PC1001 PP2101 SP1 2017

GENERIC GUIDE TO PREPARATION OF PRACTICAL REPORTS

Writing practical reports is a skill in itself and is an important part of the practical component of this course. Practical reports provide an opportunity for you to demonstrate your understanding of the concepts behind the data and also provide practice in organising, analysing and communicating results.

The following guidelines are provided to help you with the preparation of such a report. A practical report does not have to be lengthy; however, it must follow a **specific format** and it must be written in grammatically correct English, using full sentences. Specific instructions with regards to the requirements for each practical report will be provided during each practical session. The report is comprised of the following sections:

Title
Aim(s)
Introduction
Materials and Methods
Results
Discussion (Questions)
Conclusion
References

The front page of the practical report should include the student's name and student number, subject code, title of practical report, date of practical session attended and group number (if appropriate).

The **individual sections should be clearly titled**. The report should **flow logically** and the reader should not have to search through to find relevant material. The Methods, Results and Discussion sections should be written in the **past tense** and all of the report should be written in the **third person**. For example, the statement “my blood pressure is...” would be written as “The blood pressure of Subject A was...” etc. Notes and abbreviations (unless defined) are not acceptable in a practical report.

Report writing guidelines and sample practical report

The following section contains specific instructions on what material to include in each section of the report. To help you further, we have also included a **brief sample practical report**, contained within the boxed sections below. **Please note: students will be expected to write up full practical reports for each practical session unless otherwise instructed**.

Background information to help you understand the sample practical (not part of the report)

This practical class investigates one of the factors that regulate breathing. In particular, we are looking at the effects of changing the levels of inspired CO_2 on respiration rate. Subjects are connected to a respiratory measurement device called a spirometer, and breathe from a gas reservoir. The experimenter gradually increases the level of CO_2 in the reservoir over time. Respiration rate and % CO_2 levels are continuously recorded on a computer.

Following the experiment, students analyse the data and produce a table of respiratory rate versus % CO_2 in the inspired air.

CO_2 (%)	respiration rate (breaths / min)
0.03	12
0.5	13
1	14
1.5	16
2	18
3	24

Title

This should be clear, concise and descriptive. It should not be copied from the practical manual.

The effect of inspired carbon dioxide (CO_2) levels on respiratory rate.

Aim(s)

Clearly, state the **purpose of the practical**, not the learning objectives. Be specific about the aim(s) of the practical and/or the hypotheses to be tested. If a number of hypotheses are being tested, you could list them under appropriate subheadings.

Aim:

The aim of this study was to investigate the effect of increasing CO_2 in inspired air on respiration rate in human subjects.

Introduction

This section should cover **what you investigated and why.** It is important to set the scene for the reader and provide a context for the practical. Briefly, describe the relevant theoretical background (with reference to journal articles or text books) including information that is required for the interpretation of the Results and Discussion. This should encompass the major points that will be addressed in the experimental work and provide sufficient information to explain why the particular experimental procedure was performed. Try not to be too general - give only the relevant physiological theory. It is often best to write this section last.

Introduction

It is important that the rate and depth of breathing can be regulated in response to the changing requirements of the body. The rate of respiration is controlled by the respiratory centres found within the medulla and pons in the brain. Nerve pathways from the respiratory centres innervate the respiratory muscles in the chest to change the rate and depth of breathing.

The activity of the inspiratory centres is influenced by higher brain centres, which enables voluntary control of breathing, and also by responses to stimuli such as pain and emotional changes (Marieb, 2001). Other factors that influence the respiratory centre are the levels of chemicals such as carbon dioxide, oxygen and hydrogen ions in arterial blood. The levels of these chemicals are monitored by central chemoreceptors located in the medulla and peripheral chemoreceptors within the carotid and aortic bodies in the neck. The most important chemical stimulus for respiration is believed to be arterial P_{CO_2} *(Marieb, 2001).*

This practical will explore this relationship by investigating the effect of varying levels of CO_2 *in inspired air on respiration rate.*

Materials and Methods

This section should contain sufficient information to enable someone else to repeat the experiment. It is acceptable to refer to the practical manual e.g. "The experiment was followed according to the James Cook University PC1001/PP2101 Laboratory Notes 2017 in regards to section entitled 'Respiratory Function" **but any changes in procedure or equipment must be noted**.

Material and Methods (in text)

The experiment was followed according to the James Cook University PC1002 Human Anatomy and Physiology II Practical Manual 2003 in regards to section entitled 'Respiratory Function'.

Results

The Results section will be a mixture of text and figures/tables. The results should be described but not interpreted. This means you should describe **what happened** but **not why**. Do not include what you predicted to find or were supposed to find in this section. The **data you obtained should be summarized into tables or figures**, anything that is not a table is referred to as a figure e.g. maps, graphs, traces etc. You should include a brief description of all figures and tables; refer to them by number in the description of the results.

Tables and Figures

Label all figures and tables **clearly** with a figure/table number and title. The title should provide a complete description of the relevant table or figure. Titles for tables go above the table, while titles for figures go below the figure. Tables and figures should be **presented in the body of the text** as soon as possible after they are mentioned. Any raw data should be placed in an appendix. Where appropriate, lines connecting plotted points must be a curve or "line of best fit". Every column/row or axis must have a label **including correct units** and legends should be included, when necessary. In short, tables and figures must be **self-explanatory**. Data should not usually be presented in more than one way i.e. do not present a graph and a table showing the same information.

An example of a table

Results

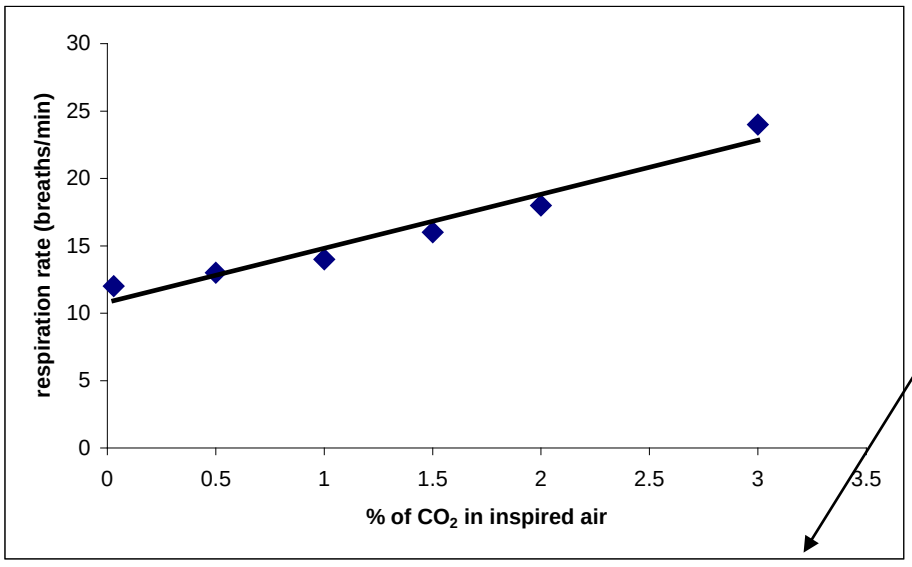
Over the course of the experiment, the level of CO_2 in the inspired air increased from 0.03% to 3%. As the CO_2 levels in inspired air increased, respiration rate also increased from an initial value of 12 breaths per minute up to 24 breaths per minute when CO_2 reached 3% (see Table 1).

Table 1: Relationship between %CO_2 of inspired air and respiration rate

% CO_2	Respiration Rate (breaths/min)
0.03	12
0.5	13
1	14
1.5	16
2	18

Note the "description" of the data

An example of a figure



Note WHERE the "titles" are placed

Figure 1: Effect of increasing % CO_2 of inspired air on respiration rate

Over the course of the experiment, the level of CO_2 in the inspired air increased from 0.03% to 3%. As the CO_2 levels in inspired air increased, respiration rate also increased from an initial value of 12 breaths per minute up to 24 breaths per minute when CO_2 reached 3% (see Figure 1).

(Please note that you would not normally present data as a table and a figure. I have only done this so you can see an example of each.)

Calculations

Calculations are often required. This is so you can demonstrate your ability to use experimental data to obtain a result. When calculations are required, they should be clearly set out with units shown throughout and referred to within the body of the text. The answers should be given to an appropriate number of significant figures, with the appropriate units.

Summary

- Summary of overall findings, in sentence form
- Paragraph related to each table/figure
  - Sentence of overall findings
  - More sentences with key details
- number, title and label all tables and figures correctly and clearly (remember units)
- all tables and figures must be referred to in the text
- provide requested calculations

Discussion

This section is for the **interpretation** and **explanation** of the experimental results. It is your opportunity to show that you understand the theoretical concepts behind the practical. Relate what your experimental results indicate, with reference to textbooks/references and the information that you have outlined in the introduction. Make any comparisons between results here. You should attempt to explain all of the main results, including those which may not have been as expected. There may be discussion points in the practical manual that suggest particular aspects of your experiments that you should consider. In addition, issues such as the accuracy of your results and errors that may have affected your data should be discussed where appropriate.

Discussion

An increase in the level of CO_2 in the inspired air caused a large increase in respiration rate (Figure 1). Increasing inspired CO_2 will result in an increase in arterial P_{CO_2}. Normally P_{CO_2} in arterial blood is maintained at 40mmHg by homeostatic mechanisms (Marieb, 2001). However rising levels will increase the pH of the cerebrospinal fluid, stimulating the central chemoreceptors in the medulla. Peripheral chemoreceptors are also stimulated by rising arterial P_{CO_2} (Marieb, 2001). Chemoreceptors trigger the medullary respiratory centres, which in turn stimulate respiratory muscles to increase ventilation. An increase in ventilation (hyperventilation) has the result of flushing CO_2 out of the blood and decreasing blood pH thereby returning levels to within the normal range. Thus, the results of this study show that the CO_2 level of inspired air is an important chemical stimulus for respiration rate.

Questions

Instructions will be given as to whether specific questions need to be answered and included in your report. If required, number these clearly. In some cases, questions are suggested as points to be discussed in the Discussion only. These should be discussed within the text of the discussion. If the questions are an integral part of the report, be sure to answer them all or marks ***cannot*** be awarded.

Conclusion

This should consist of a clear statement of the conclusions reached based on information already reported and should not be longer than a few sentences. State **what is known for certain as a result of the practical** and justify the statement. The conclusion should relate back to the Aim. There should be NO NEW INFORMATION. **Be specific** about what the practical demonstrated.

Conclusion

The level of CO_2 in inspired air is a potent stimulus for altering the rate of respiration. There is a direct relationship between the level of CO_2 and the respiratory rate, as the percentage of CO_2 increases, so does the respiration rate.

Referencing

Your statements must be supported either by your own data or published material. Where you are suggesting or hypothesising a link/explanation, this should be clear to the reader. Recognition of previously published work must always be made in order not to infringe copyright law. You can reference information in the text in two ways: by paraphrasing the information or using a direct quote.

In scientific writing, direct quotes are almost never used and should not appear in laboratory reports. Paraphrase the information you wish to convey, to clearly demonstrate your understanding of the material.

Referencing should be done in-text, this means there should be reference point (author and date, or number) at the appropriate point in the text, which refers reader to the full citation placed in the Reference section.

There are several different formatting standards for references, and you will find different JCU subjects, colleges and even staff members request various styles. In addition, individual journals have their own variations. **As long as you are consistent, you will not lose any marks.** For further information on referencing styles see the JCU library webpage: http://libguides.jcu.edu.au/referencing, here you will find examples of the major styles used, and video clips with inbuilt quiz check to show you how to do referencing. There are dedicated library staff available to help students with referencing and also drop in and online tutorials available. In your later years when reference lists become long and complex, you may learn automated reference building tools such as Endnote.

The most likely sources you will reference are books, journals and websites and some examples are given below, based on the APA style, for these sources.

Book

Moffett, D.F., Stacia, B. and Shauf, C.L. (1993). Human Physiology: Foundations and Frontiers, Mosby (2nd edition).

Chapter from Book

Fontana, A & Frey, J. (1994). Interviewing: The art of Science. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research.* (pp.361-376). Thousand Oaks, CA: Sage.

Journal

Mateika, J.H. & Ellythy, M. (2003). "Chemoreflex control of ventilation is altered during wakefulness in humans with OSA", *Respir.Physiol.&Neurobiol.,138(1):45-57*

Practical Manual

Physiology and Pharmacology Discipline (2012). Human Anatomy and Physiology 2 (PC1002) Practical Note Book, pages 3-6. Printed by James Cook University.

Web sites

Do not reference websites that don't contain peer-reviewed material. Only articles from online scientific journals should be used in preparing your practical reports.

If you wish to reference scientific journal articles that have been published online, but the article has also been published in hard copy, then referencing is the same as for print journals with a note that it was retrieved electronically.

Mateika, J.H. & Ellythy, M. (2003). "Chemoreflex control of ventilation is altered during wakefulness in humans with OSA", *Respir. Physiol. & Neurobiol., 138(1):45-57* [Electronic version]

For an electronic journal, formatting is the same as for print journals with the addition of the date the article was retrieved and the URL.

Internet-published articles (i.e. those not published in electronic journals) are referenced the same as unpublished printed material, with the addition of the URL and date accessed.

Seiler, S. (1997). "Ventilatory physiology and endurance. Does lung function limit how fast we can go?" [Online] http://home.hia.no/~stephens/ventphys.htm [2004, November 17]

Before including a website as a source of information it is wise to evaluate whether the information is accurate and unbiased. The JCU Library web page has a number of checklists to use when considering the validity of web information. See "Internet Resource Evaluation" at www.library.jcu.edu.au/Educ/guides.html

Do not include references that have not been cited in the report.

Other Resources

The Writing Centre at the University of North Carolina has a very wide range of handouts relating to all aspects of writing: http://writingcenter.unc.edu/handouts/ , including lab reports: http://writingcenter.unc.edu/handouts/scientific-reports/

LabWrite is an online tool to help you write a lab report. It has a self-guided mode and an interactive mode. You can try it out at: http://www.ncsu.edu/labwrite/, keep in mind though, that some of our formatting requirements for this subject are a little different, e.g., figures/tables to be kept in the Results section, and Aims to be stated separately from the Introduction.

REPORT WRITING CHECKLIST

- ☐ **START WITH A PLAN**
- ☐ Correct format/overall presentation – written in scientific style.
- ☐ Avoid using direct quotes.
- ☐ Avoid spelling errors.
- ☐ ***AIM***
  - Not learning objective – practical objectives.
  - Be specific.
  - Make sure to include all of them.
- ☐ ***INTRODUCTION***
  - Stay on topic.
  - Don't be too general, but also, don't be too specific – some things are best left for the discussion. – The heading of the prac will usually give you a clue to what is relevant.
  - Don't go too long – 1 page is generally enough.
- ☐ ***RESULTS***
  - Describe key results – summarise all findings in tables/figures.
  - All tables and figures to be presented in the results section – If it is integral to your report it goes in RESULTS not appendix. Present them in a logical sequence, so that they tell the "story" of your data.
  - All tables and figures described within the text and correctly labelled.
  - Calculations included, where required. Don't forget units.
- ☐ ***DISCUSSION***
  - Answer all questions fully, but not necessarily in question & answer format.
  - Show your depth of understanding of the concepts. Expand on information provided in the INTRODUCTION; explain how your results relate to the concepts.
- ☐ ***CONCLUSION***
  - Relate back to AIM and INTRODUCTION.
  - Not in the first person.
  - Not about the equipment/learning objectives.
  - Directly state what the results illustrate about the concepts being investigated.
- ☐ ***REFERENCES***
  - All in-text references included.
  - Make sure in-text referencing is properly formatted.
  - Do not include references not cited in-text.
  - Formatted correctly as per style chosen / requested.
- ☐ ***APPENDICES***
  - Raw data only.
  - Calculations, only if instructed.
  - Other information that would make the report complete, but that would disrupt the flow if included elsewhere.