NEUR3101

Muscle and Motor Control

Course Outline

Term 2, 2023

School of Biomedical Sciences

Faculty of Medicine & Health

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1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenors	A/Prof Ingvars Birznieks Senior Lecturer Frederic von Wegner	NEUR3101@unsw.edu.au	Tuesdays 4pm: Blackboard via Moodle 24/7: Q&A forums on Moodle, e-mail	Office: Wallace Wurth 314 +61 (2) 9065 1598
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2. Course information

Units of credit: 6 UoC (0.125 FTSL)

Pre-requisite(s): PHSL2101- Physiology 1A or PHSL2121- Principles of Physiology A or PHSL2501- Human Physiology A or NEUR2201- Neuroscience Fundamentals

Teaching times and locations:

Please refer to online timetable*: http://timetable.unsw.edu.au/2023/NEUR3101.html and*

Moodle page for course schedule and updates
https://moodle.telt.unsw.edu.au/mod/resource/view.php?id=5689921

2.1 Course summary

This course examines how movement is controlled from brain to skeletal muscle. The major themes are the contribution of the brain and spinal cord to the control of movement, muscle function, motor learning, movement disorders, fatigue and ageing. The course will reinforce the relationship between integrative neuromotor function, movement physiology and cellular and molecular physiology. The course intertwines normal physiological mechanisms with analyses of motor system disorders to help understand both aspects. The lectures provide the core topics explored in the course. Practicals and seminars focus on how fundamental knowledge can be applied to solving clinical, practical and sports performance problems. Advanced practical classes range from experiments with isolated mammalian muscle to human studies using electromyography (EMG) and electrical stimulation. One of the aims is to train students to obtain and process high quality EMG recordings, analyse, critically evaluate and interpret obtained data. In an interactive practical the students watch professionally developed short educational and patient examination videos that aim to actively engage in the related learning tasks. A tutorial-supported creative group assessment strengthens deep learning and the connections between theoretical knowledge and real-life applications in day-to-day activities, sports performance, and/or pathology. Students create a brief video illustrating one theoretical aspect of motor control in the context of a real-life situation. This allows fostering the students' own vision of course relevance to real life situations from their own diverse perspectives. The assessment is peer marked on engagement/entertainment, educational value and scientific quality. The student-created materials are used for blended learning by other students of the same and following years.

2.2 Course aims

The motor system is a vibrant research area in neuroscience, spanning, for example, the molecular genetics of muscle tissue, the cellular physiology of motoneurones, the plasticity of nerve cells in the brain, animal models of movement diseases, unravelling systems physiology in human subjects, and engineering control theories to identify the fundamental principles of motor control. In this course, you will be encouraged to learn and understand more about the physiology of the neuromuscular system. The emphasis is on how the motor control centres, sensory and muscular systems work together to produce movements and how this is disrupted by disease and normal ageing.

The aims of this course are to develop an understanding of skeletal muscle function and adaptation and how the brain and spinal cord interact to produce different movements. The course furthermore aims to develop an understanding of the mechanisms of motor learning and factors that influence motor learning, and an appreciation of current techniques and future directions in movement neuroscience research. The course aims to apply anatomical and physiological knowledge to discover the mechanisms and treatments underlying motor system disorders.

2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Be able to effectively communicate how skeletal muscle and the nervous system work to generate controlled movements.
2. Demonstrate an understanding of the key theoretical concepts in the field of movement neuroscience that allows an extension to specific areas relevant for future professional practice in this field.
3. Demonstrate the knowledge of current and (likely) future directions in movement neuroscience research and have ability to independently research and interpret relevant literature in the field.
4. Demonstrate an understanding of experimental study design in the area of motor and muscle control and present relevant scientific data.
5. Demonstrate competence to perform EMG recordings and electrical nerve stimulation, and interpret experimental results based on understanding of the techniques and underlying physiological principles.

Student learning outcomes describe what it is that you should be able to do, explain or understand if you have learned effectively in the course. For each lecture, seminar, practical and assessment item, the expected learning outcomes will be explicitly stated. The assessment in the course will be designed to test how well you have achieved the learning outcomes of the course. The general learning outcomes for the course are as follows:

At the end of the course you are expected to

- Be able to effectively communicate how skeletal muscle and the nervous system work to generate controlled movements.
- Demonstrate an understanding of the key theoretical concepts in the field of movement neuroscience that allows an extension to specific areas relevant for future professional practice in this field.
- Demonstrate the knowledge of current and (likely) future directions in movement neuroscience research and have the ability to independently research and interpret relevant literature in the field.

- Demonstrate an understanding of experimental study design in the area of motor and muscle control and present relevant scientific data.
- Demonstrate competence to perform EMG recordings and electrical nerve stimulation, and interpret experimental results based on understanding of the techniques and underlying physiological principles.

Graduate Attributes developed in this course – *for Medical Science and Science students*

- The skills involved in scholarly enquiry
- An in-depth engagement with disciplinary knowledge in its interdisciplinary context
- The capacity for analytical and critical thinking
- The ability to engage in independent learning
- Information Literacy – the skills to locate, evaluate and use relevant information
- The skills of effective communication.

Graduate Attributes developed in this course – *for Exercise Physiology students*

- Understand the relationship between physical activity and health
- Apply clinical skills and knowledge relevant to cardiovascular, metabolic, musculoskeletal and neuromuscular rehabilitation
- Engage in independent and reflective learning for the betterment of professional clinical practice, following an evidence-based approach
- Communicate effectively with patients, colleagues and other health professionals.

2.4 Relationship between course learning outcomes and assessments

Course Learning Outcome (CLO)	**LO Statement**	**Related Tasks & Assessment**
CLO 1	Be able to effectively communicate how skeletal muscle and the nervous system work to generate controlled movements.	II. Solving a research challenge III. Motor control explained IV. End of session exam
CLO 2	Demonstrate an understanding of the key theoretical concepts in the field of movement neuroscience that allows an extension to specific areas relevant for future professional practice in this field.	I. Progress quizzes I. Practicals and associated quizzes II. Solving a research challenge III. Motor control explained IV. End of session exam
CLO 3	Demonstrate the knowledge of current and (likely) future directions in movement neuroscience research and have the ability to independently research and interpret relevant literature in the field.	II. Solving a research challenge III. Motor control explained IV. End of session exam
CLO 4	Demonstrate an understanding of experimental study design in the area of	I. Practicals and associated quizzes. II. Solving a research challenge

	motor and muscle control and present relevant scientific data.	
CLO 5	Demonstrate competence to perform EMG recordings and electrical nerve stimulation, and interpret experimental results based on understanding of the techniques and underlying physiological principles.	I. Progress quizzes. I. Practicals and associated quizzes. IV. End of session exam

3. Strategies and approaches to learning

3.1 Learning and teaching activities

Note that activity plan below may change during the term. Please follow updates on the course Moodle page.

Muscle and Motor Control is delivered across 10 weeks in Term 2, with teaching activities encompassing lectures, seminars, and practical classes. There are 7 weeks of directed learning comprising 3-4 hours of pre-recorded learning materials per week; there are also five 3-hour practicals, four of which require prior preparation. Two weeks will be allocated for self-directed work on two assessments when no other teaching activities are planned. Also, week 10 has no new learning activities except peer-marking of video projects and should be used for reflection and consolidation of the learned material. The rationale for the course load distribution during the term is to be in anti-phase with demands of other courses. Lectures will provide you with the concepts and theory essential for an understanding of the course content. The practical classes assist in the development of research and analytical skills, and further learning of the key objectives. The skills you will learn in practical classes are relevant to your development in your professional career or in research. The practical classes and Q&A sessions will allow you to engage in a face-to-face and a more personal, interactive form of learning than is possible with the pre-recorded material. You will have to allocate additional self-directed study time for on-line quizzes (progress, pre-prac, and post-prac), revision for assessments, testing knowledge, self-study assessment tasks and work on the group project. Additionally, effective learning can also be enhanced through self-directed use of other resources such as textbooks, literature references, web-based sources and educational materials created by students in previous years.

The teaching strategy is based on principles that concepts and understanding are more important than memorising details, that learning should be fun and thereby facilitate deeper learning, and that student engagement and creativity is the way for students to see connections between learned knowledge and real-life experiences. The teaching rationale fosters a deep sense of community and belonging through use of engaging and enjoyable group work and peer engagement that applies course content to real-life situations. The teaching rationale engages all forms of memory for multisensory reinforcement and to suit different learning styles and to enable greater understanding and memorizing of complex concepts. This covers all the different learning styles in the classical Neil Flemings V.A.R.K. model: visual, auditory, read/write and kinaesthetic (tactile) learning. Hence the teaching rationale fuses classic principles of pedagogy with contemporary neuroscience learning models.

Lectures – Lectures will be delivered pre-recorded (voice-over MS PowerPoint presentation videos on Moodle). PDF copies of the lecture notes will be available on Moodle and can be used prior to each lecture to gain an overview of how various concepts are logically linked together.

There is no single textbook covering all course content; the content of each lecture is unique, delivered by discipline experts, and drawn from different research areas.

Seminars – Similar to lectures, but less formal learning material delivery than a lecture. Seminars will also be used to explain course requirements and give assessment task instructions. Some seminars will focus on one specific narrow question or application. The purpose of seminars structured around a "classic" research paper chosen from a field relevant to the course content is to gain a core understanding of the scientific basis of the discipline and strict research logic. Such skills are required to critically evaluate research publications and to design research studies. "Classic" paper content will not be tested explicitly in the quizzes. These seminars are provided as additional material to improve the understanding of core concepts and to apply them in a problem-based learning approach.

Seminar presentations will be pre-recorded and available for study at your own time. Seminar timeslot is dedicated for synchronous graded quizzes (Thursdays, 10-11 am). It is the course requirement that you should make yourselves available during this time.

Live Q&A sessions and Moodle Q&A forums

For each lecture and seminar topic there will be a specific Q&A forum where you will be able to ask questions. All questions will be answered in timely manner either in writing directly in the Q&A forum on Moodle or live during scheduled interactive question and answer sessions. To ensure that local and guest lecturers can answer all your questions in a well-structured manner before the scheduled progress quizzes, each topic-specific Q&A forum will have a closing date after which you will not be able to post new questions. If live Q&A session will be scheduled for a specific topic (subject to guest lecturer's availability), you will still be able to ask questions live and engage in discussion. This will provide opportunity to clarify or reinforce the ideas that have been presented.

Practicals – The purpose of the practical components of the course are twofold. The first purpose is to help you to develop technical and practical skills that will be relevant in your professional career and, most importantly, are requested by accreditation authority. It is essential that you obtain some hands-on experience with the major research and/or clinical techniques in human motor control before you begin your practicum or the clinical rehabilitation courses. The second purpose is to use experiments to demonstrate and reinforce key theoretical concepts that have been covered in lectures. The questions contained in the practical outlines will guide your learning in this respect. When practicals are held in the teaching laboratory the attendance of practicals is compulsory, but online versions of the practicals will be made available for students who have approved special consideration.

Practicals require preparation by studying the relevant background theory and familiarising yourself with the experimental procedures described in the prac protocols. The purpose of pre-prac quizzes is to ensure you come to the laboratory prepared, use laboratory resources responsibly, and finish work within the allocated time.

Practical protocols must be uploaded via a Moodle link. *It is obligatory to submit a protocol for each of the five practicals to pass the course*. *Access to the corresponding post-prac quiz will be granted only after the upload of the completed protocol*. Protocols are submitted by *each student individually*, even though students work in groups during the practicals and can share the data and answers to questions.

Flipped classroom – is the main learning and teaching approach used in this course. It means that you are given access to lecture and video material explaining modern approaches to research and therapy

to carry out a self-directed learning task. Then you have the opportunity for discussion of the learned concepts with your lecturers and other students in the group.

Blended learning – The blended learning approach is designed to leverage perspectives from the motor control lectures to produce a consolidated set of explanatory statements and provide answers to theoretical and everyday life problems thus encouraging broad communication across the motor control discipline. By working in creative teams, you will produce your own audio-visual products to be used as blended learning aids. Created media products will be peer marked and ranked. The best products will be demonstrated to the whole cohort. Creativity and engagement is a key component of the blended learning experience. Those activities are aimed to review most relevant motor control concepts, make a set of summaries and ideas that will reflect the understanding from your own perspective.

Independent study – The lectures, seminars, and practicals on their own are too limited for you to develop a deep understanding of the concepts covered in this course. For you to achieve the learning outcomes that will be assessed, you will need to revise the material presented in the course regularly. You will probably also need to do additional reading beyond the lecture materials to learn effectively. Some relevant additional resources are listed in this guide and lecture materials, but you are encouraged to go beyond that and search various information sources on our own.

Assessments – These tasks have been chosen as tools to enhance and guide your learning as well as a way of measuring performance.

3.2 Expectations of students

Students are reminded that UNSW recommends that a 6 units-of-credit course should involve about 150 hours of study and learning activities. The formal learning activities total approximately 50 hours throughout the term and students are expected (and strongly recommended) to do at least the same number of hours of additional study.

For the whole duration of the course (except final exam) there are **only 22 hours of time-locked synchronous activities**, from these 15 on campus (5 x 3 hour practicals) and 7 hours on-line (7 x 1 hour progress quizzes).

The course starts with learning-intensive seven weeks of structured study materials but will ease towards the end of the course leaving more time to consolidate knowledge, work creatively on assessments and prepare for the final exam.

Students are expected to follow the information and course announcements on Moodle as they may contain crucial information about tasks and assessments, as well as changes due to acute circumstances or according to student suggestions.

Face-to-face activities: The only face to face activities in this course are five practicals. The attendance of practicals is compulsory. Practicals require preparation to understand the theory underlying the techniques used in the lab and to familiarise yourself with the procedures.

Synchronous on-line assessments: The course has 7 Progress Quizzes which are held during the live online Seminar time slot accordingly to the course schedule. Progress Quizzes are an assessment task and online participation during the allocated timeslot is necessary to get marks.

Synchronous on-line interaction: The course has weekly live Q&A sessions in which students are encouraged to ask questions and discuss learning materials, assessment tasks or any other aspect of the course with course convenors and guest lecturers.

Asynchronous interaction: The course convenors will work hard to provide online advice (response to forum posts and emails) to students in a timely manner, including after-hours and on weekends (24/7), whenever possible; however, the expectations shouldn't exceed the business hours and academic workload allocated to this course. Students should be organised and clarify all essential questions well in advance.

If a student is unable to attend the practical and has approved special consideration, the face-to-face practical will be replaced with an equivalent online practical.

4. Course schedule and structure

0-week Mon 22 – 26 May; Weeks 1-10: 29-May to 6 Aug; Exam period:11-24 Aug; Supplementary Exam Period: 4 September − 8 September

L – lecture; **S** – seminar; **P** – practical

IB – A/Prof Ingvars Birznieks; **FvW** – Dr Frederic von Wegner; **VB** – Dr Vita Birzniece, **BB** – Dr Bart Bolsterlee

NEUR3101 Course schedule T2, 2023 (version 1.0; 3-May-2023)

L – lecture; S – seminar; P – practical, red: assessment related activities

Week # starting	Recorded learning materials	Practicals (Mondays)	Deadlines	Live events (lab practicals not listed)
1 29 May	**L1 -** Introduction to muscle physiology, expected prior knowledge **IB** **L2** – Motor unit and motoneuron recruitment; the size principle **IB** **L3** – Muscle fibre typing; the genetics of speed and endurance **FvW** **S1 –** Course introduction and important information about assessments **IB**		**Wed 31 May, 4 pm:** Watch seminar S1 before Q&A session **Sun 4 June:** 1. **Preprac quiz P1** 2. Question submission for: • lectures L1-L3 • seminar S1 • practical P1	**Wed 31 May, 4 pm:** Live chat Q&A about the course

Week # starting	Recorded learning materials	Practicals (Mondays)	Deadlines	Live events (lab practicals not listed)
2 5 June	**L4** – Spinal control of locomotion – muscle and cutaneous afferents and reflexes **IB** **L5** –– Cortical control of movement **FvW** **L6 –** Brain and movement (the ascending and descending tracts) **IB** **S2** – EMG techniques and clinical use. **FvW**	**P1:** EMG basics: motor units and force regulation	**Sun 11 June:** 1. **Prac protocol P1** 2. **Postprac quiz P1** 3. Question submission for: • lectures L4-L6 • seminar S2	**Wed 7 June, 4 pm:** Live chat Q&A about L1-3 **Thu 8 June, 10-11 am:** **Progress quiz 1** (lectures L1-3)
3 12 June ***Mon 12: King's birthday***	**L7** – Sensorimotor control – voluntary movement, feedback and feed-forward control **IB** **L8&9 –** Motor learning and internal models **IB** **S3 –** Classic Paper Rhythmic movements and H-reflex **IB**	***No practicals*** *Mon 12-June public holiday: King's birthday*	**Sun 18 June:** 1. **Preprac quiz P2** 2. Question submission for: • lectures L7-L9 • seminar S3 • practical P2	**Wed 14 June, 4 pm:** Live chat Q&A about L4-6, S2, P1 **Thu 15 June, 10-11 am:** **Progress quiz 2** (lectures L4-6)

Week # starting	Recorded learning materials	Practicals (Mondays)	Deadlines	Live events (lab practicals not listed)
4 19 June	**L10** – Cerebellum and motor control: learning & disorders **IB** **L11 –** Basal ganglia in motor control, including Parkinson's disease **IB** **L12 -** Sensorimotor control of dexterous manipulation in humans **IB** **S4 –** Assessment II: Essay on research logic (discussion and instructions) **IB**	**P2:** Reflexes and electrical stimulation (Hoffmann reflex)	**Sun 25 June:** 1. **Prac protocol P2** 2. **Postprac quiz P2** 3. **Preprac quiz P3** 4. Question submission for: • lectures L10-L12 • seminar S4 • practical P3	**Wed 21 June, 4 pm:** Live chat Q&A about L7-9, S3 **Thu 22 June, 10-11 am:** **Progress quiz 3** (lectures L7-9)

Week # starting	Recorded learning materials	Practicals (Mondays)	Deadlines	Live events (lab practicals not listed)
5 26 June	**L13** – Muscle architecture **BB/FvW** **L14** - Muscle growth injury and regeneration **BB/FvW** **L15** – Muscle pain **FvW** **S5 –** Putting it all together: Examples of task integration for motor control **IB**	**P3:** Computational neuroscience and human-computer interfaces	**Thu 29 June:** 1. Essay experiment ideas submission for feedback **Sun 2 July:** 1. **Prac protocol P3** 2. **Postprac quiz P3** **Sun 9 July (end of week 6!):** 1. **Preprac quiz P4** 2. Question submission for: • lectures L13-L15 • seminar S5 • practical P4	**Wed 28 June, 4 pm:** Live chat Q&A about L10-12, S4, P2 (questions on Essay assessment) **Thu 29 June, 10-11 am:** **Progress quiz 4** (lectures L10-12)
6 03 July	**STUDY WEEK Essay writing (deadline on Tuesday 11 July)**			

Week # starting	Recorded learning materials	Practicals (Mondays)	Deadlines	Live events (lab practicals not listed)
7 10 July	**L16** – Muscle fatigue **FvW** **L17** – Muscle building drugs and performance supplements **VB** **L18** – Central fatigue **FvW** **S6 –** Blended learning video project (*Veni, vidi, vici*, or how to) **IB**	**P4:** Working muscle physiology (fatigue and pain).	**Tue 11 July:** **Essay submission (assessment II)** via Turnitin **Sun 16 July:** 1. **Prac protocol P4** 2. **Postprac quiz P4** 3. Question submission • lectures L16-L18 • seminar S6 • practical P5 *** Prac 5 does *NOT* have a preprac quiz**	**Wed 12 July, 4 pm:** Live chat Q&A about L13-15, S5, P3 **Thu 13 July, 10-11 am:** **Progress quiz 5** (lectures L13-15 and seminar S5)
8 17 July	**L19** - Muscle cramps: causes and treatments **FvW** **L20** – Sarcopenia and Muscular dystrophies **FvW** **L21** – Stroke and rehabilitation **IB** **L22** – Plasticity and adaptation to training and disuse **FvW**	**P5:** Motor control and pathology	**Sun 23 July:** 1. **Prac protocol P5** 2. **Postprac quiz P5** 3. Question submission • lectures L19-L22	**Wed 19 July, 4 pm:** Live chat Q&A about L16-18, S6, P4 **Thu 20 July, 10-11 am:** **Progress quiz 6** (lectures L16-18)

Week # starting	Recorded learning materials	Practicals (Mondays)	Deadlines	Live events (lab practicals not listed)
9 24 July	**STUDY WEEK for blended learning (video) projects (deadline on Sun 31 July; peer marking deadline on Wed 3 August)**		**Sun 30 July:** 1. **Video project submission** (assessment III) 2. Question submission for the end of course discussion	**Wed 26 July, 4 pm:** Live chat Q&A about L19-22, P5 and video projects **Thu 27 July, 10-11 am:** **Progress quiz 7** (lectures L19-22)
10 31 July			**Wed 2 August: Video project peer marking** (assessment III)	**Thu 3 August, 10-11 am:** Live chat: course conclusion Q&A about the final exam
11-24 August	**Exam period: final exam**			
4 –8 Sept	**Supplementary Exam Period**			

CLO mapping:
Test: Progress theory and practical quizzes are addressing CLO2, CLO3, CLO4, CLO5
Assignment: Solving a research challenge is addressing CLO1, CLO2, CLO3, CLO4
Project: Motor control explained (blended learning assignment) is addressing CLO1, CLO2, CLO3
Examination: End of Session Exam is addressing CLO1, CLO2, CLO3, CLO5
Practicals are addressing CLO5
Lectures are addressing CLO1, CLO2, CLO3
Seminars are addressing CLO1, CLO2, CLO3, CLO4, CLO5

5. Assessment

5.1 Assessment tasks

Assessment of your learning in the course will be achieved through quizzes and a final exam. This format tests your ability to recall and demonstrate understanding of the subject. The course comprises open book assessments testing your ability to find the relevant information as well as testing your ability to apply the relevant knowledge in time-constrained settings.

These requirements are similar to those encountered when dealing with a client or patient in a face-to-face setting, or when communicating with other health professionals or researchers. The examinations will be designed to determine how well you have achieved the general learning outcomes outlined above, and the specific learning outcomes outlined in each lecture/practical/seminar.

The essay on solving a research challenge will assess your ability to critically evaluate scientific rigour and interpret the scientific literature in the field of muscle and motor control. You may be required to perform similar tasks in many professional settings within exercise physiology practice or medical research. For example, you will evaluate evidence and refer to the scientific literature to inform clinical exercise prescription. In the essay you will have opportunity to demonstrate your creativity through attempting to solve one of outstanding scientific challenges by designing your own experiment. In the process of defining aims, hypothesis, and methods you are expected to demonstrate your ability to apply critical thinking learned from the classic paper analyses. You will also learn skills of research data presentation.

Assessments overview on the next page.

	Assessments	Value, final marks	Due Date
I.	*QUIZZES*	**Pre-prac quizzes: 4%** *(pracs 1-4)* **Post-prac quizzes Including protocol submission: 6%** *(pracs 1-5)* **Progress quizzes: 10%** *(weeks 2-5,7-9)*	**Sunday** before the Monday prac **By the end of the week** of prac you are enrolled in **Thursdays** 10-11 am
II.	*ESSAY ON RESEARCH LOGIC: SOLVING A RESEARCH CHALLENGE*	**Essay: 20%**	**11th Jul** Tuesday Week 7
III.	*BLENDED LEARNING ASSIGNMENT – MOTOR CONTROL EXPLAINED*	**Project: 15%** **Peer marking: 5%**	**30th Jul** Sunday Week 9 **2nd Aug** Wednesday Week 10
IV.	*FINAL EXAMINATION (2 HOURS)*	**MCQ: 20%** **Short answer: 20%**	Examination period **11-24th Aug**

Note: unless stated otherwise submissions close at 11:59 pm

ASSESSMENT TASK I – Pre-prac, post-prac and progress quizzes

There are 4 pre-prac, 5 post-prac and 7 progress quizzes with a total weight of 20% of your final mark. Each quiz may have a different number of questions and different weighting, which isn't determined by the number of questions.

The purpose of pre-prac quizzes is to ensure you come to the laboratory prepared, use laboratory resources responsibly, and finish work on (or before) time.

The pre-prac quiz is available until midnight on the day before the prac on the week scheduled for the group you are enrolled in. If for some reason you attend the practical in a different week from that you were enrolled in, the pre-prac deadline for you will not change.
If no face-to-face practicals will be held due to restrictions, the deadline for pre-prac quizzes will be the same regardless in which prac group you are enrolled in.

Post-prac quizzes are testing your understanding of the results you obtained in the lab and your ability to put them into the context of the theoretical framework. Some quiz questions may be ungraded and only require the reporting of experimental outcomes. You can complete them straight after each practical or until the end of the week. Submission of the practical protocol is part of the post-prac activities and should be regarded as the first step of the post-prac quiz. Protocol submission is

necessary to unlock access to the post-prac quiz questions. Completed prac protocols contain the obtained data, data analyses, and answers to the protocol questions.

Progress quizzes test your knowledge of the current study week including lecture and seminar content. They are **open only during** the scheduled **seminar timeslot** (Wednesdays, 5-6 pm). Not every week has a progress quiz, please follow the course schedule and announcements.

ASSESSMENT TASK II – Essay on research logic: Solving a research challenge

Pre-recorded detailed instructions will be made available to you. To complete this assessment successfully, you must carefully study the instruction slides.

Marks will be given for quality of the content, and ability to follow the prescribed formatting rules typically used in research reports.

The word limit is 1500 words maximum in total. There is no lower boundary – it is only the content that matters – you might be able to demonstrate understanding by explaining the main concepts concisely and still get maximum marks. However, you should adhere to the maximum word limit or your marks could be reduced. A 10% excess tolerance is acceptable to accommodate some formatting elements. Tables, figures, and references do not contribute towards the total word count. Tables and figures should not be misused to insert text which typically should be part of the main text. Note that the word maximum limit is introduced in your interests to avoid exceeding your workload and set adequate expectations for this assessment. Typically, average marks for this assessment are higher than for the whole course. Word count for individual section is given as a recommendation and will not be checked. This assessment is worth 20% of your final mark.

Professional activities of many of you will require preparing reports evaluating effects of various factors and interventions undertaken at your workplace, including those designed by yourselves. The quality of such professional reports and your adherence to evidence-based evaluation will determine your ability to succeed driving development in your workplace and become future leaders.
For this to happen you should be able to identify lack of evidence or controversy surrounding accepted routine procedures widely used in many contexts of everyday life and in professional settings. Importantly you should be able to design a study yourselves to evaluate interventions you will introduce in your professional life and know how to present your findings in a scientifically acceptable format. The overarching aim of this assessment is to teach you to do exactly that.

Option 1: Solving an open problem. Attempt to resolve an open problem or a controversy in the fields of muscle and motor control in a thought experiment and present mock results.

Option 2: Demonstrating knowledge experimentally. Explain a motor control principle or muscle physiology mechanism *beyond* the content already covered in the course lectures and seminars. Design a thought experiment and present mock results which would give experimental evidence confirming currently held views on this matter.

There are no strict boundaries between option 1 and 2, and you don't have to label your essay as being option 1 or 2. These options are given as a guidance on how to approach the essay.

For this assessment, all students are encouraged to use a dedicated Moodle forum to discuss research problems, practical questions, or research controversies you want to know answers to. A list of example research papers will be available on Moodle.

Originality and complexity of the research question and the methods employed is part of the evaluation criteria and will influence your marks, especially for sections 1-3.

Your study should investigate a physiological mechanism. A mechanism is a chain of causal events (A → B → C …, read the arrows as 'causes'). The experimental methods should be designed to address a specific causal effect. For example, if you hypothesize that repeated muscle fibre contractions (A) lead to cellular hypertrophy (B) via an increase in the number of myofibrils, your experimental method must be able to quantify the myofibril content. Reporting a simple observation will score lower marks. A very simple observation would be something like "endurance exercise training 3 times per week leads to more pronounced muscle hypertrophy compared to training once per week", or "post-exercise whole body cooling reduces delayed-onset muscle soreness". A study trying to identify the mechanisms (e.g. analyzing genetic factors, molecular or cellular changes) explaining this observation would score a higher mark. Additionally, it is important to use proper control groups, for example a placebo control if a drug is involved.
In previous years, a frequently used essay design was to report how a certain training program positively influenced a performance parameter or the progress of a neurological disease. Such an approach is likely to receive a low to average originality and complexity score from the examiners. Complexity would score higher if a chain of events was tested experimentally, for example: training → change in certain metabolites → change in cellular signalling cascade → change of a certain cellular feature. As you don't have to perform the experiments and are allowed to work with hypothetical outcomes as you imagine them, you are strongly encouraged to explore frontiers and challenges of current research fields, including unsolved controversies as well as popular myths and misconceptions.

You will be given opportunity to discuss the choice of your research question with the course convenors and to receive feedback on your proposal before deciding on the topic and mock experiment ideas. A link for a written feedback system will be provided. The deadline for submitting ideas for feedback is Thursday on week 5.

The essay should include the following sections and headings:

1. **Background and physiological context (25%; ~400 words)**
   In this section you should demonstrate your knowledge of the topic and ability to use existing scientific literature. Introduce context and specify the research problem. A minimum of 6 references to original peer-reviewed journal papers are required in this section. Other types of references (books, journal review papers, internet pages, documentaries, movies) are all equally important, but do not contribute to the reference count. If you are addressing a research controversy you should refer to or cite literature expressing two opposing views and evidence used to support each of them. You may even form pairs or groups where each of you will advocate for a different view.

If you chose Option 1, consider:

- Why is the question you would like to address important to you and in a wider context (describe either practical or theoretical importance, or both)?
- Is prior knowledge available in the literature?
- Where is the existing evidence inconclusive or what hasn't been investigated yet?

If you chose Option 2, consider:

- Why is the concept you would like to explain and demonstrate experimentally important from a practical or theoretical perspective?
- What is currently known from the literature and what evidence is available?
- Why would new experimental evidence be valuable and how would it be applicable?

2. The experimental aim and hypothesis (10%; <200 words)

Describe what exactly you want to investigate or demonstrate in your thought experiments, define aims and explain the expected outcomes. Use three subheadings Aim, Hypothesis and Rationale. Aim is usually defined in one or two sentences. The hypothesis what the expected outcome is should be described in one to three sentences and add another one to three sentences if you have an alternative hypothesis (two alternative expected outcomes of the experiment). In the Rationale section you must explain the physiological mechanisms underlying your hypothesis and the logic behind your hypothesis.

3. Experimental design and methods to test the aim (15%; ~300 words)

This is a thought experiment – show your creativity and technical knowledge, let your imagination fly: money is no object. What matters are the logic of your thinking and a meaningful and controlled experimental design to address the aims you defined.

4. Results (20%; ~300 words)

Demonstrate your knowledge about how research data are analysed, presented, and formatted. The mock outcome data of your experiments should be presented as tables, diagrams, or graphs. You can use either one or a combination of these elements. Pay particular attention to the formatting of figure labels, figure/table captions and legends. It is important that data are represented with variability measures (e.g. standard error of the mean). This section should only report and explain the results but should not discuss them. The obtained results and effects should be explained in the text and not in figure legends.

5. Discussion (explanation of mock results and discussion in the wider context) (20%; ~300 words)

Discuss your results in the context of your initial hypothesis and the existing literature. You will demonstrate understanding of the topic by interpreting the obtained results in a wider research and application context.

6. References (10%)

Must be consistently formatted using standards for research reports.

Referencing and References list
The scientific literature should be cited in both parts using in-text citation style https://student.unsw.edu.au/harvard-referencing. A full Reference list should be inserted at the end of the essay. The number of required references may differ depending on your chosen question, some topics may require more than others. The general rule is if you give a specific statement about something which is not a general knowledge, you may need to refer to the source of this statement or where more information could be found.
It is suggested that you use one of available reference management software packages like EndNote which is available to UNSW students for free (https://www.it.unsw.edu.au/students/software/). You can also choose to use freeware like Mendeley (https://www.mendeley.com/). Search for introductory and how-to demos online (e.g. YouTube).
It is suggested that you use Harvard referencing style, which has detailed instructions on UNSW website: https://student.unsw.edu.au/citing-different-sources
Most research papers will have a DOI (Digital Object Identifier), please include those in the list when available.

Marks will be subtracted for formatting and referencing style inconsistencies and errors.

By completing this assessment, you will
- develop and refine the skills needed to obtain information on a topic in muscle and motor control from scientific journals,
- improve your ability to interpret and assess scientific articles,
- develop your ability to comprehend and extend a field of scientific research.

Submission through Turnitin

ASSESSMENT TASK III – Motor control explained (blended learning assignment)

Educational video project
For the educational video project students will choose one of the motor control topics discussed during lectures or seminars. The project may also be based on literature research by the students. It is expected that you will produce a short educational video or use any widely accessible audio-visual means and animations to explain an aspect of muscle physiology or demonstrate motor control in action. This is a group assignment performed by 3-4 students per group, strictly no more than 4 students per group. *You will choose your own group members to work with, therefore you can start planning and forming groups for this assessment at any time during the course.* While this is a team project and everyone is expected to take part in every step of the production, in some situations, when communication between team members is less efficient, it is suggested that the group assigns task-coordinating responsibilities to individuals. For example, the group may designate one student to coordinate the narrative, one student for screenplay and one or two students in charge of video editing. This assessment is worth 15% of your final mark.

While working in groups, adhere to the current social-distancing rules at the moment of production.

The videos should be no longer than 3 minutes. There is no automatic grade penalty for exceeding this time limit, but excessive length could negatively impact the peer marks, if you lose the audience's attention. It is the idea that counts, video quality should not matter, if it is sufficient to convey the message. You can use your smartphone, i-device, webcam, or digital camera. You can digitally edit and

combine separately shot videos or shoot as one continuous take without editing. The videos can also be made entirely from animated slide presentations created by software like PowerPoint, Keynote or similar tools that can save presentations as animated video files. Based on past experience, videos including some acting elements and physical forms of expressions are better received due to better engagement leading to better learning. Nevertheless, there have also been many outstanding fully software-created projects.

It is suggested that the videos are uploaded to YouTube. You should carefully consider privacy settings and respect copyright. Depending on the content, you may prefer to select a YouTube setting which leaves the video unlisted (not found by search engines) and share the video as a private link. The videos need to be accessible for peer marking and public demonstration in the classroom. If there are concerns, instead of uploading videos online, you can submit the video file via Moodle and grant permission to demonstrate the submitted file in the classroom.

The videos require some embedded text recapping the main concepts. The videos should start with a title page and finish with end credits stating individual contributions (your names should be without personal information like student IDs, z numbers; your photos are permitted, optional), software used to create it and links to audio-visual materials taken from elsewhere (you should indicate duration and time of insertion point).

The ending credits are not included in the 3-minute duration of the video.

Each video submission should be accompanied with a separate document file containing one multiple choice question related to the content of your video. It must include at least 4 answer choices indicating a correct answer.

Peer marking

Created blended learning products will be peer marked by other students enrolled in this course. You will receive marks for contribution to the peer assessment process. The final mark will be decided by the course convenors based on the average peer marks. Your contribution to the peer-marking is worth 5% of your final mark.

Peer marking criteria

- **Scientific quality of the narrative (8 marks):** scientific depth (4 marks), scientific correctness (4 marks).
- **Adequate multiple-choice question and answer choices provided for the project (2 marks)**
- **Media learning value (5 marks) as detailed in the table below:**

	5 marks	3-4 marks	2 marks	1 mark	0 marks
Media learning value: clever, engaging, entertaining, demonstrations helping to explain difficult concepts and promoting interest in the topic.	Product has high learning and entertaining value. Explanation of scientific concept is significantly aided by screenplay and audio-visual means. Visually appealing or humorous presentation.	Product has good learning value. The investigated concept is explained well, but presentation is not sufficiently engaging.	Product has little learning value. Project has shortcomings explaining the scientific concept. Presentation is not engaging.	Product requires amendments to be considered for learning. Project identifies the question but fails to explain it properly.	Product not suitable for learning. Project has no substance.

By completing this assessment, you will

- learn skills of creating educational, research or professional presentation materials using various widely assessable tools and media,
- improve your ability to present complex scientific ideas in a straightforward manner using a video style format,
- learn to work as an effective member of a creative educational team,
- understand and engage in the peer assessment process.

ASSESSMENT TASK IV – End of session examination

The purpose of this exam is to test your understanding of concepts you have gained during this course. You will be tested on lecture content (including flipped classroom topics), laboratory practicals and seminars. The final exam layout comprises 40 multiple choice questions and 4 sections of 2 short answer questions. You will have to answer one question from each section (4 short answer questions in total). The exam will take place during the end of session exam period. At the time of writing of this document, the exam is planned to be an online and open-book exam, further details or changes will be announced in time. Please review Study guides for lectures when available and Q&As submitted together with Blended learning video projects.

Final exam period for Term 2 2023 is Friday 11 Aug to Thursday 24 Aug.

Supplementary exams

Supplementary exam period is 4-8 September 2023. The exact time for supplementary exams for the course will be announced in due time.

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

5.2 Assessment criteria and standards

ASSESSMENT TASK II – Essay on research logic: Solving a research challenge

Attainment / Section	Developing **0-24%**	Functional **25-49%**	Proficient **50-74%**	Advanced **75-100%**
Background	Inferior quality explanation of physiological context and justification of the study aims.	Description of the physiological context broadly linked to the study aims.	Relevant broad explanation of the physiological context relevant for study aims. Limited originality.	Highly original research idea. informative explanation of the physiological context justifying and leading to the study aims.
Aims	Physiologically unsubstantiated aims and hypothesis.	Good aims but lacking originality. Reasonable hypothesis.	Appropriate aims. Reasonable hypothesis. Limited originality.	Highly original interesting aims. Well substantiated hypothesis and rationale.
Methods	Methods possibly flawed. Poor design. Misunderstanding of research techniques.	Poor description of methods. Limited originality. The design may be not optimal to address the research question.	Appropriate standard methods. Experimental design meaningful, suited to answer the research question. Limited originality.	Creative methods showing technical knowledge. Experimental design clever. Statistical approach suited to answer the research question unambiguously.
Results	Poor analyses and formatting errors. Appropriate statistical tests lacking or used inappropriately.	Statistics questionable or substantial data format presentation errors.	Appropriate research data analyses, relevant statistics is used, clear presentation, but some formatting errors.	Skilled research data analyses, relevant statistics is used, clear presentation, and correct formatting. Data are presented with variability measures.
Discussion	Poor discussion of the results. Limited ability to link the outcomes to the aims, hypothesis and the context.	Results discussed in the context of the aims and hypothesis, but lacks evidence of understanding the topic in depth.	Results discussed in the context of the aims and hypothesis. Demonstrates understanding of the topic by interpreting the results in appropriate context.	Results discussed in the context of the aims and hypothesis. Demonstrates deep understanding and significance of the topic by interpreting the results in a wider research and application context.
References	Inconsistent formatting of in-text citations and the References list. Systematic formatting errors or references not relevant.	Key required citations might be missing. Multiple formatting errors.	Some minor reference formatting errors. The reference list is adequate.	Citations provided when required. The References list contains recent wide range of relevant original research publications. Perfect and consistent formatting of in-text citations and the References list.

ASSESSMENT TASK III – Motor control explained (blended learning assignment)

Peer marking criteria

	4 marks	3 marks	2 marks	0-1 mark
Scientific depth	Demonstrates scientifically deep knowledge, understanding and reasoning. Original thinking and choice of context.	Demonstrates basic scientific knowledge in a typical context.	Demonstrates only very basic scientific knowledge.	Limited or no scientific value of the narrative.
Scientific correctness	Scientifically flawless.	Some minor scientific or factual errors.	Some statements are debatable and taken out of context.	Some facts or interpretation are misleading.

	2 marks	1 mark	0 marks
Multiple choice question	Adequate and meaningful multiple-choice question.	Irrelevant or too obvious and trivial multiple-choice question.	Multiple-choice question is scientifically flawed.

Media learning value

	5 marks	3-4 marks	2 marks	1 mark	0 marks
Media learning value: clever, engaging, entertaining, demonstrations helping to explain difficult concepts and promoting interest in the topic.	Product has high learning and entertaining value. Explanation of scientific concept is significantly aided by screenplay and audio-visual means. Visually appealing or humorous presentation.	Product has good learning value. The investigated concept is explained well, but presentation is not sufficiently engaging.	Product has little learning value. Project has shortcomings explaining the scientific concept. Presentation is not engaging.	Product requires amendments to be considered for learning. Project identifies the question but fails to explain it properly.	Product not suitable for learning. Project has no substance.

5.3 Submission of assessment tasks

Late Submission

UNSW has standard late submission penalties as outlined in the UNSW Assessment Implementation Procedure, with no permitted variation. All late assignments (unless extension or exemption previously agreed) will be penalised by 5% of the maximum mark per day (including Saturday, Sunday and public holidays). For example, if an assessment task is worth 30 marks, then 1.5 marks will be lost per day (5% of 30) for each day it is late. So, if the grade earnt is 24/30 and the task is two days late the student receives a grade of 24 – 3 marks = 21 marks.

Late submission is capped at 5 days (120 hours). This means that a student cannot submit an assessment more than 5 days (120 hours) after the due date for that assessment.

Special Consideration

If you experience a short-term event beyond your control (exceptional circumstances) that impacts your performance in a particular assessment task, you can apply for Special Considerations.

You must apply for Special Consideration **before** the start of your exam or due date for your assessment, except where your circumstances of illness or misadventure stop you from doing so.

If your circumstances stop you from applying before your exam or assessment due date, you must **apply within 3 working days** of the assessment, or the period covered by your supporting documentation. More information can be found on the Special Consideration website.

5.4 Feedback on assessment

For each of quizzes you will receive the feedback showing you the number of correct answers. The result will be released after its closure for everyone. When appropriate, the correct answers will be released. The course academics will answer all questions posted in forums. There will be an opportunity to discuss quiz questions and correct answers during the live Q&A sessions and during the practicals. Your answers to questions in prac protocols will be analysed and explained in wrap-up videos. You will have opportunity to clarify answers to prac protocol questions during the practicals by discussing them in person with academics and demonstrators.

Individual feedback on choice of essay topic and suggestion how to address it will be given during Q&A sessions and using written feedback system on Moodle closing on week 5. After essay on research logic submission to Turnitin the quality of each component of the essay will be evaluated separately and mark provided. Upon request individual discussions will also be available.

Blended learning assignment will be peer marked using rubric. Feedback in form of a comments will be also encouraged.

5.5 Requirements to pass this course

The attendance at practical classes and submission of practical reports is mandatory as it is required to achieve CLO5.

For Exercise Physiology program students, mandatory attendance is a requirement of the professional accreditation body, Exercise and Sports Science Australia.

If a student is unable to attend a practical class, the Course Convenor should be informed. If the absence is for medical reasons the student will be required to present a medical certificate. If examinations or other forms of assessment have been missed, the student can apply for Special Consideration.

To achieve CLO5, alternative arrangements will be provided for students who have approved Special Consideration, or are registered with Disability Services and require educational adjustments.

Students who fail to submit practical reports within the requested timeframe, or who fail to meet attendance requirement without a legitimate approved reason, will not be able to pass the course. If alternative tasks assigned by the Course Convenor are not fulfilled, students will not be able to pass the course.

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Please use **Harvard referencing style**, which has detailed instructions on UNSW website: https://student.unsw.edu.au/citing-different-sources

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing
Academic integrity *is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage.*[1] *At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.*

Further information about academic integrity and ***plagiarism*** *can be located at:*

- *The Current Students site* https://student.unsw.edu.au/plagiarism*, and*
- *The ELISE training site* https://subjectguides.library.unsw.edu.au/elise

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

7. Readings and resources

Textbooks

- Purves D, Augustine GJ, Fitzpatrick D, Hall WC, LaMantia A, Mooney RD, Platt ML, White LE. (2017). Neuroscience, (6th Ed). Oxford University Press. ISBN 978-1605353807 (hardcover); 978-1605358413 (paperback)
  https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9781605353807 (print)
  https://unswbookshop.vitalsource.com/products/-v9781605357225 (digital version)
  https://www.ncbi.nlm.nih.gov/books/NBK10799/ (free e-book on PubMed 2nd (older) edition)
  Note that 7th edition ISBN 978-0197616246 will be available during 2023: Check availability on following links:
  https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9780197616246 (print)
  https://unswbookshop.vitalsource.com/products/-v9780197616680 (digital version)
- Kenney WL, Wilmore JH, Costill DL. (2019). *Physiology of sport and exercise,* (7th Ed). Human Kinetics Publishers, Champaigne IL, USA. ISBN-13: 978-1492572299.
- Kandel ER, Schwartz JH, Jessell TM, Siegelbaum SA, Hudspeth AJ. (2021). *Principles of Neural Science,* (6th Ed). McGraw Hill Education. ISBN-13: 978-1259642234.

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

Suggested reference books

- Bear MF, Connors BW, Paradiso MA. (2015). *Neuroscience: Exploring the Brain,* (4th Ed). Lippincott Williams & Wilkins, USA. ISBN-13: 978-0781778176.
- Shumway-Cook A, Woollacott MH. (2011). *Motor Control: Translating research into clinical practice,* (4th Ed). Lippincott Williams & Wilkins, USA. ISBN-13: 978-1608310180.
- Lieber RL. (2009). *Skeletal Muscle Structure, Function, and Plasticity*, (3rd Ed). Lippincott Williams & Wilkins, USA. ISBN-13: 978-0781775939.
- Enoka, RM. (2008). *Neuromechanics of Human Movement,* (4th Ed). Human Kinetics Publishers, Champaigne IL, USA. ISBN: 0736066799.
- Zigmond MJ, Rowland LP, Coyle JT. (2014). *Neurobiology of Brain Disorders.* Academic Press. ISBN: 9780123982704.
- Payne G, Isaacs L. *Human Motor Development: A Lifespan Approach* (10th Ed). Routledge. ISBN: 978-0367347376

Peer-reviewed journals

Search PubMed for peer-reviewed articles https://www.ncbi.nlm.nih.gov/pubmed
Some journals of interest: Nature Neuroscience, Nature Reviews Neuroscience, Current Biology, The Journal of Neuroscience, The Journal of Physiology, The Journal of Applied Physiology, Experimental Brain Research Clinical Neurophysiology, The Journal of Motor Behaviour, Progress in Neurobiology, Muscle and Nerve.

8. Administrative matters

Student enquiries should be submitted via student portal https://portal.insight.unsw.edu.au/web-forms/

Please note that course convenors do not manage enrolment system, for technical questions and academic enquiries please use the web form above.

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- *Student Wellbeing and Health* https://www.student.unsw.edu.au/wellbeing
- UNSW IT Service Centre: https://www.myit.unsw.edu.au/services/students
- *UNSW Student Life Hub:* https://student.unsw.edu.au/hub#main-content
- *Student Support and Development:* https://student.unsw.edu.au/support
- *IT, eLearning and Apps:* https://student.unsw.edu.au/elearning
- *Student Support and Success Advisors:* https://student.unsw.edu.au/advisors
- *Equitable Learning Services (Formerly Disability Support Unit):* https://student.unsw.edu.au/els
- *Transitioning to Online Learning* https://www.covid19studyonline.unsw.edu.au/
- *Guide to Online Study* https://student.unsw.edu.au/online-study