

Stress Physiology Lab with an Ulterior Motive: Helping First Year University Students Deal with Stress

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The Department of Biology at Acadia University identified stress as one of the challenges that hinders student success. We have noticed that although many of the existing services available on campus could help students deal and cope with stress, they did not necessarily make use of these services. We developed a laboratory exercise where we measured pulse rate and pressure in the context of the fight or flight response and demonstrated how these parameters could be altered under stress. We also made the students find and report on the different campus resources that would help them deal with stress. In this hands-on mini-workshop, the participants will learn the rationale behind the laboratory exercise and would experience firsthand the different aspects of the exercise from the perspective of a student.

Keywords: Stress, physiology, campus services, fight or flight response, pulse, student success

Introduction

After a series of Department discussions, and input from a departmental workshop attended by faculty and students, stress was identified as a factor hindering students' success. We recognized that stress is part of everyone's life and sometimes is hard to avoid so we decided to explore tools for resilience. Students that joined the workshop and department meetings reported that our program's core courses taken in their 2nd year was overwhelmingly stressful, however, they also acknowledged that it prepared them for the following years. They were adamant that there was no need for the content to change, but rather a need to help students master the material and step up to the challenge.

We implemented an action plan to help our students master the material and succeed in their education goals. We worked with the Biology Student Society to implement tutorials and promote the already existing peer support system, Bio-buddies. We also drew attention to the different forms of student-student and student-faculty mentorship available in our program. Furthermore, we started a shared document where the timing of assessments for all Biology courses was compiled before the start of the semester. This allowed for some evaluations to be spread around so that not all evaluations happened at the same time. It also resulted in some faculty re-designing their

assessment tools. Finally, we included a first year laboratory exercise in the fall semester to study the physiology of stress, but more importantly, we introduced campus resources to help students cope and manage stress.

We invited Dr. Brian Wilson, our in-house physiologist, as a guest speaker in the lecture portion of the first year Biology course. He talked about the nervous systems and the centralized Stress Response (Selye, 1970). We also recruited Emma Whitley, a 4th year student that had taken the physiology course and had been a Teaching Assistant for the Introductory Biology Laboratory, to develop the laboratory exercise. She contacted different campus services to learn more about what they did and how they could help students cope. Emma also had expertise in using BIOPAC[®] to measure pulse rate and pressure (Biopac Systems, 1998). Emma completed this work as part of a Research Topics in Biology course she took for credit.

Interns from the campus Student Resource/Counselling Centre came to the pre-lab. They introduced their services and talked about stress from the counselling perspective. They emphasized the importance of nurturing mind, body and spirit. They also discussed mechanisms to cope with stress and walked students through a short relaxation exercise. The latter provided an opportunity for students to apply the knowledge presented.

The laboratory exercise first introduced the students to the physiology of stress, then to campus resources and finally to pulse plethysmography testing. While the students researched different campus resources, basal pulse and pressure measurements were taken. We then assigned each student a particular campus resource and gave them 5 minutes to prepare for a two-minute presentation to the class. This came as a surprise to the students as this was not written in the lab exercise. As they were presenting, pulse rate and pressure were recorded again. When students seemed comfortable presenting the instructors would try to interrupt them or ask them to speak louder to induce stress. Pulse and pressure recorded during the presentation were later compared to their basal readings. Both pulse rate and pressure are expected to

increase due to the activation of the sympathetic nervous system during the fight or flight response (Selye, 1970, Solomon et al., 2008).

Even if an increase in pulse rate and/or pressure was not observed in every single case, the students gained appreciation for the main idea of the exercise. After completion of the lab exercise, we created awareness about what stressors students might face in their program and ways to cope. We have also reminded students of the different campus resources they heard about when they first started, but probably had forgotten about. Additionally, we established new relationships between the department and different campus services.

Student Outline

Laboratory Exercise

Stress Physiology

Readings

Textbook: Chapter 42, section 42.2: Central and Peripheral Nervous Systems; Chapter 47, section 47.7: Hormonal Responses to Stress

Objectives

After completing this lab exercise, you should be able to:

- Understand the principles of the fight or flight response due to stress
- Learn different ways to cope with stress response
- Be familiar with Acadia University campus resources and how to contact them
- Measure your own pulse rate, and pressure
- Learn how stress may affect pulse rate and pressure

Physiological Response to Stress

Regardless of the nature of stress an organism responds to stress in a similar manner (Selye, 1970). In most vertebrates under normal conditions the adrenal medulla, which is the inner part of the adrenal gland, secretes a low baseline amount of the hormones epinephrine and norepinephrine.

The autonomic nervous system is the part of the nervous system that is not subject to voluntary control, for the most part. During stress or anxiety, the portion of the brain responsible for regulating the autonomic nervous system (hypothalamus) activates the adrenal medulla causing the release of epinephrine and norepinephrine. Also, the sympathetic nervous system releases norepinephrine on target tissues. This innate response to stress an organism has is called *fight or flight response*. Epinephrine and norepinephrine are responsible for many physiological changes including the dramatic overall metabolic rate increase of up to 100%. Typically the *fight or flight* response includes:

Cardiovascular Response

In a *fight or flight response* heart rate increases as well as the strength of the contractions of the heart. The blood vessels dilate in areas requiring more oxygen (such as skeletal muscles). Blood vessels constrict in regions of less immediate importance.

Respiratory Response

Respiratory rate increases; as well the depth of breathing increases. Both responses amplify the oxygen intake.

Metabolic Response

There is an increase in glycogenolysis (breakdown of glycogen to glucose) in muscles and liver to provide extra glucose for muscle cells and to supply glucose to the blood (to transport to the rest of the body). This results in increased skeletal muscle contraction strength.

Nervous Response

The *fight or flight response* starts as a nervous response, in the hypothalamus. There is an increase in arousal and alertness while nonessential functions such as digestion are inhibited.

Campus Resources

Coping with stress is something we all deal with. Whether it is the stress caused by academic, personal or social issues, Acadia has the resources to help. Listed below are some resources on campus, and the contact information to help manage the stress of university. Any of these campus services would be happy to help at any time.

Student Advising

Stefanie Chapman is Acadia's Student Advisor. She is a source of support on campus and is someone you can speak to with questions about academics and overall student life. Many times asking for help is the hardest step and she is able to

help with that. Stefanie recently graduated from Acadia and can relate to the struggles all students have. She is also familiar with all the resources on campus and is a good person to help you find the right resources and aid you in reaching out to those. She is someone to talk to about any challenge you are having and will either assist you or find the right person to do so. Contact her at stefanie.chapman@acadiau.ca

International Student Advisor

Julie Snair is a great resource for international students. If you are an international student and have a question about life in Wolfville, academics, etc., she is a great resource. Contact her at: julie.snair@acadiau.ca

Tutoring

Elisabeth Frost is the coordinator for the peer-tutoring program. If there is a course for which you need extra support e-mail her at tutoring@acadiau.ca

There are also several free help centres on campus including:

Biology Help Centre

A new initiative of the Biology Society and the Department of Biology which takes place **every Tuesday night in the Biology Building from 6:00pm to 8:00 pm**. All biology students are welcome to drop by for assistance with Biology class and lab material. A number of senior students will be present to help individuals and groups that attend the help centre.

Math and Statistics Help (M.A.S.H.)

Students in any introductory math or statistics course can use the M.A.S.H. centre during their drop-in hours to get some hints and help. Drop in hours are course specific. For more information <http://mathhelp.acadiau.ca/> or e-mail Dr. Caroline Cochran, the Coordinator of MASH, at: caroline.cochran@acadiau.ca

Chemistry Help Centre

Students in first or second year chemistry classes can drop by Monday, Tuesday and Wednesday evenings between 6-9 PM for drop in extra help. They will assist on assignments, labs, or general course work. For more information <http://tutoring.acadiau.ca/chemistry-tutorials.html> e-mail Dr. Bobby Ellis at bobby.ellis@acadiau.ca

Physics Help Centre

Students in first year physics classes (including astronomy) can drop in to the physics help centre. Drop in hours are course specific. For more information see http://tutoring.acadiau.ca/physics_ECON-help-centre.html

The Writing Centre

Many students are intimidated by the writing process and are unsure how to write effectively. There is a lot of free help available through the writing centre including: presentations and workshops on writing, writing tips and resources or free one-to-one writing tutorials. If you have any questions contact visit <http://tutoring.acadiau.ca/chemistry-tutorials.html> or e-mail the coordinator of the Writing Centre at: writingcentre@acadiau.ca

Accessible Learning

Accessible Learning helps students who have medical documentation of a disability. They will help with individualized support plans, facilitate any classroom accommodations, and help you access assistive technology. They will help you find what resources on campus you may benefit from. You can contact them by visiting <http://accessiblelearning.acadiau.ca/> or e-mailing disability.access@acadiau.ca

Counselling Services

Many students experience stress due to the adjustments required by their studies and the multiple roles in their lives. If you are feeling, anxious, stressed, depressed, lonely or are experiencing difficulty adjusting to university or have academic or career concerns, personal counselling is an opportunity to resolve problems, improve understanding and learn new skills. Contact them by visiting <http://counsel.acadiau.ca/> or e-mailing counseling@acadiau.ca

Internal Organizations in the ASU

The Acadia Student Union offers support to students through organizations that include:

Acadia Pride

An outlet for LGBT2IQ students as well as friends and allies. This group provides support for students facing issues related to sexual orientation and gender identity. Acadia Pride also strives to make campus a safe and open atmosphere and making members of the community aware of issues surrounding the LGBT2IQ community. Contact Acadia pride at: pride@acadiau.ca

Mental Health Society

An organization striving to reduce the stigma and create awareness about living with mental illness. They aim to inform students about resources on campus and aim to facilitate discussions about those resources. Contact the mental health society at: rachelsparling@acadiau.ca

Women's Centre

A place where students can learn about many issues facing women and strives to provide campus wide awareness of such issues. It is a space that women can go to for guidance or support. Contact the women's centre at: womens.centre@acadiau.ca

Library

The library is more than just a building it has many great resources to take advantage of. Biology has a librarian, Jennifer Richard. She can help find a resource, determine what is a good resource, help with citations, and answer any worries about what constitutes as plagiarism. The library also has a great network of scholarly sources available for all students. When the biology librarian is not available someone is always at the research desk ready to help. Contact Jennifer Richard at: jennifer.richard@acadiau.ca

Other Resources to Remember

- Your Professor's (office hours)
- Your TA's
- Your Peers
- Your RA's

Activity 1

Please use a computer device and the information in this laboratory exercise to complete the questions in the *Hand-in Assignment* while everyone completes in Activity 2.

Pulse Plethysmography testing

Plethysmography is the study of blood volume changes within an organ. The sensor being used is a photoelectric transducer that shines a beam of light through the skin and measures the amount of light reflected. It works because the amount of light absorbed is proportional to blood volume, the more light absorbed the greater the volume and vice versa. The tissues and organs in your body change in volume as blood vessels dilate or constrict, this is known as the pulse of blood. Pulse rates, and pressure can change due to the activation of the sympathetic nervous system during the *fight or flight response*.

Activity 2

1. Divide your room into 2 groups.
2. Position the Pulse Transducer on the right index fingertip of the subject so the sensor is on the pad of the finger.
3. Attach the Velcro[®] around your finger to secure it snugly. Ensure it is tight but not so tight you have lost circulation in your hand (Figure 1).
4. Relax hand on table.
5. Press START on the computer screen (bottom right button with blue triangle).
6. Let run for approximately 20 seconds before pressing STOP.



Figure 1. Positioning of Pulse Transducer.

7. Using the I selector tool highlight the top of an average wave mid-way through recording to the bottom the wave (Figure 2).

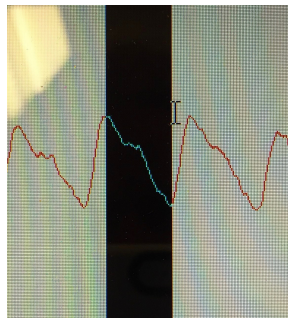


Figure 2. Highlight of wave for Delta reading.

8. This will give you the pressure difference in the systolic and diastolic readings (shown as Delta) in mV. **Record your Delta here** _____
9. Now highlight the top of the same wave but this time go the top of the next wave (Figure 3).

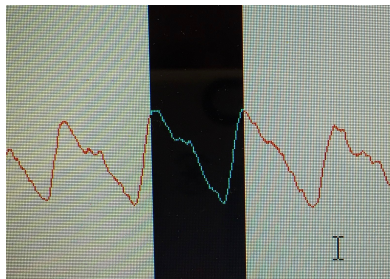


Figure 3. Highlight for BPM recording.

10. This gives you your heart beat per minute (shown as BPM). **Record your BPM here** _____
11. Wait for further instructions from the TA before doing the tests again.
12. **Record results here**
 - **Delta** _____
 - **BPM** _____

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Note

This laboratory exercise was developed as part of the course BIOL3413 *Research Topics in Biology* of the fourth year Biology student Emma Whitley.

Materials

- 2 Biopac consoles
- 2 laptop computers
- 2 Pulse Transducers (SS4LA)
- 2 sets of 12 different campus services labels

Notes for the Instructor

All instructors should be familiar with the set up of the Biopac system and basic operation of the Biopac Pro software to obtain the basic pulse plethysmographic readings (pulse rate and pressure). Two Biopac consoles with attached computers have successfully been used in a single lab section of 24 students with two instructors present. Each instructor can use a set up and handle 12 students at a time.

The first students to present have usually been very nervous making it simple to observe the increase in pulse rate and pressure. As more students present and become more comfortable the instructor starts introducing other stressors by asking students to speak louder, questioning the content presented or rushing them to finish. These tactics also help increase pulse rate and pressure.

The same exercise can be adapted using different methods to obtain pulse rate. During the 39th Association for Biology Laboratory Education, for instance, the same activity was demonstrated without the need of any plethysmographic equipment. We grouped learners in pairs and asked them to take each other's pulse rate to obtain the basal reading. We then assigned them a particular service at the University of Wisconsin they needed to research and present to the class. We then took aside one member of each team and told them to take the pulse rate of the partner as they were presenting by working out a signal for them to know when to start and stop. While the other team members started presenting we used different tactics to stress them while they were talking.

The ulterior motive of familiarizing students with different campus services is further emphasized in the *Hand-in Assignment*. Activity 1 of the laboratory exercise contains particular questions pertaining to different campus resources that they complete and submit by the end of the lab session (see Appendix A).

Cited References

- Biopac Systems. 1998. Biopac Student Lab Version 3.0: Manual Revision. Santa Barbara, CA.
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Appendix A Hand-in Assignment Stress Physiology

Name: _____

Partner(s) Name(s): _____

Campus Resources:

Q1. What is the first step to take if you want to change majors? (Student Advising)

/1

Q2. What do you include in an e-mail requesting a tutor?

/1

Q3. What days can you go to M.A.S.H. for Statistics for Life Sciences (MATH 2213)?

/1

Q4. What days is the Writing Centre open?

/1

Q5. What are the three ways to make an appointment at Student Counselling Services?

/1

Q6. What room and building is the Chemistry Help Centre at?

/1

Q7. Where is the office for Acadia Mental Health Society?

/1

Q8. If the biology librarian is unavailable where can you go for help in the library?

/1

Q9. How can you access the Biology Scientific Writing Guide?

/1

Pulse Plethysmography

Q10. Did you notice a difference in your readings: Why do you think this may or may not have been the case?

/3

THIS ASSIGNMENT IS DUE AT THE END OF THE LAB TODAY

TOTAL

/12

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