DIET
Mechanisms and relation to nutrition and disease
Polymorphisms and homocysteine metabolism, diet and genome methylation
Short-chain fatty acids and cell proliferation
Role of PUFA in carcinogenesis

**PART 4**
Student Presentations
EXAMS: There will be 8, 15-minutes long quizzes, one for each of the topics listed in PAR1; two Midterms and a comprehensive Final.

Examples of Selected Readings

Breakdown of points for NSC602:

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