Independent research project

HBS3IRP Independent Research in Human Physiology

2019

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Project overview

This research project is the capstone experience for the Human Physiology and Anatomy major. It gives you the opportunity to apply and extend the skills and knowledge you have developed earlier in your degree.

In a team of 5, you will design and carry out a research project that steps you through all stages of the scientific method. Teams will act independently through the project; however, you will have an advisor to provide advice and guidance when asked by the team.

The independent research project runs for all of semester 2 and has three major assessment tasks: a project proposal (team and individual components), a team poster, and an individual research article. Your work throughout the project is supported by online material and face to face learning activities in workshops.

Conducting a research project and presenting your outcomes over the course of 12-weeks is a challenging task. We have a suggested weekly schedule in this guide to help keep you on track

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Intended learning outcomes

On successful completion of this project students will be able to:

- Apply understanding of the processes of scientific inquiry and ability to critically analyse and solve scientific problems to emulating the role of scientist during completion of a team-based scaffolded research project
- Analyse information and data critically and synthesise new knowledge to produce coherent individual and team understandings
- Be accountable for learning and scientific work by demonstrating an ability to work effectively, responsibly and safely in an individual and team context
- Demonstrate effective communication skills by communicating scientific results, information, and arguments to a range of audiences, for a range of purposes, and using a variety of modes

The La Trobe Essentials

The Essentials are aimed at producing students who are "…able to address the most pressing global challenges intelligently and decisively". The *Innovation and Entrepreneurship* Essential is embedded in this subject and will appear on your Australian Higher Education Graduate Statement.

La Trobe is committed to creating opportunities for you to take an active role in shaping the forces that will shape our world. No matter where your degree takes you, the ability to tackle problems creatively will set you apart. *Innovation and entrepreneurship* creates success in whatever you do.

La Trobe's Innovation and Entrepreneurship Essential will give you opportunities to:

- generate new ideas
- create change
- resolve problems
- take risks
- be taught how to thrive in a fast-changing world
- be challenged to use your creativity to generate and effectively manage new ideas
- learn how to understand and solve complex problems
- locate and use knowledge to reduce risk and make smart decisions.

Due Dates

Week	Task	Marks	Due date	Submission format
3	Project proposal (team mark) and oral presentation (individual mark)	15	Files: Thursday 15th August 11.55pm Presentation: Friday 16th August	Files to LMS drop box: presentation file and data collection plan
6	Individual literature review	10	Monday 2nd September 11.55pm	File to LMS Turnitin drop box
12	Poster (team mark) and presentation (individual mark)	25	Thursday 24th October 12-2pm	Presentation at the Odeon
Exam period	Research article (individual)	40	Monday 4th November 11.55pm	File to LMS Turnitin drop box

Important deadlines (no marks)

Week	Task	Marks	Due date	Submission format
1	Health and Safety (individual) quiz	0	Monday 5th August 11.55pm	Complete LMS quiz
10	Research article (individual) plan or draft	0	Monday 7th October 11.55pm	File to LMS drop box
11	Poster (team) submission	0	Monday 14th October 11:55pm	File to LMS drop box

Missed assessments and late penalties

Please see the HBS3IRP subject learning guide for details.

Marking and Feedback

See the end of this guide for the marking scheme rubrics we will use to mark assessment tasks. We recommend that you read the marking schemes early in semester and review them as you are completing your assessment tasks. Advisors will be able to give you verbal feedback on drafts of your work (outside of the formal feedback processes described in this guide).

Weekly schedule

Week 1

In face-to-face lecture:

1. Attend the lecture (or view on Echo) to find out what you will be doing this semester
2. If you haven't formed a team, use this session to find students who are interested in the same project as you

In 2-hour weekly online content block (time of your choosing):

1. Complete the *Teamwork Foundations* online content, and apply the information learned to the team agreement, and team work throughout semester
2. Review Chapter 2 of *How to Do Science: a guide to researching human physiology* which provides information on experimental design
3. Complete the Experimental Design online quiz (no marks) which should help you design an appropriate experiment for your project

Independent research time

1. Form a team of 5 students and have all members sign up to the same team number in the LMS sign-up activity in the Proposal & Literature Review topic
2. Read this guide and look around the LMS site so you are familiar with how the project will run
3. Complete your Health and Safety quiz on the LMS (no marks)
4. If you need a refresher, watch the *EndNote Essentials* online content
5. If you haven't done so already, download EndNote and enter the research articles you have found into your EndNote library

In workshop:

1. Meet your advisor
2. Complete a team agreement, and save a copy by posting to your team forum so you can access (and update) later
3. Discuss project topic ideas with your team mates:
    a. Human research: choose a topic; refer to the available equipment, the *Human Research Project Ideas guide* and the image gallery of past posters on LMS and your advisor for help
    b. Scientific-laboratory research project: choose a topic; speak to your advisor and review documents provided
4. Make a plan for a literature search on research conducted on your topic area; see chapter 5 of *How to Do Science: a guide to researching human physiology* which provides information relating to searching the scientific literature. There is also an activity on LMS called *Systematic searching for Medline & Cinahl* which steps you through how to search databases

Week 2

In 2-hour weekly online content block (time of your choosing):

Work through the online content for this week (see in the suggested weekly schedule on LMS)

In workshop:

1. Discuss what you discovered through your literature search and refine your project if necessary
2. Focus on completing the Hypothesis, Aim, Background, and Study Design sections of your project proposal
3. Give your advisor a summary of your progress and your planned next steps, and ask for feedback on this
4. Decide on a plan for completing a draft of your proposal presentation
5. Technical staff will attend workshop this week; use this opportunity to discuss the resources you will require for your human research project. The technical staff will let you know if we have the resources and/or if we can order them in time for data collection

Independent research time:

1. Continue searching and reviewing the scientific literature related to your topic
2. Complete a full draft of your project proposal presentation so it is ready to receive feedback from your advisor in week 3 workshop

Week 3

In 2-hour weekly online content block (time of your choosing):

Work on responding to advisor feedback on your team proposal, and start writing your individual literature review Refer to chapter 7 of How to Do Science: a guide to researching human physiology and this guide for help

In workshop:

1. Receive feedback from your advisor on your proposal
2. For human research projects:
    a. Refer to the laboratory booking system and book time in the lab for the data collection period (week 4-6); liaise with your advisor to book times when you are all available
    b. Liaise with students in your workshop class to recruit participants for your study / find a study to act as a participant in; you may also use LMS forums to do this
3. For scientific-laboratory research projects: liaise with your advisor to arrange times to attend their laboratory for the data collection period (week 4-6)

In seminar:

Present your team project proposal to a panel of advisors and peers

Independent research time:

Finalise your project proposal before the submission deadline, and work on your individual literature review

Assessment: Team project proposal & presentation

Week 4

In 2-hour weekly online content block (time of your choosing):

Work through the online content for this week (see in the suggested weekly schedule on LMS)

Independent research time:

1. Work on your individual literature review
2. For human research projects: print out Participant Information and Consent forms for your participants to read and sign prior to commencing data collection

In practical class:

Note: you must have addressed all items in the project proposal appropriately before you can begin data collection. Also, you must have completed the Health and Safety quiz before entering the laboratory

1. Attend the practical laboratory at the time(s) you have scheduled for human research projects in teaching laboratories or attend your advisor's scientific laboratory
2. For human research projects, hand out Participant Information and Consent forms for your participants to read and sign prior to commencing data collection
3. Begin data collection
4. Consider taking photos/video of data collection to use when demonstrating your methods when presenting your project; make sure you obtain consent from anyone who will be identifiable in photos/video you take
5. Before leaving the lab, review the team's bookings for next week and decide if any changes need to be made. Please make sure any additions/deletions to teaching laboratory bookings are made by Wednesday 11.55pm to allow technical staff time to prepare for next week's classes

Milestone: Begin data collection

Week 5

In 2-hour weekly online content block (time of your choosing):

Work through the online content for this week (see in the suggested weekly schedule on LMS)

Independent research time:

1. Work on your individual literature review
2. Discuss plans with team members for creating your poster

In practical class:

1. Attend the practical laboratory at the time(s) you have scheduled for human research projects in teaching laboratories or attend your advisor's scientific laboratory
2. Before leaving the lab, review the team's bookings for next week and decide if any changes need to be made. Please make sure any additions/deletions to teaching laboratory bookings are made by Wednesday 11.55pm to allow technical staff time to prepare for next week's classes

Week 6

In 2-hour weekly online content block (time of your choosing):

1. Work through the online content for this week (see in the suggested weekly schedule on LMS)

In practical class:

Attend the practical laboratory at the time(s) you have scheduled for human research projects in teaching laboratories or attend your advisor's scientific laboratory

Independent research time:

1. Finish and submit your individual literature review
2. If you have completed data collection, begin data analysis; see chapter 3 of *How to Do Science: a guide to researching human physiology* which provides instructions for obtaining descriptive statistics and conducting statistical analyses
3. Start working on the content for the introduction and methods for your research plan and team poster. Refer to chapter 6 and 7 of *How to Do Science: a guide to researching human physiology* and this guide for help
4. As you work on the content for the introduction, refer to chapter 5 of *How to Do Science: a guide to researching human physiology* which links to instructions for inserting references as you write and create a reference list

Assessment: Submit individual literature review

Milestone: Complete data collection

Week 7

In 2-hour weekly online content block (time of your choosing):

Work through the online content for this week (see in the suggested weekly schedule on LMS)

In lecture:

Attend the lecture (or view on Echo) for an overview of what will happen in weeks 7-12

In workshop:

1. Using your collected data, work through the appropriate sections of chapter 3 of *How to Do Science: a guide to researching human physiology* to statistically analyse the data; determine if there are statistical differences between the data sets
2. Read chapters 3 and 4 of *How to Do Science: a guide to researching human physiology* and follow the instructions to on how to work with data in Excel spreadsheets to create tables and graphs to present your data
3. Discuss the outcomes of the statistical analysis with your advisor; begin thinking about how you might explain your results

Independent research time:

Start working on the results for your research plan and team poster. Refer to chapter 6 of How to Do Science: a guide to researching human physiology and this guide for help

Week 8

In 2-hour weekly online content block (time of your choosing):

View online content: review the annotated Discussion and Conclusion in chapter 6 of How to Do Science: a guide to researching human physiology

Independent research time:

Start working on the discussion and conclusion for your research plan and team poster. Refer to chapter 6 of How to Do Science: a guide to researching human physiology and this guide for help

In workshop:

Discuss any questions or issues with your advisor

Week 9

In 2-hour weekly online content block (time of your choosing):

Revise online resources to help you finish tasks you are working on this week; watch or rewatch videos / visit or revisit websites that will help you with finalising your presentations

Independent research time:

1. It is suggested that you swap your research article plan with a fellow student, so you can each provide and receive feedback based on the marking scheme
2. Work on research article plan / draft
3. Work on the team poster

In workshop:

Use this time to work on team poster, and receive feedback from your advisor

Week 10

Independent research time:

1. Submit your research article plan / draft by the deadline
2. Complete work on the team poster

In workshop:

Discuss your team poster with your team mates and advisor

ASSESSMENT: Submit research article plan

Week 11

Independent research time:

1. Submit the team poster by the deadline
2. Review feedback from your advisor on your research article plan; start revising article based on feedback

DEADLINE: Poster submission

Week 12

Independent research time:

1. Continue to work on your research article
2. Prepare to present your poster

In class conference:

As a team, present your poster and answer questions; look at other team posters; vote on best poster

ASSESSMENT: Poster presentation

Exam period

Finalise your research article and submit by the deadline

ASSESSMENT: Research article final submission

Project Proposal

You will work with your team to develop a proposal for your research project. As a team, you will submit a completed proposal template, presentation file and data collection plan. The language and delivery aspect of the team presentation will be assessed individually, along with a brief literature review on the topic being investigated.

1. Team formation & sign-up

You will form a team of 5 of your choice at the beginning of semester and teams will work together for the whole project. We recommend that teams complete a team agreement at the beginning of semester.

Each team will have an academic advisor. Advisors will not lead the team or make decisions for the team; however, they are there to help and guide you when needed.

Your task

Form a team of 5 students and sign-up to the same team via the LMS team sign-up activity in the Proposal and Literature Review topic.

You have the choice of a:

- human research projects (using your team and peers as participants) in the teaching laboratories
- research project in established scientific laboratories where you will analyse animal tissue or cell cultures, or possibly biopsied human tissue.

By default, teams will conduct a human participant project. If you are interested in working with an advisor in their own scientific research laboratory, you will need to contact them and gain approval to sign-up to one of these projects. If you are interested, please get in early as project numbers are limited.

Information about the specific types of projects you can complete are provided on LMS in the ***Human Research Project Ideas guide*** and the ***Scientific Laboratories Research Project Ideas*** guide.

Human research projects

You will be required to participate in the data collection for your team and for another team's research project. You can recruit any students enrolled in HBS3IRP to participate in your study.

Students who do not participate in data collection (your team and another) may not be eligible for the team poster marks.

You do not have to participate in the same project as the rest of your team. If you have any difficulties, please contact the subject coordinators.

Scientific-laboratory research projects

You will not be required to participate in data collection for another team's research project because you will be able to collect enough data with your own team members, and the data collection process is likely to be more time consuming than for human research projects.

Team dynamics issues

Please communicate with your advisor if you have any concerns about team dynamics as soon as issues arise. If you have concerns regarding team members not contributing the proposal and/or poster assessments, it is recommended that you discuss this with your advisor as early as possible and in the week prior to submission of the assessment task at the latest. If a team member does not contribute to the data collection and analysis and/or assessment tasks, it is acceptable to leave their name off the submitted work and Team Contribution.

2. Health and safety quiz (no marks)

You are required to complete the health and safety quiz on LMS before you can enter a laboratory for data collection.

This declaration lists the health and safety guidelines to be followed in *HBS3IRP Independent Research in Human Physiology* practical-based activities.

If you will be completing a project with an advisor in a scientific research laboratory, there will be additional health and safety guidelines that you need to abide by, and your advisor will inform you of these.

3. Research project proposal

A research project proposal is a way to inform others about the proposed area of research and provides an explanation of:

- the proposed research (what will be done),
- the importance of the study (why it should be done),
- an overview of the methods and techniques to be used (how it will be done).

In addition to this student guide, *How to Do Science: a guide to researching human physiology*, and the marking scheme for this task will help you complete your proposal.

Topic selection

You will need to choose a topic and research question to investigate. You are limited by time, equipment availability, and safety and ethics.

Your project should have a control group or crossover study design, with one independent variable and two or three groups. A study design that is more complex than this is likely to be too challenging to complete within the available time. Whether you choose a control group or crossover study design will depend on nature of the experiments.

Refer to ***Human Research Project Ideas*** and ***Scientific Laboratories Research Project Ideas*** guides on LMS for suggested aims, scientific literature, methodologies, and things to consider. You could choose one of these ideas or adapt it to your team's interests. It is acceptable for teams to plan a study that has been conducted previously.

Your task

Student teams will work together to:

- Formulate a title for the study
- Devise the background and significance of the proposed research

- Formulate a hypothesis and aim for the study
- Devise an experimental design and methodology including statistics that will generate data that will either support or refute the hypothesis
- Create a realistic schedule for data collection
- Address key ethical and safety issues for the project

Teams will present their proposal in the form of a presentation (e.g., using PowerPoint) and will complete a Data Collection Plan

You should include the following in your presentation slides:

- Title
- Background and significance
- Aims and hypotheses
- Methods:
    - experimental design
    - procedure
    - statistical analysis
- References presented as footnotes throughout

We recommend teams complete the project proposal template provided, and use the content to create the presentation slides.

The **Data Collection Plan** gets you to:

- Create a realistic schedule for data collection
- Address key ethical and safety considerations for the project
- List team member contributions to completing the project proposal

Teams conducting human research projects will also:

- Create a comprehensive list of resources required for data collection to help tech staff prepare the lab for you*
- Plan for team members to participate in another team's study
- Write a Participant Information and Consent form to make sure participants understand any health and safety issues relating to the project

** For human participant projects, you will need to think about all of the equipment and consumables you will require each week for data collection. The technical staff will use this list to make your resources available each week; if you do not include everything you need on the list, it cannot be guaranteed that technical staff will be able to make extra resources available at short notice.*

Proposal presentation instructions

Your team will deliver their presentation in class in week 3 to a panel of advisors and other classmates.

- Check the timetable for the presentation time options in Week 3; the team leader is to sign up for the session via the LMS sign-up in the Proposal and Literature Review topic (you can do this in week 1)
- Team members are to meet at the venue; please arrive early; in fairness to all presenters, **late entry into the room will not be permitted** from 5 minutes past the hour
- Teams will access their presentations from the LMS dropbox
- Each team member should present

If you are not present for your proposal presentation but have a justification, please refer to the subject learning guide for information on what you should do.

File submissions

Teams will submit their **presentation file** and their completed **Data Collection Plan** document to the LMS drop box by the deadline.

Marking and Feedback

These tasks are worth 15% of your final grade.

For the oral presentation, the panel of advisors and classmates will provide you with verbal feedback immediately following your oral presentation. You will also receive feedback via the rubrics on LMS.

For the Data Collection Plan, your advisor will mark this, and you will receive feedback via the rubric on LMS.

Laboratory information for research projects using human participants

You will be able to book time in the laboratories (at a suitable time for the team and advisors) on Monday and Tuesday from 9am-6pm during weeks 4-6. You will book laboratory times via the online booking system linked to on LMS in the Proposal and Literature Review topic. Each team is able to book the lab for a maximum of 8 hours per week during the data collection phase. A maximum number of 5 teams will be able to use each laboratory at the same time. Lab bookings should be completed by the time you submit your final project proposal to give the tech staff time to get your team's equipment set up.

Instructions for booking laboratory time

Your team leader should access the lab booking calendars via the links on LMS to book time for data collection. Please take care not to delete or override other teams' bookings. Contact the coordinators if you have any issues with lab bookings.

How to make a Booking

Click on one of the two links to make a booking of Lab BS2-263 or Lab BS2-264. There are 5 available time slots available at any one time. **Note.** Once you make a booking, you cannot modify it after 30 minutes

1. Select time on the calendar
2. The Add Event panel will open
3. Title - Input your Team Number into the Title field
4. When – Input the time period you need the lab (no more than 4 hour blocks)
5. Calendar – Select the Slot number from the dropdown menu
6. Who - Enter your name (the person doing the booking, team leader)
7. Where – Leave this field blank
8. Save – Make sure you save the booking

Laboratory information for scientific laboratory research projects

Teams involved in scientific laboratory research projects will be guided by their advisor.

Human Research Project Proposal

1a. Project proposal – oral presentation

Here is a summary of the information that you should include in your proposal presentation. Enter the information that is relevant for your study into the provided template (available on LMS) and use this as the basis of your presentation.

Section	Description
Title	Provide an informative and succinct title for your project.
Background and significance	Provide brief relevant background information for your study, and a rationale for the study. In other words, what do we know about this area of research and why is it important? Make sure that you reference this section appropriately.
Aims	State the aim(s) of the project. For a guide to writing, refer to *How to Do Science: a guide to researching human physiology*.
Hypotheses	State the hypothesis/hypotheses of the project. For a guide to writing, refer to *How to Do Science: a guide to researching human physiology*.
Methods – experimental design	State whether you will use a: 1. Control group experimental design, or 2. Treatment order control/crossover experimental design Chapter 2 of How to Do Science: a guide to researching human physiology provides examples of different types of study design that you could implement. Figure 2.14 on page 49 provides a flow diagram that should help you with this decision. If using a Control group experimental design, state: ▪ Your groups and how many participants in each ▪ How you will create groups: random assignment, or balanced groups based on one or more variables (state these) ▪ Blinding – will there be blinding, who will be blinded and to what? If using a Treatment order control/crossover experimental design, state: ▪ Participant number ▪ Your conditions ▪ How you will counterbalance order of presentation of conditions ▪ Blinding – will there be blinding, who will be blinded and to what?
Methods – step by step procedures	▪ Include a description of what participants will do, including how they will prepare for participating ▪ If you are using any supplements, explain the doses you will administer (what this is based on) and the placebo you will use, and provide references ▪ Explain any exercise protocols ▪ Refer to any equipment used along with manufacturer details if known ▪ If you are using any scales or tests, explain these and what they measure, and provide references

	▪ Explain how you will measure the dependent variables
Methods – data and statistical analysis	Describe the dependent variables and what statistical tests you will use to analyse the data For a guide to writing, refer to Chapter 6 of *How to Do Science: a guide to researching human physiology*.
References	Use footnotes for referencing in your PowerPoint file Format your references using your preferred style.

1b. Data Collection Plan & Ethics

Here is a summary of the information that should be entered into the provided template (available on LMS).

Data collection schedule & resource list	Fill in the provided sections of the template. Liaise with your advisor to determine when you will attend the laboratory – try to arrange a time when your advisor is available. A full list of available equipment is provided in the ***Human Research Project Ideas* guide** to help with your resource list.
Ethical & safety considerations	▪ State the body who provided ethical approval for the project (La Trobe University Human Ethics Committee) ▪ Describe any exclusion criteria that will stop anyone participating who may be at risk if they undertake your protocol (e.g., participant doesn't meet pre-exercise screening criteria) ▪ Describe how you will protect the confidentiality of your participants (e.g., how will you store their data) ▪ Describe the specific safety measures that you will implement (e.g., safe use of treadmills including minimum space left around treadmills and use of spotters to assist if the participant falls off)
Participant Information and Consent form	▪ Complete the template
Team Contributions	State the percent contribution of each team member toward completion of this task. If all team members contributed equally, for a team of 5 it will be 100% each. If a team member completed half of the tasks that they were responsible for, state 50% contribution for that team member. If a team member did not contribute and should not receive marks – please state 0% for that team member. We will use this information to assign assessment marks.

	We strongly advise all students to keep records of their contributions (e.g. forum or Facebook posts, drafts) in the event that you need to show these to coordinators if you want to claim or dispute a less than 100% contribution.

Scientific-Laboratory Research Project Proposal

1a. Project proposal – oral presentation

Here is a summary of the information that should be included in your proposal presentation. Enter the information that is relevant for your study into the provided template (available on LMS) and use this as the basis of your presentation.

Section	Description
Title	Provide an informative and succinct title for your project.
Background and significance	Provide brief relevant background information for your study, and a rationale for the study. In other words, what do we know about this area of research and why is it important? Make sure that you reference this section appropriately.
Aims	State the aim(s) of the project. For a guide to writing, refer to *How to Do Science: a guide to researching human physiology*.
Hypotheses	State the hypothesis/hypotheses of the project. For a guide to writing, refer to *How to Do Science: a guide to researching human physiology*.
Methods – experimental design	State whether you will use a: 1. Control group experimental design, or 2. Treatment order control/crossover experimental design Provide the following details for **animal studies**: ▪ Number, sex, species, strain and weight of animals ▪ How animals are allocated to groups (random assignment, or balanced groups based on one or more variables) ▪ Animal housing conditions including diet ▪ What will be done to the animals prior to sacrifice ▪ Justify any drug doses or supplement doses with references Provide the following details for **cell culture studies**: ▪ What cells you will use (primary vs cell lines) ▪ Which species & tissue the cells were derived from ▪ What you will measure as your experimental results (e.g. proliferation, differentiation, mRNA, protein, biochemical assays)
Methods – step by step procedures	Provide the following details for **animal studies**: ▪ Tissue harvesting and sample preparation ▪ Explain how each dependent variable will be measured, referring to any equipment used along with manufacturer details if known Provide the following details for **cell culture studies**: ▪ What treatments will be used (i.e. chemical compounds, hypoxia, etc.). ▪ Justify treatment concentrations with references

	▪ Explain how each dependent variable will be measured, referring to any equipment used along with manufacturer details if known
Methods – data and statistical analysis	Describe the dependent variables and what statistical tests you will use to analyse the data For a guide to writing, refer to Chapter 6 of *How to Do Science: a guide to researching human physiology*.
Reference list	Use footnotes for referencing in your PowerPoint file. Format your references using your preferred style.

1b. Data Collection Plan & Ethics

Here is a summary of the important information that should be entered into the provided template (available on LMS).

Data collection schedule	Fill in the provided sections of the template. You will only be able to attend the laboratory when your advisor is present. Your advisor will work with you to decide on appropriate times for data collection.
Ethical & safety considerations	▪ State the body who provided ethical approval for the project ▪ Provide the key information presented in the ethics application that was approved by the relevant body ▪ Describe the specific safety measures that you will implement when working in the laboratory (e.g., use of disposable gloves and other safety equipment; describe the safety measures that were outlined when you had the laboratory induction)
Statement of Contribution	State the percent contribution of each team member toward completion of this task. If all team members contributed equally, for a team of 5 it will be 100% each. If a team member completed half of the tasks that they were responsible for, state 50% contribution for that team member. If a team member did not contribute and should not receive marks – please state 0% for that team member. We will use this information to assign assessment marks. We strongly advise all students to keep records of their contributions (e.g. forum or Facebook posts, drafts) in the event that you need to show these to coordinators if you want to claim or dispute a less than 100% contribution.

4. Literature review

Scientific literature reviews are scholarly papers found in academic journals that describes the current knowledge on a topic. Literature reviews are secondary sources, and do not report new or original experimental work, but provide a synthesis and evaluation of the existing literature, usually citing many studies.

Your task

Using a provided template, you will write a brief literature review on the topic of your team research project. Although this is a discrete assessment task, the work completed will be invaluable for successful completion of your research article, in particular, the introduction and discussion sections.

It is suggested that you refer to *How to Do Science: a guide to researching human physiology* and the literature review marking scheme to help with writing your review. There is also a literature review analysis grid template on LMS to help you get started.

Format

The review document should include your name, student ID and advisor's.

The review should be between 450-550 words and include:

1. Synthesis and evaluation of current literature on the topic
2. Concluding comments providing justification for the research
3. Reference list using EndNote software

The 450-550-word count does not include the reference list.

File submission

Your submission should be uploaded to LMS prior to the deadline and should include the following documents:

1. Completed literature review document
2. A copy of your EndNote file (.enl file) containing the references that you included in your review

Marking and Feedback

This task is worth 10% of your final grade.

You will receive written feedback on your review and a mark via the rubric marking scheme on LMS.

Data collection

In this three-week period, you will conduct your experiments as described in your project proposal. You will not be able to begin data collection until your advisor has confirmed that your proposal describes a sound study and that all ethical considerations have been addressed to their satisfaction.

Your task

Collect your data as you planned in your project proposal.

Laboratory bookings for human research projects

You will schedule laboratory bookings for data collection as part of your project proposal.

Human research projects

If you find that you have booked more time than you need, please contact coordinators via email to cancel your bookings. Alternatively, if you find that you need more time than you originally booked, make additional bookings by 11.55pm on Wednesday to allow technical staff enough time to arrange for your resources to be available the following week.

Laboratory use for scientific laboratory research projects

You will work with your advisor to collect data as agreed in your project proposal.

Data analysis & presentation of results

Now that you have conducted your experiments and collected your data, it is time to analyse the data and present the results.

Your task

You will analyse your data to determine if there are significant differences between groups, and you will present this data in text and scientific figures and/or tables.

Data analysis and presentation

All stages of data analysis and presentation are supported by step-by-step instructions in *How to Do Science: a guide to researching human physiology*. See:

- Chapter 3 for instructions on organising your data in a spreadsheet, obtaining descriptive statistics, and carrying out statistical tests (t tests and ANOVA)
- Chapter 4 for instructions on creating a figure and figure legend to display your data
- Chapter 4 for instructions on creating a scientific table and table legend to display your data

Poster and research article

In the final stage of the scientific method, scientists communicate their findings to the wider community.

Scientists communicate with their peers (i.e., an audience with whom they share similar expertise) informally in individual and laboratory group discussions, and formally via posters and oral presentations at scientific conferences, and the publication of research articles in scientific journals. If student scientists are to develop expertise in communication, they need opportunities to develop the skills and to practice them in a variety of formats.

Your task

Communicate your independent investigation to the scientific audience via two modes that scientists use to communicate with their peers:

1. Poster (team)
2. Research article (individual)

While you will communicate the outcomes of the same experiments via these two methods, you will need to make decisions on what information is essential to include and how you can tailor your presentation to best reach your audience using this communication platform.

Poster presentation (team and individual task)

In this task you will present your independent investigation as a poster in the same format as for a meeting at a scientific conference.

Scientific posters summarise research concisely and attractively to help publicise it and generate discussion and usually includes brief text mixed with tables and/or graphs, and other presentation formats.

Resources

It is suggested that you refer to chapter 6 *How to Do Science: a guide to researching human physiology*, past student posters, the poster template available on LMS and the marking scheme to help with preparation of the poster. Online resources will help you think about interesting ways to design your poster.

Poster format

Overall visual appearance

The poster should be A1 poster size, portrait orientation, and with an appropriate font size for readability.

There should be a banner heading spanning the full width of poster which includes a concise descriptive title, authors, and institution; the rest of the poster summarises the research concisely and attractively.

There should be minimal text: diagrams may be included, as well as figures and/or tables to effectively transmit information.

Poster content

Your poster should include:

1. Title, authors and institution:
2. Short summary of your research project for a non-scientific audience
3. Introduction
4. Methods
5. Results (including figures, tables as appropriate for your study)
6. Discussion
7. References

Refer to chapter 6 of *How to Do Science: a guide to researching human physiology* and the online content for advice.

You should refer to the body that provided ethical approval (La Trobe University Human Ethics Committee or relevant body approving scientific laboratory projects) and confirm that informed consent was obtained from all human participants.

Note: students often make the mistake of focusing on "limitations" of the study in the discussion (especially if no significant effects are observed), rather than discussing the results in light of the existing literature.

Examples of possible methodological limitations are briefly discussed below with suggestions for how to talk about them in the discussion. Do not just provide a list of all of the things you think you did wrong in your study!

- **Sample size:** small sample sizes are not uncommon in research and having a small sample size is not automatically a limitation. However, if your study had few participants compared to similar research that found significant effects/differences, you may suggest that the different sample size may explain why your findings are inconsistent.
- **Measure used to collect the data:** when writing up your results you may find that you should have used different methods of data collection to better investigate a particular variable; this may explain why you did not find a significant effect or why your results varied to other published findings. Frame this discussion around comparisons to other findings.

Source: University of Southern California Research Guide

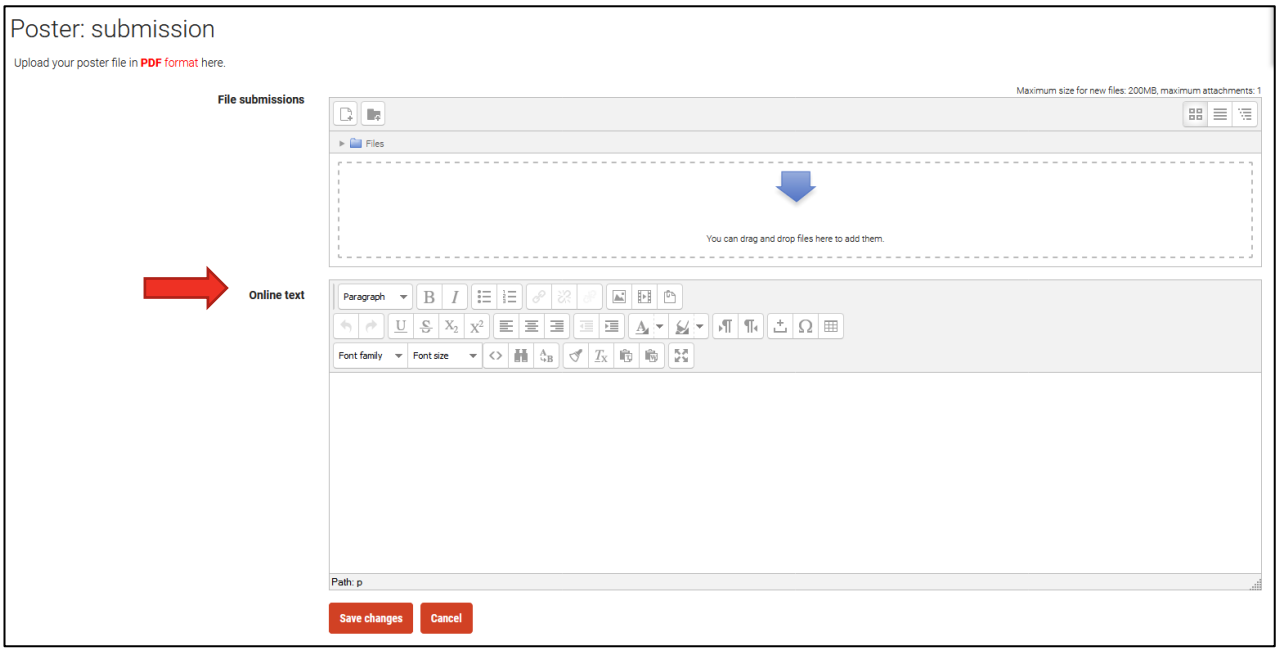
Team contributions

State the percent contribution of each team member toward completion of this task.

If all team members contributed equally, for a team of 5 it will be 100% each. If a team member completed half of the tasks that they were responsible for, state 50% contribution for that team member. If a team member did not contribute and should not receive marks – please state 0% for that team member. We will use this information to assign assessment marks.

We recommend you keep records of their contributions (e.g. forum or Facebook posts, drafts) in case you want to claim or dispute a less than 100% contribution.

Enter this information into the *Online text* box in the poster file submission drop box:



Submission details

- The poster is to be submitted before the deadline as a **PDF** file via the team's LMS assignment drop box. Please include your team number and the team leader's full name in the title of your submitted file
- The coordinators will have the posters printed and displayed at the poster presentation
- If a team does not submit their poster file by the deadline, it will be the team's responsibility to print their poster (according to the specifications in this manual) and bring it to the venue for display at the poster session. *You still nee to upload your file to help with marking.*

Poster presentation details

- Team members meet at the venue at 12pm and stand by the poster
- Two examiners will visit your poster during the session and both will ask each team member a question relating to the information displayed in the poster
    - Each team member will be marked individually on their ability to answer questions (worth 5 out of the 25 marks for the poster)
- After the questions, team members can view other team posters and ask questions. During this period, your poster should be manned by at least one team member

Feedback

You will receive feedback on your poster and a mark via the rubric marking scheme on LMS.

Research article (individual task)

You will present your independent investigation as a research article written in the same format as for submission to a scientific journal.

A research article reports the results of original research, assesses its contribution to the body of knowledge in a given area, and is published in a peer-reviewed scholarly journal.

Format

We suggest you use *How to Do Science: a guide to researching human physiology* and the research article marking scheme to help with writing your article. There is also an example of an article from *The Journal of Physiology* in the format you should submit your article on LMS.

The research article should be typed 12-point font, double spaced, with approximately 30 mm margins. You are required to use EndNote software for your references.

The article should be between 1500 and 1800 words and include:

8. Title page:
   - Appropriate title
   - Student name & number
   - Team number
   - Three key words (should not be words included in the title)
   - Word count of the research article; includes in-text citations (does not include key-points summary, abstract, references and figure/table legends).
9. Key-points summary with word count stated (150 word limit)
10. Abstract with word count stated (250 word limit)
11. Introduction
12. Methods
13. Results
14. Discussion
15. References (begin on a new page)
16. Tables and caption (one per page)
17. Figures and caption (one per page)

The 1500-1800-word count comprises the introduction, methods, results and discussion; the title page, key-points summary, abstract, references, tables and figures are NOT included in the word count.

There should not be an Appendix or footnotes included in your article.

Key-points summary

See chapter 6 of *How to Do Science: a guide to researching human physiology* for information on key-points summaries, including some examples.

Abstract

The abstract is a summary of the research article, in no more than 250 words.

Suggested format:

- *Brief background*: 1-2 sentences
- *Aim*: 1 – 2 sentences
- *Methods*: an overview of the methods employed
- *Results*: presented quantitatively where appropriate, together with the statistical significance.
- *Conclusion(s)*: 1 - 2 sentences

See chapter 6 of *How to Do Science: a guide to researching human physiology* for an annotated abstract.

Introduction (literature review)

This section should introduce the study by presenting relevant background information and explaining the rationale for the study in a logical manner, with appropriate reference to the literature and physiological mechanisms, and concluding with the purpose of the study.

See chapter 6 of *How to Do Science: a guide to researching human physiology* for an annotated introduction.

Method and statistics

This section should describe how the study was conducted in sufficient detail to allow another researcher to replicate the study; it should include the experimental design, the methods employed to collect data, and details of statistical analysis used.

Suggested format:

- *Paragraph 1*: Contains participant demographics, experimental design, and name of body that provided ethical approval (La Trobe University Human Ethics Committee or relevant body approving scientific laboratory projects) and confirmation that informed consent was obtained from human participants
- *Paragraph 2 & beyond*: Experimental procedures
- *Final paragraph*: Statistical tests & data analysis; use the same format as in the HBS3HPR *Research Skills module* in semester 1

See chapters 2 and 6 of *How to Do Science: a guide to researching human physiology* for tips and an annotated Methods and Statistics section.

Results

Results should be presented logically and succinctly in text form and supported by figures and/or tables (with captions) as appropriate.

See chapter 6 of *How to Do Science: a guide to researching human physiology* for an annotated Results section.

Discussion

See chapter 6 of *How to Do Science: a guide to researching human physiology* for tips and an annotated Discussion and conclusion.

Note: students often make the mistake of focusing on “limitations” of the study in the discussion (especially if no significant effects are observed), rather than discussing the results in light of the existing literature.

Examples of possible methodological limitations are briefly discussed below with suggestions for how to talk about them in the discussion. Do not simply provide a list of all of the things you think you did wrong in your study!

- **Sample size:** small sample sizes are not uncommon in research, and having a small sample size is not automatically a limitation. However, if your study had few participants compared to similar research that found significant effects/differences you may suggest that the different sample size may explain why your findings are inconsistent.
- **Measure used to collect the data:** when writing up your results you may find that you should have used different methods of data collection to better investigate a particular variable; this may explain why you did not find a significant effect or why your results varied to other published findings. Frame this discussion around comparisons to other findings.

Source: University of Southern California Research Guide

References

You are required to use EndNote referencing in the research article. Citations should be provided in text when appropriate with consistent format and a reference list included (student's choice of output style). See chapter 5 of *How to Do Science: a guide to researching human physiology* for help.

Abbreviations

You should avoid abbreviations unless they are easily understood and help in reading the paper. It is recommended that you only abbreviate very long words that are used repeatedly; in most cases it is easier to read a paper when the words are written out in full each time. Abbreviations should be defined at their first mention; for example, beats per minute (bpm).

Research article plan/draft submission and feedback

You can receive feedback from your advisor on your dot point research article plan, or full draft if your work is in a more advanced stage. If you follow the weekly schedule you should have a plan for your research article by this stage. The plan should include the key items you will include under each subheading in your article; a template is provided on LMS.

You will receive written feedback on your draft via LMS to show you where you are at this stage of writing. If you submit your file on time you will receive feedback by Friday 11th October in week 10. Refer to the subject learning guide for details regarding late submissions.

Research article submission and feedback

Your submission should include the following documents:

1. Research article
2. A copy of your EndNote file (.enl file) containing the references that you have included in your research article

The research article is to be submitted by the deadline via the LMS drop box.

You will receive written feedback on your research article and a mark via the rubric marking scheme on LMS.

HBS3IRP Independent Research in Human Physiology

Research article plan template

Student name:
Team number:
Advisor:

PLAN

Title
[insert title here]

Key-points summary
[insert key points summary here]

Abstract
[insert abstract here]

Introduction (literature review)
Use the skills you developed with the HBS3HPR literature review in semester 1 where you learnt how to synthesise and evaluate findings from studies.
Complete the following table in point form using the prompts to guide you.

Points to cover	References you will use to support this section
1. [insert relevant background here] 2. [insert synthesis and evaluation of the relevant literature here] 3. [explain the importance of what you will study] 4. [describe the aim of the study]	1. [insert references that support the relevant background] 2. [insert references that support the synthesis and evaluation of the relevant literature here] 3. [insert references that support the importance of what you will investigate]

Methods and statistics

Complete the following table in point form using the prompts to guide you.

Points to cover	References you will use to support this section
1. [insert details of subjects and experimental design here] 2. [insert details of protocols here including details of the equipment used] 3. [insert details regarding how the dependent variables were measured, including details of the equipment used] 4. [insert details of statistical analysis here]	[insert references that support the methods used excluding statistical analysis, examples include but are not limited to: choice of supplement dose; choice of exercise protocol; choice of cognitive test; choice of mood test]

Results

Complete the following table in point form using the prompts to guide you.

Points to cover
1. [insert details of results that you will present in text form] 2. [insert details of results you will present in figure form in the form of the figure legend; please note, it is possible depending on the data that some teams will not present data in a figure] 3. [insert details of results you will present in table form in the form of a table legend; please note, it is possible depending on the data that some teams will not present data in a table]

Discussion

Use the skills you developed with the HBS3HPR literature review in semester 1 where you learnt how to synthesise and evaluate findings from studies.

Complete the following table in point form using the prompts to guide you.

Points to cover	References you will use to support this section
1. [provide a summary of the main findings of the study] 2. [insert a main finding of the study here along with the synthesis and evaluation of the relevant literature] 3. [insert another main finding of the study here along with the synthesis and evaluation of the relevant literature] 4. [insert another main finding of the study here along with the synthesis and evaluation of the relevant literature – repeat this step until all of the main findings have been presented] 5. [insert the points to be covered in the conclusion here]	[insert references that support the synthesis and evaluation of the relevant literature here]

Marking schemes

This section of the student guide contains copies of the marking rubrics that will be used to mark the major assessments of the independent research project.

- Project proposal
- Literature review
- Poster
- Research article

LA TROBE UNIVERSITY

HBS3IRP Independent Research in Human Physiology

Project proposal marking scheme

Note: each student will be assessed *individually* in the oral presentation on language, speech and delivery and this will make up 5 of the 15 marks for the proposal

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
INDIVIDUAL: ORAL PRESENTATION STYLE				
Language and speech (50%)				
Speaker is audible and highly fluent. Language in presentation is highly appropriate to audience. Speaker uses most or all of the allocated presentation time.	Speaker is audible and highly fluent. Language in presentation is highly appropriate to audience. Speaker uses most or all of the allocated presentation time. Minor errors.	Speaker is mostly audible and fluent, but include some errors. Language in presentation is appropriate to audience. Speaker uses most or all of the allocated presentation time.	Speaker is sometimes inaudible or hesitant. Language in presentation may not be appropriate to audience. Speaker uses less than 80% of the allocated presentation time, or goes over time.	Speaker is often inaudible or hesitant. Language in presentation may not be appropriate to audience. Speaker uses less than 60% of the allocated presentation time, or goes overtime.
Delivery (50%)				
Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident. No referral to notes.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident. No referral to notes. Minor errors.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable. Delivery techniques may need improvement at times. Minimal referral to notes.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, but the speaker may appear tentative. Frequent referral to notes.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and the speaker may appear uncomfortable. Relies on notes for most of the presentation. Uses mobile phone or laptop for notes.

Note: the following will be assessed as a team which will comprise 8 of the 15 marks for the proposal

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
TEAM: ORAL PRESENTATION CONTENT				
Visual aids (15%)				
Slides are error-free and very logically present the main components of the project. Material is highly readable and the graphics highlight and support important concepts.	Slides are error-free and very logically present the main components of the project. Material is highly readable and the graphics highlight and support important concepts. Minor errors.	Slides are mostly error-free and logically present the main components of the project. Material is mostly readable and graphics highlight and support important concepts.	Slides contain some errors and at times may lack a logical progression. Material may not be readable at times, and some aspects of the project may be missing or confusing.	Slides contain errors and lack a logical progression. Many aspects of the project are absent or confusing.
Title (5%)				
Title is highly informative and succinct.	Title is highly informative and succinct. Minor errors.	Title is relevant.	Title lacking in relevance and/or clarity.	Title is related to the topic but inappropriate for the project.
Background and significance (15%)				
The background information and rationale for the study is presented in a highly-logical manner with utmost clarity and highly relevant literature is cited.	The background information and rationale for the study is presented in a highly-logical manner with utmost clarity and highly relevant literature is cited. Minor errors.	The background information and rationale for the study is presented in a mostly logical manner with clarity, and relevant literature is cited.	The background information and rationale for the study is presented in a somewhat logical manner but may lack clarity at times; relevant literature may be lacking.	The background information and rationale lack logic and clarity and relevant literature is lacking.
Hypotheses and aims (15%)				
Hypotheses and aims are accurate and succinct and are presented in scientific format.	Hypotheses and aims are accurate and succinct and are presented in scientific format. Minor errors.	Hypotheses and aims are accurate and presented in scientific format, but with some errors.	Hypotheses and aims are presented in scientific format but lack clarity and may be lengthy.	Hypotheses and aims are inappropriate/inaccurate and/or not presented in scientific format.
Experimental design (20%)				
Correct group creation and experimental design chosen for study. Explained with utmost accuracy and clarity.	Correct group creation and experimental design chosen for study. Explained with utmost accuracy and clarity. Minor errors.	Correct group creation and experimental design chosen for study, mostly accurate details are provided, and explained clearly.	Correct group creation experimental design chosen for study, but explanation lacks clarity and/or accuracy.	Incorrect group creation or experimental design chosen for study (e.g., does not include cross-over or blinding, if appropriate) and/or details presented are inaccurate or very unclear.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		Procedures (15%)		
Clearly and comprehensively states the research methodology being used and provides a clear rationale for the choices that were made (supported by references).	Clearly and comprehensively states the research methodology being used and provides a clear rationale for the choices that were made (supported by references). Minor errors.	States the research methodology being used and provides rationale for the choices that were made (supported by references); however, more subtle elements may be ignored or unaccounted for.	Methodology is not clearly stated and/or the rationale for the choices that were made lacks clarity and some references may be missing. Important elements of the methodology may be missing, incorrectly developed, or unfocused.	There is little attempt to explain the methodology and/or the text is very confusing. No references to literature provided to support methodological choices.
		Statistical analysis (15%)		
Appropriate statistical analysis chosen. Statistical methods explained accurately and succinctly.	Appropriate statistical analysis chosen. Statistical methods explained accurately and succinctly. Minor errors.	Appropriate statistical analysis chosen, but there are some inaccuracies or omissions.	Appropriate statistical analysis chosen, but there are many inaccuracies or omissions.	Inappropriate statistical analysis chosen, and/or very poorly explained.

Note: the following will be assessed as a team which will comprise 2 of the 15 marks for the proposal

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		TEAM: DATA COLLECTION PLAN & ETHICS & SAFETY REPORT		
Data collection schedule, and ethical and safety considerations are comprehensive and explained with utmost clarity.	Data collection schedule, and ethical and safety considerations are comprehensive and explained with utmost clarity. Minor errors.	Data collection schedule, and ethical and safety considerations are comprehensive and are mostly well explained. Teams to update and resubmit for advisor approval to start data collection.	Data collection schedule, and ethical and safety considerations are lacking in some detail and/or clarity of explanation. Teams to update and resubmit for advisor approval to start data collection.	Data collection schedule, and ethical and safety considerations are lacking in significant detail and/or clarity of explanation. Teams to update and resubmit for advisor approval to start data collection.

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Literature review marking scheme

A mark of zero will be given for work that does not meet Poor (cell one) level performance.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
Written communication (30%)				
Literature review is well organised and accurately and clearly written. The underlying logic is clearly articulated and easy to follow. Words are chosen that precisely express the intended meaning and support reader comprehension. Sentences are grammatical and free from spelling errors. Within the word limit.	Literature review is well organised and accurately and clearly written. The underlying logic is clearly articulated and easy to follow. Words are chosen that precisely express the intended meaning and support reader comprehension. Sentences are grammatical and free from spelling errors. Within the word limit. Minor errors.	Literature review is organised and accurately and clearly written for the most part. In some areas the logic or flow of ideas may be difficult to follow. Words are well chosen with some exceptions. Sentences are mostly grammatical, and some spelling errors are present, but they do not hinder the reader. Within the word limit.	Literature review lacks organisation, accuracy, clarity, logic and flow of ideas in areas. Words are not well chosen at times, and spelling errors and grammatical errors are apparent throughout the document. Not within word limit. Word count is within the range of 50 words below or above the 500 word limit.	Literature review is not accurately or clearly written. Grammatical and spelling errors make it difficult for the reader to interpret the text. Not within word limit. Word count is less than 450 words or more than 550 words.
Synthesis and evaluation (60%)				
Accurate synthesis and evaluation of the literature on the topic, presented with utmost clarity and logic.	Accurate synthesis and evaluation of the findings is presented with utmost clarity and logic. Minor errors.	Synthesis and evaluation of the findings is generally well presented but may be lacking in comprehensiveness or accuracy or clarity or logic at times.	Synthesis and evaluation is superficial and lacking in logic. Relevant sections may be missing or lacking in clarity or accuracy.	Synthesis and evaluation is severely lacking, and there may be major issues with logic, accuracy and clarity throughout.
Concluding comments (5%)				
Brief concluding comments that provide a clear and accurate justification for the importance of the research in this area.	Brief concluding comments that provide a clear and accurate justification for the importance of the research in this area. Minor errors.	Brief concluding comments that provide a justification for the importance of the research in this area.	Concluding comments are vague and lacking in clarity and/or accuracy, or missing detail.	Concluding comments are extremely vague and lacking in clarity and accuracy or missing.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		Reference list (5%)		
All evidence is properly cited in in-text citations and reference list. 10-20 references included. EndNote is used for referencing.	All evidence is properly cited in in-text citations and reference list. 10-20 references included. EndNote is used for referencing. Minor errors.	All evidence is cited in in-text citations and reference list, but there are some minor problems with completeness or format of some citations. 10-20 references included. EndNote is used for referencing.	Some pieces are unreferenced or inaccurately referenced, and there are problems with completeness and format of citations. 10-20 references included. EndNote is used for referencing.	Significant portions of text are unreferenced and/or there are significant problems with completeness of citations. <10 or >20 references included. A mark of zero will be awarded if EndNote is not used.

HBS3IRP Independent Research in Human Physiology

Poster presentation marking scheme

Note: the following will be assessed as a team which will comprise 20 of the 25 marks for the poster

A mark of zero will be given for work that does not meet Poor (cell one) level performance.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
VISUAL PRESENTATION (30%)				
Poster is error-free and very logically presents the main components of the project. Material is highly readable and the graphics highlight and support important concepts.	Poster very logically presents the main components of the project. Material is highly readable and the graphics highlight and support important concepts. Minor errors.	Poster is mostly error-free and logically presents the main components of the project. Material is mostly readable and graphics highlight and support important concepts.	Poster contains some errors and at times may lack a logical progression. Material may not be readable at times, and some aspects of the project may be missing or confusing.	Poster contains errors and lacks a logical progression. Many aspects of the project are absent or confusing.
SUMMARY FOR THE NON-SCIENTIFIC AUDIENCE (10%)				
All relevant details of the study are explained at a level appropriate for the target audience.	All relevant details of the study are explained at a level appropriate for the target audience. Minor errors.	Attempts are made to explain the details of the study at a level appropriate for the target audience. Some errors or missing information.	Many important aspects of the study are not explained and/or the study isn't communicated at a level appropriate for the target audience.	The study is mostly not explained and/or the study isn't communicated at a level appropriate for the target audience.
SCIENTIFIC METHOD (60%)				
Introduction (10%)				
The background information and rationale for the study is presented in a highly-logical manner with utmost clarity and highly relevant literature is cited.	The background information and rationale for the study is presented in a highly-logical manner with utmost clarity and highly relevant literature is cited. Minor errors.	The background information and rationale for the study is presented in a mostly logical manner with clarity, and relevant literature is cited.	The background information and rationale for the study is presented in a somewhat logical manner but may lack clarity at times; relevant literature may be lacking.	The background information and rationale lack logic and clarity and relevant literature is lacking.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		Hypotheses and aims (5%)		
Hypotheses and aims are accurate and succinct and presented in scientific format.	Hypotheses and aims are accurate and succinct and presented in scientific format. Minor errors.	Hypotheses and aims are accurate and presented in scientific format, but with some errors.	Hypotheses and aims are presented in scientific format but may lack clarity and may be lengthy.	Hypotheses and aims are inappropriate/inaccurate and/or not presented in scientific format.
		Methods (10%)		
Provides a very clear and accurate description of the experimental design, the methods employed to collect data, and details of the statistical analysis used.	Provides a very clear and accurate description of the experimental design, the methods employed to collect data, and details of the statistical analysis used. Minor errors.	Provides a mostly accurate and clear description of the experimental design, the methods employed to collect data, and details of the statistical analysis used.	Provides a description of the experimental design, the methods employed to collect data, and details of the statistical analysis used, however, some information is unclear, lacking accuracy, or missing.	Information regarding the experimental design, the methods employed to collect data, and details of statistical analysis are unclear or missing.
		Results (10%)		
Results are very clearly and accurately explained in a comprehensive level of detail and are well-organised. Tables/figures (with captions that describe the visual elements) very accurately and clearly convey the data. Statistical analyses are appropriate tests and are accurately interpreted.	Results are very clearly and accurately explained in a comprehensive level of detail and are well-organised. Tables/figures (with captions that describe the visual elements) very accurately and clearly convey the data. Statistical analyses are appropriate tests and are accurately interpreted. Minor errors.	Presentation of results are sometimes lacking in clarity, accuracy, and detail, and there may be organisational issues. Tables/figures and captions may be lacking in clarity and accuracy. Statistical analyses are appropriate tests and are accurately interpreted.	Presentation of results are lacking in clarity, and/or accuracy, and/or detail, and there may be organisational issues. Tables/figures and captions may be lacking in clarity and accuracy; significance symbols may be missing. Statistical analyses may be inappropriate tests and/or are not accurately interpreted.	Results are not clearly explained, level of detail is severely insufficient, and there are serious organisational issues (e.g., data are presented more than once). Tables/figures are not clear/concise in conveying the data; no error bars or captions. Statistical analyses are inappropriate tests and/or are not accurately interpreted (non-significant results are often referred to as changes).

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		Discussion (10%)		
Accurate and comprehensive evaluation of the findings is presented with utmost clarity. Interpretations of results are thoughtful and insightful, are clearly informed by the study's results, and thoroughly address how they supported, refuted, and/or informed the hypotheses. Insightful discussion of how the study relates to and/or enhances the present scholarship in this area. An accurate and succinct conclusion is presented in required format and consistent with data collected.	Accurate and comprehensive evaluation of the findings is presented with utmost clarity. Interpretations of results are thoughtful and insightful, are clearly informed by the study's results, and thoroughly address how they supported, refuted, and/or informed the hypotheses. Insightful discussion of how the study relates to and/or enhances the present scholarship in this area. An accurate and succinct conclusion is presented in required format and consistent with data collected. Minor errors.	Accurate evaluation of the findings is presented. Interpretations of results are sufficient but somewhat lacking in thoughtfulness and insight, are informed by the study's results, and adequately address how they supported, refuted, and/or informed the hypotheses. Discussion of how the study relates to and/or enhances the present scholarship in this area is adequate. An accurate conclusion is presented in required format and consistent with data collected.	Evaluation of findings has areas lacking in comprehensiveness, and or accuracy and/or clarity. Interpretations of results are lacking in thoughtfulness and insight, are not clearly informed by the study's results, and do not adequately address how they supported, refuted, and/or informed the hypotheses. Discussion of how the study relates to and/or enhances the present scholarship in this area has weaknesses. The conclusion is long-winded, and/or not presented in format consistent with hypothesis and aim.	Evaluation of findings is lacking in accuracy and clarity. Interpretations/analysis of results severely lacking in thoughtfulness and insight, are not informed by the study's results, and do not address how they supported, refuted, and/or informed the hypotheses. Discussion of how the study relates to and/or enhances the present scholarship in this area is severely limited and/or absent altogether The conclusion is inaccurate and/or not presented in format consistent with hypothesis and aim. The discussion marks will be allocated to this cell if the following are included in the discussion: Non-significant results are consistently referred to as changes; Limitations are consistently discussed.
		References (5%)		
All evidence is properly cited in in-text citations and reference list.	All evidence is properly cited in in-text citations and reference list. Minor errors.	All evidence is cited in in-text citations and reference list, but there are some problems with completeness or format of some citations.	Some pieces are unreferenced or inaccurately referenced, and there are problems with completeness and format of citations.	Significant portions of text are unreferenced and/or there are significant problems with completeness of citations.

Note: each student will be assessed *individually* on the ability to answer questions and this will make up 5 of the 25 marks for the poster

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
ABILITY TO ANSWER QUESTIONS				
Student responds accurately and succinctly and with utmost clarity to examiner questions. The response gives evidence of a complete understanding of the problem. It is fully developed and clearly communicated. All parts of the problem are complete. There are no errors.	Student responds accurately and succinctly and with utmost clarity to examiner questions. Minor errors and/or omissions.	Student responds accurately and clearly to examiner questions. Some errors and/or omissions.	Student responds mostly accurately and clearly to examiner questions. The response gives evidence of a reasonable approach but also indicates gaps in conceptual understanding. Parts of the problem may be missing. The explanation may be incomplete.	Student response is unclear and/or does not answer the question. The response fails to address or omits significant aspects of the problem. A mark of zero will be awarded if the response is completely incorrect or irrelevant or "I don't know".

HBS3IRP Independent Research in Human Physiology

Research article marking scheme

A mark of zero will be given for work that does not meet Poor (cell one) level performance.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
WRITTEN COMMUNICATION (15%)				
Research article is well organised and accurately and clearly written. The underlying logic is clearly articulated and easy to follow. Words are chosen that precisely express the intended meaning and support reader comprehension. Sentences are grammatical and free from spelling errors. Within the word limit.	Research article is well organised and accurately and clearly written. The underlying logic is clearly articulated and easy to follow. Words are chosen that precisely express the intended meaning and support reader comprehension. Sentences are grammatical and free from spelling errors. Within the word limit. Minor errors.	Research article is organised and accurately and clearly written for the most part. In some areas the logic or flow of ideas may be difficult to follow. Words are well chosen with some exceptions. Sentences are mostly grammatical and some spelling errors are present but they do not hinder the reader. Within the word limit.	Research article lacks organisation, accuracy, clarity, logic and flow of ideas in areas. Words are not well chosen at times, and spelling errors and grammatical errors are apparent throughout the document. Word count is within the range of 100 words below or above the 1500-1800 word limit.	Research article is not accurately or clearly written. Grammatical and spelling errors make it difficult for the reader to interpret the text. Not within word limit. Word count is less than 1400 words or more than 1900 words.
SCIENTIFIC METHOD (85%)				
Key-points summary (5%)				
Clearly, accurately and succinctly summarises the background, results and importance of the results in 5 bullet points within the word limit for a non-expert audience. Written in plain English, without scientific jargon, abbreviations or acronyms.	Clearly, accurately and succinctly summarises the background, results and importance of the results in 5 bullet points within the word limit for a non-expert audience. Written in plain English, without scientific jargon, abbreviations or acronyms. Minor errors.	Accurately summarises the background, results and importance of the results within the word limit for a non-expert audience. Written in plain English, without scientific jargon, abbreviations or acronyms.	A summary of the background, results and importance of the results are presented within the word limit, however, at times the text is confusing, and/or not written in plain English, and/or includes abbreviations or acronyms.	The key-points summary does not summarise the paper and/or is not within the word limit. The text is confusing, and/or not written in plain English, and/or includes abbreviations or acronyms.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		Abstract (5%)		
Clearly, accurately and succinctly presents: the background and purpose of the study; methods, results, and conclusions within the word limit.	Clearly, accurately and succinctly presents: the background and purpose of the study; methods, results, and conclusions within the word limit. Minor errors.	Accurately presents: the background and purpose of the study; methods, results, and conclusions within the word limit. There are some issues with clarity and/or succinctness.	Presents the abstract within the word limit but there are issues with accuracy and/or clarity and/or succinctness in sections of the text; some sections may be confusing or missing.	The abstract is not within the word limit. There are major issues with accuracy and/or clarity throughout the abstract.
		Introduction (18%)		
The background information and rationale for the study is presented in a highly-logical manner with utmost clarity and highly relevant literature is cited.	The background information and rationale for the study is presented in a highly-logical manner with utmost clarity and highly relevant literature is cited. Minor errors.	The background information and rationale for the study is presented in a mostly logical manner with clarity, and relevant literature is cited.	The background information and rationale for the study is presented in a somewhat logical manner but may lack clarity at times; relevant literature may be lacking.	The background information and rationale lack logic and clarity and relevant literature is lacking.
		Hypotheses and aims (2%)		
Hypotheses and aims are accurate and succinct and presented in scientific format.	Hypotheses and aims are accurate and succinct and presented in scientific format. Minor errors.	Hypotheses and aims are accurate and presented in scientific format, but with some errors.	Hypotheses and aims are presented in scientific format but may lack clarity and may be lengthy.	Hypotheses and aims are inappropriate/inaccurate and/or not presented in scientific format.
		Methods (10%)		
Provides a very clear and accurate description of the experimental design, the methods employed to collect data, and details of the statistical analysis used.	Provides a very clear and accurate description of the experimental design, the methods employed to collect data, and details of the statistical analysis used. Minor errors.	Provides a mostly accurate and clear description of the experimental design, the methods employed to collect data, and details of the statistical analysis used.	Provides a description of the experimental design, the methods employed to collect data, and details of the statistical analysis used, however, some information is unclear, lacking accuracy, or missing.	Information regarding the experimental design, the methods employed to collect data, and details of statistical analysis is unclear or missing.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		Results (10%)		
Results are very clearly and accurately explained in a comprehensive level of detail and are well-organised. Tables/figures (with captions that describe the visual elements) very accurately and clearly convey the data. Statistical analyses are appropriate tests and are accurately interpreted.	Results are very clearly and accurately explained in a comprehensive level of detail and are well-organised. Tables/figures (with captions that describe the visual elements) very accurately and clearly convey the data. Statistical analyses are appropriate tests and are accurately interpreted. Minor errors.	Presentation of results are sometimes lacking in clarity, accuracy, and detail, and there may be organisational issues. Tables/figures and captions may be lacking in clarity and accuracy. Statistical analyses are appropriate tests and are accurately interpreted.	Presentation of results are lacking in clarity, and/or accuracy, and/or detail, and there may be organisational issues. Tables/figures and captions may be lacking in clarity and accuracy; significance symbols may be missing. Statistical analyses may be inappropriate tests and/or are not accurately interpreted.	Results are not clearly explained, level of detail is severely insufficient, and there are serious organisational issues (e.g., no written results, data are presented more than once). Tables/figures are not clear/concise in conveying the data; no error bars or captions. Statistical analyses are inappropriate tests and/or are not accurately interpreted (non-significant results are often referred to as changes).
		Discussion (30%)		
Accurate and comprehensive evaluation of the findings is presented with utmost clarity. Interpretations of results are thoughtful and insightful, are clearly informed by the study's results, and thoroughly address how they supported, refuted, and/or informed the hypotheses. Insightful discussion of how the study relates to and/or enhances the present scholarship in this area. An accurate and succinct conclusion is presented in required format and consistent with data collected.	Accurate and comprehensive evaluation of the findings is presented with utmost clarity. Interpretations of results are thoughtful and insightful, are clearly informed by the study's results, and thoroughly address how they supported, refuted, and/or informed the hypotheses. Insightful discussion of how the study relates to and/or enhances the present scholarship in this area. An accurate and succinct conclusion is presented in required format and consistent with data collected. Minor errors.	Accurate evaluation of the findings is presented. Interpretations of results are sufficient but somewhat lacking in thoughtfulness and insight, are informed by the study's results, and adequately address how they supported, refuted, and/or informed the hypotheses. Discussion of how the study relates to and/or enhances the present scholarship in this area is adequate. An accurate conclusion is presented in required format and consistent with data collected.	Evaluation of findings has areas lacking in comprehensiveness, and or accuracy and/or clarity. Interpretations of results are lacking in thoughtfulness and insight, are not clearly informed by the study's results, and do not adequately address how they supported, refuted, and/or informed the hypotheses. Discussion of how the study relates to and/or enhances the present scholarship in this area has weaknesses. The conclusion is long-winded, and/or not presented in format consistent with hypothesis and aim.	Evaluation of findings is lacking in accuracy and clarity. Interpretations/analysis of results severely lacking in thoughtfulness and insight, are not informed by the study's results, and do not address how they supported, refuted, and/or informed the hypotheses. Discussion of how the study relates to and/or enhances the present scholarship in this area is severely limited and/or absent altogether The conclusion is inaccurate and/or not presented in format consistent with hypothesis and aim. The discussion marks will be allocated to this cell if the following are included in the discussion: Non-significant results are consistently referred to as changes; Limitations are consistently discussed.

5 (100%) Excellent	4 (80%) Very good	3 (70%) Good	2 (50%) Needs improvement	1 (25%) Poor
		References (5%)		
All evidence is properly cited in in-text citations and reference list. 10-20 references included. EndNote is used for referencing.	All evidence is properly cited in in-text citations and reference list. 10-20 references included. EndNote is used for referencing. Minor errors.	All evidence is cited in in-text citations and reference list, but there are some minor problems with completeness or format of some citations. 10-20 references included. EndNote is used for referencing.	Some pieces are unreferenced or inaccurately referenced, and there are problems with completeness and format of citations. 10-20 references included. EndNote is used for referencing.	Significant portions of text are unreferenced and/or there are significant problems with completeness of citations. <10 or >20 references included. A mark of zero will be awarded if EndNote is not used.