



# Learning by Doing: Using PowerLab Data Acquisition Units to Help Students Learn Research Skills

Kim T. Fredricks, Ph.D.

Biology Department, Viterbo University

900 Viterbo Dr., La Crosse, WI 54601 Email: ktfredricks@viterbo.edu



## Introduction

At Viterbo University, we offer a core biology curriculum designed, in part, to teach laboratory and communication skills that are expected in upper level elective courses. The culmination of our curriculum is a capstone research series where students design and complete a mentored research project and formally present their work. Undergraduate research is important because it helps students think like scientists and ask questions like scientists (Randall *et al.* 2004). Students can also see a direct application of their “book” knowledge from our core curriculum to answer a unique question. Previous research suggests that this type of active learning process should be the most effective at helping students learn (Yuretich 2004, Orvis and Orvis 2005).

Often students are not sure where to start or where to get ideas for their mentored projects. Expanding on a technique learned in a laboratory exercise can help meet our goals and objectives for mentored research projects. Additionally, these mini-research projects can help reinforce the skills learned as part of our core curriculum that are expected in upper level courses and the capstone research series. For example, 2007 assessment data suggested that students have a difficult time carrying forward statistical techniques learned in their sophomore year to their capstone research project. The mini-research projects in human physiology laboratory should help bridge the statistical gap between their sophomore and senior years

Students in an upper level human physiology course will use PowerLab to learn research skills (ADInstruments' PowerLab data acquisition systems are a complete hardware/software computer-based solution for data collection in the student laboratory. Students can record, visualize and analyze data from their experiments using a Windows or Macintosh-based computer and monitor). The first 3 weeks of the laboratory component of the course will allow students to learn the capabilities of PowerLab. Students will then design a small research project with consent of the instructor. They will formulate a hypothesis, create the experimental design (including proper statistical tests), conduct the project, analyze their data, and write a formal laboratory report.



## Materials and Methods

- Students will work in pairs to learn how to use the PowerLab units.
- Each student will learning several methods for collecting physiological data ranging from heart rate and EKG (figure 1) to breathing function tests (figure 2)
- Each student will submit a testable hypothesis by the 4th week of lab.
- Students will then have a week to work on their experimental design, including statistical analysis, before they may begin their data collections.
- Students will use the next lab period to collect their data and begin their analysis.
- Students will write a formal laboratory report and also present their findings to the class to help build communication skills.
- Student perceptions of research, the value of research in the curriculum, and their satisfaction with the use of PowerLab in the course will be collected by survey to determine if we our meeting our course outcomes.

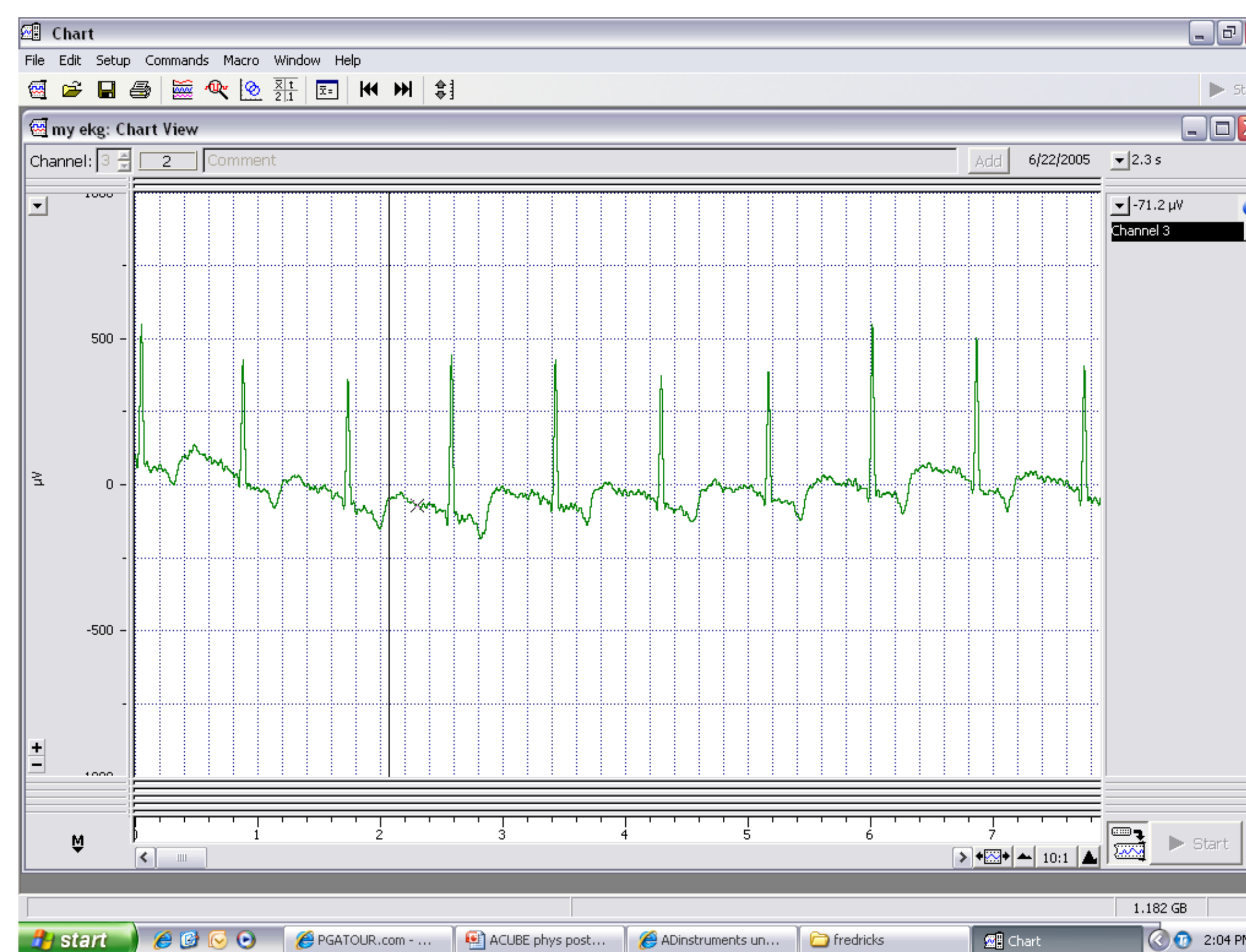


Figure 1. Electrocardiogram recorded in an upper level human physiology lab setting.

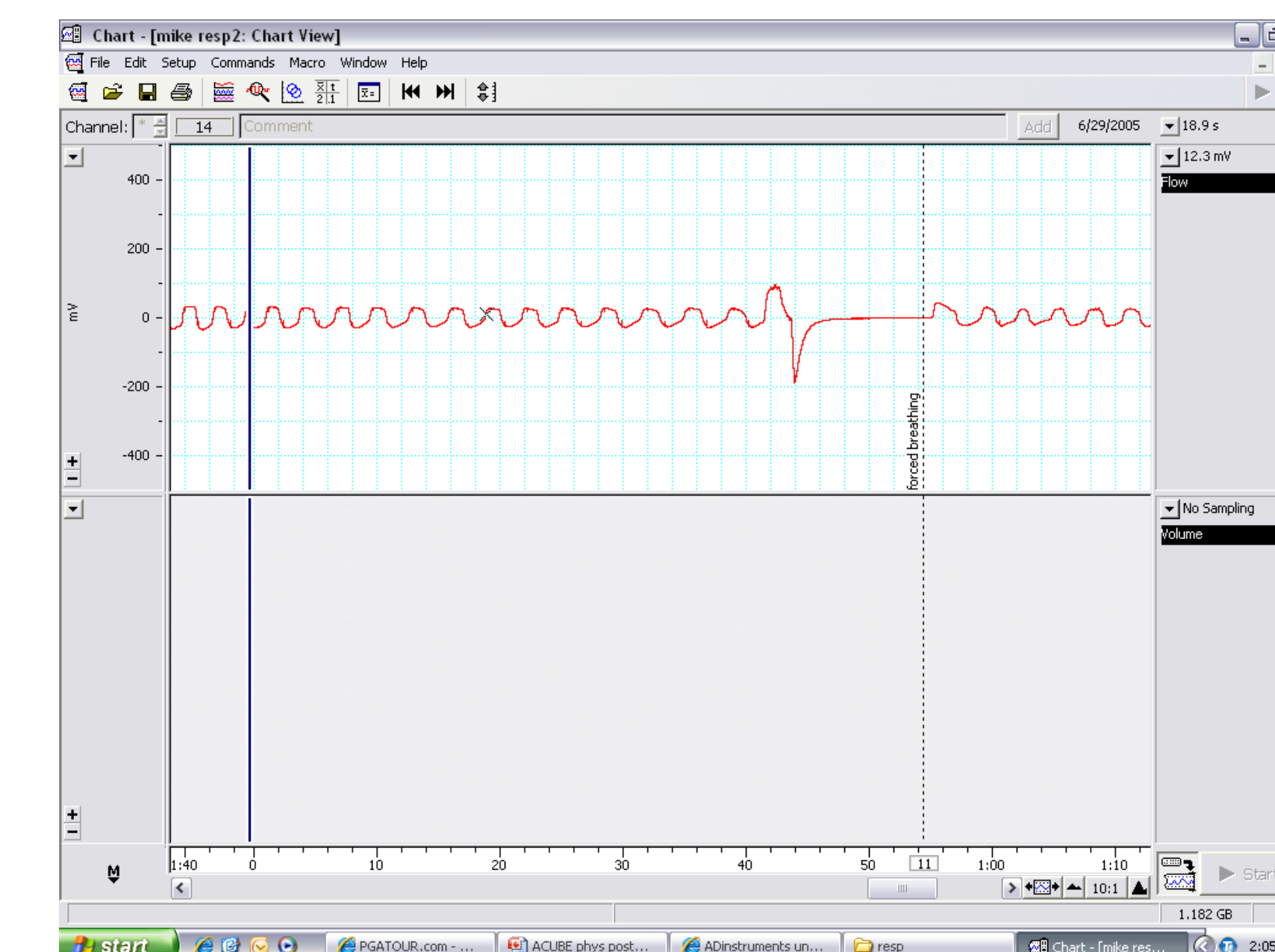


Figure 2. Human respiratory function data recorded during a Human Anatomy and physiology laboratory.

In the past, students have enjoyed using PowerLab units in “canned” laboratory experiments. We are hoping that by providing the opportunity to be more actively involved in the scientific process, it will foster enthusiasm for research, learning physiology, and developed enhanced critical thinking skills.

## References

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