HLTH 2004 EXERCISE BIOENERGETICS

Credit Points 10

Legacy Code 400883

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Description This unit investigates exercise metabolism and related genomics and proteomics in an integrated fashion. Covering: energy pathways; metabolic control; metabolism, oxygen consumption and respiratory quotient relationships; metabolic responses to acute and chronic exercise; pathway contributions to exercise; metabolic limitations to exercise; metabolic contributions to fatigue; metabolic acidosis, cellular and systemic implications of metabolic thresholds, conditions that can alter cellular metabolism. Whilst skeletal muscle metabolism is the primary focus, liver and adipose tissue metabolism are also considered as are anabolic pathways. Students will be exposed to basic biochemical assays of interest to the exercise physiologist.

School Health Sciences

Discipline Human Movement

Student Contribution Band HECS Band 4 10cp

Check your HECS Band contribution amount via the Fees (https://www.westernsydney.edu.au/currentstudents/current_students/fees/) page.

Level Undergraduate Level 2 subject

Pre-requisite(s) NATS 1009 AND
NATS 1010 AND
SPRT 1001 AND
HLTH 1001

Equivalent Subjects BIOS 2003 - Bioenergetics of Exercise

Restrictions Students must be enrolled in 4658 Bachelor of Health Science (Sport and Exercise Science).

Assumed Knowledge

The knowledge and skills covered in the pre-requisite subjects.
In addition students are expected to have a mathematical ability equal to a passing level in the BOSTES (NSW) numeracy test. See http://www.boardofstudies.nsw.edu.au/rosa/literacy-and-numeracy-tests.html . Students whose mathematical ability is not at this level or who have not used such mathematics recently are encouraged to seek assistance early through the Mathematics Educational resource Hub (MESH). http://www.westernsydney.edu.au/mesh/mesh

Learning Outcomes

On successful completion of this subject, students should be able to:

1. Interpret the information in chemical equations, formulae, structures, as well as understand the general concepts involved in biological applications of thermodynamics, genomics, proteomics and metabolomics.
2. Explain the mechanism of action of enzymes and factors that affect rate of enzyme-controlled reactions.
3. Describe the structure and functions of DNA and RNA, the processes of replication, translation and transcription along with how rates of these to processes can be altered by exercise.
4. Detail the major concepts of aerobic, alactic and lactic energy production including regulation and integration of the metabolic pathways, as well as understand the different terminology for these energy systems.
5. Detail the factors that influence the contribution of carbohydrate, lipid and protein metabolism to the supply of energy for a range of exercise and conditions.
6. Explain the relationships between metabolism, oxygen consumption and respiratory quotient, metabolic rate, blood lactate, pH and metabolic thresholds.
7. Explain the biochemistry of metabolic acidosis and its implication for exercise performance.
8. Proficiently use basic biochemical testing equipment and understand the basis for protocol, objectivity, reliability and validity.
9. Explain the relevance of and interpret an array of biochemical assays used as part of integrated exercise and fitness testing and physiological research.
10. Calibrate equipment used in exercise biochemistry including gas analysers, blood lactate analysers.

Subject Content

Note: For all areas mentioned below the following will be covered: gender differences and changes over the life span.
1. Introduction to Chemistry, Biochemistry and Molecular Biology
a. Chemical symbols, formulae, structure representation, bonding, formula mass, moles, pH, ions, solubility, reaction equations, equilibrium vs steady state vs completion.
b. Terminology in context metabolism, catabolic, anabolic, genomics, proteomics, metabolomics
c. High Energy phosphate and High Energy Carriers.
d. Chemical thermodynamics
- Free energy
- Enthalpy
- Entropy
- spontaneous reactions
- Catalysts effect on
- energy and bonds
e. Oxidation reduction reactions
f. Energy substrates, their structures and storage in humans: CHO, Fat, protein.
g. Enzyme structure function and factors influencing rate of enzyme controlled reactions.
h. Nucleic acids and gene expression
- structure and function
- replication, translation and transcription
- The basics of The processes
- Altering rates of
- Importance in energy metabolism
- impact of Exercise on current status of research
i. The work energy relationship at a cellular level
- mechanical work
- muscle contraction energy metabolism link
- Electrical work.
2. Skeletal Muscle Energy Production Pathways and exercise
a. ATP/PC (Alactic) system
b. Anaerobic Glycolysis
c. Aerobic pathways
- Aerobic glycolysis
- Tricarboxylic acid cycle
- Oxidative Phosphorylation and The Electron transport system
- Lipolysis and Beta-oxidation of Fats
- protein and Amino acid metabolism
d. Bioenergetic shuttle systems and the adenylate kinase & deaminase reactions
e. Measuring contributions of pathways to energy of exercise

- Oxygen Consumption, Respiratory quotient, metabolic rate, blood lactate, pH and metabolic thresholds (including calculations)
- Equipment calibration and protocols - Accuracy, Objectivity, reliability, validity; Limitations
- interpretation of results
f. Metabolic responses to exercise
- Acute Exercise - The sprinter, The marathon runner and ultra-marathon runner
- chronic Exercise - sprint and Endurance running training
- Factors influencing substrate usage in Exercise
- metabolic acidosis
- The fate of lactate
- Metabolisms Contributions to central and peripheral fatigue
g. Energy metabolism integration and control
3. Differences in energy metabolism between tissues and Overview of other processes related to energy metabolism and exercise.
a. Muscle and liver
- Gluconeogenesis
- glycogen Synthesis
b. Adipose tissue and Fatty Acid synthesis
c. Amino acid and pro

Assessment

The following table summarises the standard assessment tasks for this subject. Please note this is a guide only. Assessment tasks are regularly updated, where there is a difference your Learning Guide takes precedence.

Item	Length	Percent	Threshold	Individual/ Group Task
Practical	Varied - From 5 to 20 minutes each	S/U	Y	Individual
Quiz	30 minutes maximum allowed time each.	30	N	Individual
Report	minimum 3-4 pages, 10 point Arial font single spaced	20	N	Individual
Final Exam	3 hours	50	N	Individual

Prescribed Texts

- Mougios, V., Exercise Biochemistry, Human Kinetics, 2nd Edition, 2020

Teaching Periods

Autumn

Campbelltown

Day

Subject Contact Shona Papalia (https://directory.westernsydney.edu.au/search/name/Shona Papalia/)

View timetable (https://classregistration.westernsydney.edu.au/even/timetable/?subject_code=HLTH2004_22-AUT_CA_D#subjects)