ENDEAVOUR College of Natural Health

SUBJECT OUTLINE

Subject Name:

Nutritional Biochemistry

Subject Code:

NMDF211

SECTION 1 – GENERAL INFORMATION

Award/s:		**Total Course Credit Points:**	**Level:**
	Bachelor of Health Science (Naturopathy)	128	2nd Year
	Bachelor of Health Science (Nutritional and Dietetic Medicine)	96	2nd Year
Duration:	1 Semester		
Subject is:	Core	**Subject Credit Points:**	2

Student Workload:

No. timetabled hours per week: 3	No. personal study hours per week: 2	Total hours per week: 5

Delivery Mode*:

☐ **On campus** ☒ **Online / Digital** ☐ **Blended** ☐ **Intensive**

Weekly Session^ Format/s - 1 session per week:

☒ Livestream lectures:	☐ 2 hours	☒ 3 hours	1 x 3 hour lecture/tutorial per week

*All modes are supported by the online learning management system which will include subject documents such as handouts, readings, assessment guides and e-Learning support modules.

^A 'session' is made up of 3 hours of timetabled / online study time per week unless otherwise specified. Each subject has a set number of sessions as outlined above.

Note: As they are aware, international students on a Student Visa (500) must attend livestream classes on their local campus, using the Virtual Classrooms provided.

Study Pattern:	☒ Full Time ☒ Part Time
Pre-requisites:	BIOH122, NMDF121
Co-requisites:	Nil

SECTION 2 – ACADEMIC DETAILS

Subject Rationale

This subject draws on students' understanding of biochemistry and explores the metabolic functional relevance of nutrients and food constituents in the human body. Students gain an appreciation of the clinical applications of macro and micronutrients on biochemical pathways with the aim to modulate physiological dysfunction. Students integrate their previous knowledge of food sources, deficiencies and excess of food based nutrients with the development of clinical signs while comparing a normal vs deranged metabolic status. Learners develop their clinical understanding of the role that biological oxidation, microbiome and epigenetics plays in disease processes. Students acquire knowledge about the underlying nutritional biochemical mechanisms as the origin of modern

diseases through investigation of liver detoxification pathways, neurotransmitter synthesis, antioxidant -quenching mechanisms, inflammation, and immune system interplay and novel significance of mitochondrial function. This subject deepens students' understanding of cores of clinical nutrition and diet therapy while developing their investigative and research skills in a way that will augment later nutritional medicine and clinical practicum subjects.

Learning Outcomes

1. Identify nutrient cofactors, agonists, antagonists, enzymes and sequential stages in the biochemical absorption, transport, storage, and functions of macro- and micro- nutrients in facilitating homeostatic status within the body and for preventing signs and symptoms of diseases through evidence-based nutritional intervention strategies.
2. Explain the components and relevance of microbiome and liver detoxification in a disease state along with evidence-based investigation into the clinical applications of nutrients/foods, pathways and metabolites involved for modulating diseases.
3. Describe processes of inflammation and oxidation; function of antioxidants and the impact these can have on developing physiological dysfunctions that translate into diseases.
4. Discuss the nutritional importance of mitochondria and gene expression and their modulation through dietary / nutrient support with the strategic aim to prevent metabolic dysfunction.
5. Explain the implications of deficiency/excess of nutrients and their food sources necessary in the synthesis of eicosanoids and neurotransmitters to moderate signs and symptoms of diseases.

Assessment Tasks

Type	Learning Outcomes Assessed	Session Content Delivered	Due	Weighting
Case Study – Part A Online quiz (30 minutes)	1	1 - 5	Week 6	20%
Case Study – Part B Report (500 words)	1-2	1 - 7	Week 8	30%
Final Written Exam Multiple choice, short answer, and case study questions (1.5 hours)	2-5	6 - 13	Final Examination Period	50%
All written assessments and online quizzes are due at 11:55 p.m. (AEST) Sunday and submitted through the LMS				

Prescribed Readings:

1. Gropper, S. S., Smith, J. L. & Carr, T.P. (2021) *Advanced nutrition and human metabolism* (8th ed.). Cengage Learning. [ebook available]

Recommended Readings:

1. Lord, R. S., & Bralley, J. A. (Eds.).). (2012) *Laboratory evaluations for integrative and functional medicine* (Rev. ed.). Metametrix Institute.
2. Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry* (7th ed.). W.H. Freeman.
3. Pagana, K. D., & Pagana, T. J. (2018). *Mosby's manual of diagnostic and laboratory tests* (6th ed.). Elsevier. [ebook available]
4. Stipanuk, M. H., & Caudill, M. A. (2019). *Biochemical, physiological, and molecular aspects of human nutrition* (4th ed.). Elsevier.

Subject Content

Week	Lectures	Personal Study Activities
1.	**Introduction** (Subject Outline / Subject Aims / Assessment / Teaching Resources) **Macronutrient Pharmacokinetics** • Biochemical mechanisms of digestion, absorption, and metabolism • Transport and storage physiology	**Pre Lecture** • Watch a video on Transport mechanisms and sodium potassium pump **Post Lecture** • Revision of lipid absorption and transport • Quiz •
2.	**Water Soluble Vitamin Pharmacokinetics** • Biochemical mechanisms of digestion, absorption, and metabolism • Functions • Transport and storage physiology • Cofactors, agonists and antagonists	**Pre Lecture** • Revision activities on the food sources, deficiency symptoms and excess of Vitamin Bs **Post Lecture** • Revision of Vitamin B12 absorption and transport • Quiz • Group discussion on the impact of gastric surgery on nutrient absorption •
3.	**Fat Soluble Vitamin Pharmacokinetics** • Biochemical mechanisms of digestion, absorption, and metabolism • Functions • Transport and storage physiology • Cofactors, agonists and antagonists	**Pre Lecture** • Revision activities on the food sources, deficiency symptoms and excess of fat-soluble vitamins **Post Lecture** • Reinforce understanding of activation of f Vitamin D.

		• Quiz
4.	**Macromineral Pharmacokinetics** • Biochemical mechanisms of digestion, absorption, and metabolism • Functions • Transport and storage physiology • Cofactors, agonists and antagonists • In class activity Critical discussion on 'for' and 'against' on alkaline diet	**Pre Lecture** • Nutrient charts **Post Lecture** • Quiz
5.	**Micromineral Pharmacokinetics** • Biochemical mechanisms of digestion, absorption, and metabolism • Functions • Transport and storage physiology • Cofactors, agonists and antagonists	**Pre Lecture** • Revision of food sources, deficiency signs and toxicity of microminerals **Post Lecture** Nutrient reference values (NHMRC) Absorption, storage, and transport of Iron • Reading on 'Clinical importance of Zinc' • Quiz
6.	**Microbiome Prebiotics and Probiotics** • Functions and importance of microbiome in human health • SIBO / gut dysbiosis and association with diseases • Gut-liver axis • Probiotics and prebiotics: definition, importance, sources, and their role in moderating food intolerance, immunity, and malabsorption syndromes • Introduction to microbiome testing **In Class Blended Activity** • Discussion on 'dietary sources and recipes of prebiotic and probiotic foods'	**Pre Lecture** • Revision of types of fibre and their food sources • Reading on 'Influence of diet on the gut microbiome' • Watch video on how food affects our gut **Post Lecture** • Gut revolution-watch a video (Catalyst episode) • Quiz • Watch a video by 'Microba' on 'Introduction to microbiome testing'
7.	**Liver Detoxification** • Kupffer cells • Liver Phase One Pathway • Importance of glutathione • Liver Phase Two Pathways **Alcohol detoxification** **In class blended activity: nutritional intervention to support liver detox**	**Pre Lecture** • Revise the functions and importance of liver through animated videos **Post Lecture** • Quiz • Case study-based questions • Reading on Liver function test • Learn more about 'glutathione'
8.	**Integration of Mind and Body**	**Pre Lecture**

	• HPA axis and stress systems overview • Cofactors/nutrients and foods for HPA homeostasis • Hormonal regulation of biochemical pathways • **Oestrogen clearance** **In class blended activity: intermittent fasting: a fact or fiction?**	• Revise pre-learned concepts-Endocrine systems and Stress • Watch a video to understand "impact of stress on human body" **Post Lecture** • Watch a talk on "How to make stress your friend?" • Reading and discussion on "Promoting Psychological Well-Being through an Evidence-Based Mindfulness Training Program" • Mindfulness activity with music
	NON-TEACHING WEEK (note that make-up classes may be scheduled in this week) **Semester 1** – This aligns with the week after Easter so it may fall between Weeks 6 to 8 **Semester 2 & Online students** – The non-teaching week falls between Weeks 7 and 8	
9.	**Nutrient Control of Gene Expression** • Overview of DNA structure • One carbon metabolism • Telomeres • Epigenetics • Methylation • Homocysteine • Ethics relating to testing and challenges/ considerations for patients applying for health/life insurance • In class blended activity: overview of a gene testing report	**Pre Lecture** • Watch animated videos to revise the concept of DNA structure, functions, and gene expression **Post Lecture** • Revision of epigenetics and genetics • Group discussion after Reading on 'ethics relating to testing and challenges/ considerations for patients applying for health/life insurance' • Quiz
10.	**Managing Oxidation** • Free radical generation • Food based antioxidants • Endogenous antioxidants • Regeneration / redox pathways	**Pre Lecture** • Reading on the effect of antioxidants on quenching free radicals in human body • Watch a video to revise understanding of free radicals **Post Lecture** • Revision of free radical damage • Research reading on 'the role of exercise and antioxidants in moderating oxidative stress' • Quiz
11.	**Inflammation: Underlying Mechanisms of Origins of Diseases** • Overview of essential fatty acids and food sources	**Pre Lecture** • Reading on 'disease prevention by modulating inflammation through an anti-inflammatory diet' **Post Lecture** • Quiz

	• The role of prostaglandins, thromboxane, leukotrienes, and cytokines • Association of eicosanoid related inflammation with chronic metabolic diseases • Nutrients and foods to address inflammation **In Class Blended Activity** • 24 hr self-dietary recall for list of anti-inflammatory foods/nutrients consumed	• Revision of inflammatory response • Group discussion on dietary interventions and inflammatory modulations
12.	**Neurotransmitters** • Functions and synthesis of neurotransmitters • Nutrient and cofactors required for optimal function • Relevance for mental health **In Class Blended Activity** • Develop a strategic dietary intervention plan to provide neurotransmitter modulatory support for a university student based on discussion of a research article	**Pre Lecture** • Understanding classification of neurotransmitters **Post Lecture** • Case study questions • Quiz
13.	**Mitochondrial Dysfunction** • Mitochondrial dynamics • Nutrients as cofactors to support mitochondrial pathways • Role in chronic diseases	**Pre Lecture** • Revision of cellular respiration and energy pathways • Introduction to mitochondria **Post Lecture** • Quiz • TED talk on mitochondrial dysfunction
14.	**Non-Teaching Week/Practical Examination Week 1** Note that make-up classes may be scheduled in this week	
15.	**Non-Teaching Week/Practical Examination Week 2** Note that make-up classes may be scheduled in this week	
16.	**Final Examination Week 1** Students are required to sit examinations using the Respondus Lockdown Browser software per the Examination Policy – Higher Education. Refer to the LMS for exam opening and closing times.	
17.	**Final Examination Week 2** Students are required to sit examinations using the Respondus Lockdown Browser software per the Examination Policy – Higher Education. Refer to the LMS for exam opening and closing times.	