SR4008

Nutrition, Obesity and Metabolic Health

Course Handbook
2019-20

UNIVERSITY OF
ABERDEEN

Contents

Cover image:

Confocal micrograph of fluorescently labelled HeLa cells.

Nuclei are labelled in blue, tubulin in green and actin fibres in red.

Courtesy of:

Kevin Mackenzie
Microscopy and Histology Core Facility
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http://www.abdn.ac.uk/ims/microscopy-histology

Course Summary

Obesity is a major worldwide health challenge of our time and, clearly, is linked to overnutrition. A simple answer to the problem of obesity is for individuals just to eat less. However, in the current environment, with freely available calorie-rich foods, constant environmental cues to eat and a general reduction in physical activity there is no easy way to achieve this.

In simple terms obesity is caused by an imbalance between energy intake and energy expenditure. However, this simple equation ignores the complex range of factors that control how individuals respond to today's energy rich environment. These include differences in the way we sense hunger, our capacity to store or burn energy, our response to nutrients and how circulating factors affect the function of our metabolically important tissues.

This course examines how body weight is controlled, why obesity can cause ill-health and what we can do to prevent or treat obesity and associated diseases.

Course Co-ordinator: Dr Justin Rochford   Tel: 01224 437372

Course Aims & Learning Outcomes

Aims:

The course aims to examine why an increasing proportion of the population are becoming overweight as well as the specific physiological mechanisms behind this phenomenon. Students will gain an appreciation of the metabolic diseases associated with increased adiposity and why these occur. They will also understand how different metabolically important tissues communicate with each other, regulate metabolic health and become dysfunctional in obesity. The course will also provide an understanding of how measurements of metabolic health are made and the current and potential future therapeutic options for the treatment of obesity and related metabolic diseases.

Learning outcomes:

The student should be able to understand, discuss and critically evaluate the following areas:

1. To understand the increased prevalence of obesity and the reasons for this.
2. To appreciate the diseases associated with excessive weight gain , the functions of adipose and other metabolically important tissues and how they contribute to metabolic health
3. To gain knowledge of pathways by which appetite is regulated in the brain and how alterations in this can cause disease. The signals from other tissues such as the gut, adipose tissue and liver that can affect feeding behaviour.
4. To develop an appreciation of how obesity can lead to conditions such as cardiovascular and diabetes and the underlying pathways driving this.
5. To understand the impact of diet and specific nutrients on metabolic health and potential dietary and pharmacological therapies for obesity and diabetes.
6. To be able to collate and integrate information about various aspects of nutrition and metabolic heath and appreciate how this leads to a physiological outcome.
7. To gain an appreciation of the background and methods used in nutrition and obesity research and how novel research in this area is conducted.
8. To be able to communicate complex ideas that combine information from various sources.

9. To appreciate some of the practical and personal skills required for nutrition and obesity research or healthcare provision.

Course Teaching Staff

Course Co-ordinator(s):

Dr Justin Rochford (JJR) **j.rochford@abdn.ac.uk**

Other Staff:

Prof. Alexandra Johnstone (AJ)

Dr Nimesh Mody (NM)

Prof. Mirela Delibegovic (MD)

Dr Tyler Stevenson (TJS)

Dr Petra Louis (PL)

Dr Susan McGeoch (SM)

Prof. Alison Jenkinson (AJ)

Assessments & Examinations

Students are expected to attend all lectures, and tutorials, and to complete all class exercises by stated deadlines. The minimum performance acceptable is attendance at 75% of the lectures, seminars, and presentation of all set course work, written and oral.

Assessment is derived from course work (30%) and a written examination (70%). The continuous assessment (CA) component is based on a viva voce (oral) examination (10%), an essay assignment (10%) and the OSPE (Objective Structured Practical Examination, 10%).

Written Examination: 70% of the total assessment is based on a two hour written exam. The student has to answer two questions of equal weighting selected from a list of four.

Common grading scale (CGS) grade: The overall performance of the student is expressed as a grade awarded on the common spine marking scale.

The degree examination is held in May/June examination diet.

Class Representatives

We value students' opinions in regard to enhancing the quality of teaching and its delivery; therefore in conjunction with the Students' Association we support the Class Representative system.

In the School of Medical Sciences, we operate a system of course representatives, who are elected from within each course. Any student registered within a course that wishes to represent a given group of students can stand for election as a class representative. You will be informed when the elections for class representative will take place.

What will it involve?
It will involve speaking to your fellow students about the course you represent. This can include any comments that they may have. You will attend a Staff-Student Liaison Committee and you should represent the views and concerns of the students within this meeting. As a representative you will also be able to contribute to the agenda. You will then feedback to the students after this meeting with any actions that are being taken.

Training
Training for class representatives will be run by the Students Association. Training will take place within each half-session. For more information about the class representative system visit **www.ausa.org.uk** or email the VP Education & Employability **vped@abdn.ac.uk**. Class representatives are also eligible to undertake the STAR (Students Taking Active Roles) Award with further information about this co-curricular award being available at: **www.abdn.ac.uk/careers**.

Problems with Coursework

If students have difficulties with any part of the course that they cannot cope with, alone they should notify the course coordinator immediately. If the problem relates to the subject matter general, advice would be to contact the member of staff who is teaching that part of the course. Students with registered disabilities should contact the UG Medical Sciences Admin team (**medsci@abdn.ac.uk**) in the Medical Sciences Office (based in the Polwarth Building, Foresterhill), or Mrs Sheila Jones (**s.jones@abdn.ac.uk**) in the Old Aberdeen office associated with the teaching laboratories, to ensure that the appropriate facilities have been made available. Otherwise, you are strongly encouraged to contact any of the following as you see appropriate:

- Course student representatives
- Course co-ordinator
- Convenor of the Medical Sciences Staff/Student Liaison Committee (Professor Gordon McEwan)
- Personal Tutor
- Medical Sciences Disabilities Co-ordinator (Dr Derryck Shewan)

All staff are based at Foresterhill and we strongly encourage the use of email or telephone the Medical Sciences Office. You may have a wasted journey travelling to Foresterhill only to find staff unavailable.

If a course has been completed and students are no longer on campus (i.e. work from second semester during the summer vacation), coursework will be kept until the end of Fresher's Week, during the new academic year. After that point, unclaimed student work will be securely destroyed.

Course Reading List

Recommended reading will be issued by each lecturer during their teaching sessions in the course.

Lecture Synopsis

Lecture 1: Introduction: Obesity and associated diseases (JJR).
Overview of the lectures and areas to be covered.
What is obesity and what are the conditions associated with it?
What are the implications for personal health and society?

Lecture 2: Definitions and Assessment tools for obesity and metabolic health (AMJ).
Definitions of overweight, obesity, impaired glucose tolerance, metabolic syndrome, diabetes.
Discussion of principles and assumptions of the tools and clinical cut-offs to assess obesity and metabolic health.
Application of assessment tools for health assessment in individuals (OGTT, CGMS, finger prick, body composition, waist circumference, clinical bio-markers).
Review anonymised research/clinical data examples (case study or group data).
Definition and discussion of glycaemic index and glycaemic load in dietary assessment.

Lecture 3: Genetics of obesity (JJR).
Overview of the genetics of obesity.
Discussion of "Thrifty" vs "Drifty" genotype hypotheses.
Description of severe monogenic vs common polygenic obesity.
Experimental models involved in elucidating the genetics of body weight regulation eg Ob/Ob mice to equivalent human conditions.
How genetics could affect satiety, food choice, energy expenditure.
Discussing why dieting is often unsuccessful and the concept of having a body weight 'set point'.

Lecture 4: Crosstalk between organs and tissues regulating energy balance (JJR).
Overview of how key metabolic tissues interact.
Summary of the metabolic functions of the brain, adipose tissue, skeletal muscle, liver, pancreas and the gut.
Introduction to the signals and crosstalk between these different tissues.

Lecture 5: How to control glycemia (NM).
The importance of insulin in glucose control.
Description of the pancreas, its structure and function.
Details regarding how glucose regulates insulin secretion.
Discussion of molecules that modulate insulin secretion.

Lecture 6: Metabolic health, ageing and lifespan (MD)
Discussion of the link between calorie restriction and reduced body weight and healthy ageing/longevity.
Description of nutrient-sensitive pathways that can affect lifespan and underlying mechanisms.

Lecture 7: Obesity and cardiovascular disease (MD)
How obesity can affect cardiovascular health.
Factors leading to the development of atherosclerosis.
Description of the mechanisms underlying plaque formation.

Lecture 8: Insulin action in peripheral tissues (NM).
Description of key peripheral targets for insulin action.
Discussion of the key processes regulated by insulin (glucose uptake and storage in muscle and adipose tissue, inhibition of gluconeogenesis in liver).
Description of intracellular signalling following insulin receptor activation in target tissues.

Lecture 9: Functions of adipose tissue in health and disease (JJR).
What is fat/adipose tissue, what does adipose tissue do, why is increased adiposity bad for us?
Details of different adipose depots and their different properties.
Discussion of brown and brite fat, what makes it burn lipids and how can we induce this phenotype.
Discussion of fat turnover and how we might harness this therapeutically.

Lecture 10: Gut microbiome and Metabolic Heath (PL).
Overview of the contribution of gut microbiota to metabolic health.
How the gut microbiome may be altered by diet.
Discussion of the evidence that differences in gut microbiome may contribute to obesity and metabolic disease.

Lecture 11: Control of appetite within the brain (JJR).
What peripheral signals control hunger?
Description of the effects of leptin from fat, insulin and signals from the gut.
Description of regions of the brain controlling appetite.
Discussion of the evidence for the involvement of specific pathways and neurons in appetite regulation eg from experimental genetic modification, and human monogenic obesity. Exploration of some key neuronal networks and molecules controlling appetite.

Lecture 12: Circadian rhythms and the regulation of metabolism (TJS).
Central circadian regulation by SCN.
The presence of peripheral clocks in metabolically important tissues.
The influence of circadian dysregulation on metabolic health and feeding behaviour.

Lecture 13: Exploring the role of diet and exercise to modulate obesity and metabolic health (AMJ).
Description of weight loss improvements in adiposity and metabolic health
Role of diet composition - low fat Vs low carbohydrate diets for obesity and metabolic health
Role of diet and exercise to improve obesity and metabolic health.
Role of research to influence evidence based therapeutic and preventative medicine – discussion of nutrition applications**.**

Lecture 14: Current treatment options for type 2 diabetes and metabolic disease (SM).
Overview of type 2 diabetes and associated complications.

Description of current lifestyle, dietary and pharmacological therapies for diabetes, obesity and associated conditions.

Lecture 15: Summary Lecture (JJR).
Overview of lecture course.
What are the big questions that remain to be solved?
What are the potential future therapeutic options?

Practical/Lab/Tutorial Work

Practical

The practical work for SR4008 will take the form of an Objective Structured Practical Examination (OSPE for short!), which some of you will have experienced before in subjects such as anatomy or medicine. However, this style of assessment at multiple stations during a strict time limit is also similar to the job interviewing methods used by many employers.

The practical runs over 3 weeks since various courses are involved with it (see timetable). In week 1, ALL students will attend and have an opportunity to practice the skills, which will be assessed. During this day, staff will be on hand to demonstrate and answer questions, and students will be directed towards what they should revise for the assessment. Given that students will have little other coursework at this time, their preparation for the assessment should not be too onerous. Many of you will be already familiar with some of the practical skills assessed. Please note – ***IT IS ESSENTIAL THAT YOU ATTEND THIS LABORATORY PRACTICAL SESSION.***

In either week 2 OR 3 of term, students will be scheduled to attend the practical laboratory for a one hour long slot, during which time they will undertake their assessment. Students cannot pick and choose when they attend, appointments will be issued by staff. Allocated groups will be available on the MyAberdeen course website. Attending at the correct time is one of the professional skills that will be assessed! During your one-hour slot, you will be assessed at several stations on how well you complete the practical skills. In addition, the students' professionalism as scientists and potential employees will be graded and students will also have to submit a short written assignment.

A major benefit of this practical is that, in addition to brushing up your practical skills, it can also provide practice for future interviews for jobs or academic positions. It will also prepare you in the generic skills needed for the Honours projects you will all be undertaking in the second half-session after Christmas.

The OSPE will contribute towards your final course mark.
For these classes a laboratory coat should be worn at all times in the laboratory. The University and Department safety rules must be adhered to at all times. Students may find it useful to bring a calculator to the laboratories in order that the required calculations can be made.

Viva

The oral examination will last 15 minutes and will take place on Thursday 13th October. Details of times and venues will be confirmed. The object of this exercise is to give you experience in oral presentation and to assess your paper analysis skills. This will help you prepare for the oral examinations, which will be the final part of the evaluation for your degree, and job interviews. Each student will be allocated a scientific paper related to metabolic health and you will be expected to

answer questions on this and discuss it in detail. You may be asked to illustrate your answer with a drawing or graph which should contain details such as calibration bars and axes, and explain your figure. You will also be expected to have read around the subject area prior to the examination. The assessor at the oral exam will be asked to give some constructive comments on your performance at the end of your discussion.

Essay
The purpose of the essay assignment is to assist your preparation to the format of the finals. Details of the essay question and deadlines will be given during the course. A detailed, coherent, well-illustrated, referenced and logically organized piece of work is expected.

University Policies

Students are asked to make themselves familiar with the information on key institutional policies which been made available within MyAberdeen (**https://abdn.blackboard.com/bbcswebdav/institution/Policies**). These policies are relevant to all students and will be useful to you throughout your studies. They contain important information and address issues such as what to do if you are absent, how to raise an appeal or a complaint and indicate how seriously the University takes your feedback.

These institutional policies should be read in conjunction with this programme and/or course handbook, in which School and College specific policies are detailed. Further information can be found on the **University's Infohub webpage** or by visiting the Infohub.

The information included in the institutional area for 2019/20 includes the following:

- Absence
- Appeals & Complaints
- Student Discipline
- Class Certificates
- MyAberdeen
- Originality Checking
- Feedback
- Communication
- Graduate Attributes
- The Co-Curriculum

Medical Sciences Common Grading Scale

Grade	Grade Point	Category	Honours Class	Description
A1	22	Excellent	First	• Outstanding ability and critical thought • Evidence of extensive reading • Superior understanding • The best performance that can be expected from a student at this level
A2	21			
A3	20			
A4	19			
A5	18			
B1	17	Very Good	Upper Second	• Able to argue logically and organise answers well • Shows a thorough grasp of concepts • Good use of examples to illustrate points and justify arguments • Evidence of reading and wide appreciation of subject
B2	16			
B3	15			
C1	14	Good	Lower Second	• Repetition of lecture notes without evidence of further appreciation of subject • Lacking illustrative examples and originality • Basic level of understanding
C2	13			
C3	12			
D1	11	Pass	Third	• Limited ability to argue logically and organise answers • Failure to develop or illustrate points • The minimum level of performance required for a student to be awarded a pass
D2	10			
D3	9			
E1	8	Fail	Fail	• Weak presentation • Tendency to irrelevance • Some attempt at an answer but seriously lacking in content and/or ability to organise thoughts
E2	7			
E3	6			
F1	5	Clear Fail	Not used for Honours	• Contains major errors or misconceptions • Poor presentation
F2	4			
F3	3			
G1	2	Clear Fail/ Abysmal	-	• Token or no submission
G2	1			
G3	0			

Course Timetable SR4008: 2019-2020

Date	Time	Place	Subject	Session	Staff
Week 7					
Mon 9 Sep					
Tue 10 Sep					
Wed 11 Sep	12:00-13:00	Pol 1M:003	Introduction: Obesity and associated diseases.	Lecture	JJR
Thu 12 Sep	09:00-17:00	Pol 2:054	Introduction to OSPE.	Practical	JJR
Fri 13 Sep	09:00-10:00	Pol 1M:003	Definitions and Assessment tools for obesity and metabolic health	Lecture	AMJ
	10:00-11:00	Pol 1M:003	Genetics of obesity	Lecture	JJR
Week 8					
Mon 16 Sep	10:00-11:00	Pol 1:039/040	Crosstalk between organs and tissues regulating energy balance.	Lecture	JJR
Tue 17 Sep					
Wed 18 Sep	12:00-13:00	Pol 1M:003	How to control glycemia.	Lecture	NM
Thu 19 Sep	09:00-17:00	Pol 2:054	OSPE Group 1.	Practical	JJR
Fri 20 Sep	11:00-12:00	Pol 1M:003	Metabolic health, ageing and lifespan.	Lecture	MD
Week 9					
Mon 23 Sep	10:00-11:00	Pol 1:039/040	Obesity and cardiovascular disease.	Lecture	MD
Tue 24 Sep					
Wed 25 Sep					
Thu 26 Sep	09:00-17:00	Pol 2:054	OSPE Group 2.	Practical	JJR
Fri 27 Sep	09:00-10:00	Pol 1M:003	Insulin action in peripheral tissues.	Lecture	NM
	10:00-11:00	Pol 1M:003	Functions of adipose tissue in health and disease.	Lecture	JJR
Week 10					
Mon 30 Sep	10:00-11:00	Pol 1:039/040	Gut microbiome and Metabolic Heath.	Lecture	PL
Tue 1 Oct					
Wed 2 Oct	12:00-13:00	Pol 1M:003	Control of appetite within the brain.	Lecture	JJR
Thu 3 Oct	09:00-17:00	Pol 1M:001	Problem solving workshop	Practical	AJ
Fri 4 Oct	09:00-10:00	Pol 1M:003	Circadian rhythms and the regulation of metabolism.	Lecture	TJS
Week 11					
Mon 7 Oct	10:00-11:00	Pol 1:039/040	Exploring the role of diet and exercise to modulate obesity and metabolic health.	Lecture	AMJ
Tue 8 Oct					
Wed 9 Oct	12:00-13:00	Pol 1M:003	Current treatment options for type 2 diabetes and metabolic disease.	Lecture	SM
Thu 10 Oct	09:00-17:00	Pol 1M:001	Vivas	Practical	JJR/AJ

| Fri 11 Oct | 10:00-11:00 | Pol 1M:003 | Summary Lecture. | Lecture | JJR |

Staff

JJR: Dr Justin Rochford
AMJ: Prof. Alexandra Johnstone
NM: Dr Nimesh Mody
MD: Prof Mirela Delibegovic
PL: Dr Petra Louis
TJS: Dr Tyler Stevenson
SM: Dr Susan McGeoch
AJ: Prof. Alison Jenkinson