**Monitoring ventilation in humans at rest and after mild and vigorous exercise**

Note: This investigation is best done as a whole class project with shared data sets.

This lab reinforces the concepts associated with changes in homeostatic mechanisms in the

human body. Ventilation is the rate of breathing and is typically given as breaths min–1. An

increase in exercise predictably results in a greater use of oxygen and release of carbon dioxide

to/from muscle tissue associated with the exercise.

**Question**

What is the correlation between ventilation rate and duration of exercise?

**Hypothesis**

Ventilation rate will be positively correlated with the increasing duration of a chosen exercise.

**Planning steps necessary before beginning**

Determine a safe exercise that can be accomplished by everyone that is happy to be a

test subject. Typical examples might be walking up a flight of stairs or jumping jacks. Next,

determine the maximum time duration that is both reasonable and safe for the exercise you

have chosen. Hint: try to make it easy to subdivide your total duration time.

**Summary of procedures**

**1** Choosing human subjects for experimentation is difficult as it is often not possible to

account for comparable subjects based on criteria such as gender, age, body mass index

(BMI) similarities, health, current level of activity (sports), and genetic background. You will

probably have to make test groups from a very limited population of test subjects (e.g. your

classmates). Try to set at least some limited criteria for test subjects. Try to make three to fi ve

test groups with as many test subjects in each group as possible. Five groups of fi ve in each

group would be ideal, but perhaps not realistic.

**2** You will need baseline ventilation data for each individual test subject. Use a timer and

count the number of breaths for a 20-second time period for each test subject. Record

this as raw data and be sure to keep track of the identity of each person and his or her

20-second ventilation rate. The test subject can count his or her own breaths with someone

else acting as a timer and recorder. An alternative is to use data logging hardware and

software that is designed to measure ventilation rate and perhaps tidal volume (the volume

of air in a single breath).

**3** Individually, have each test subject do one, and only one, of the exercise durations you

predetermined. Very soon after each subject has finished, take a 20-second count of his or

her number of breaths and record that data, again making sure to keep track of who it is

and the duration of his or her exercise. If the number of test subjects is very low, you may

have to use one or more subjects for more than one exercise duration. If this is the case,

make sure to allow as much recovery time between tests as possible.

Data-processing possibilities

• For each test subject, calculate a ventilation rate, expressed in breaths min–1, for both the

baseline and after-exercise raw data (the 20-second ventilation counts).

• For each test subject, calculate a percentage increase of ventilation rate, showing the

increase after exercise compared with the baseline rate.

• Calculate the mean percentage increase for each group. Example: calculate the mean

percentage increase for all the test subjects who did jumping jacks for 90 seconds.

• If your data set included at least fi ve test subjects for each exercise duration, calculate the

standard deviation of each of the means from the previous step.

Data-presentation possibilities

• Design and create a data table showing all the relevant raw data. Test subject numbers can

be assigned instead of using names.

• Design and create a data table showing all the relevant processed data.

• Design and create a graph with exercise durations on the x-axis (with appropriate units) and

mean percentage increases (% unit) on the y-axis.

• If the data set appears to be reasonably linear on your graph, draw a single best-fi t line

representing the overall data pattern.

• Add standard deviation error bars to each mean point plotted on your graph, and add a

note to your graph that the error bars indicate standard deviation.