(June 2014)

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[33] Welcome to the start of Lab 1. This Pat Farris again, and as
you go through today's lab, I hope you'll enjoy taking a closer look
at the qualities of living organisms. Remember if you need any help
with the equipment or the lab material, let the lab instructor know.
If you have your lab manual and a pencil, you're ready to get started.

[34] To start the lab, open up to page 1.1 and notice that we have listed the lab sections and the objectives on the first page of each lab. If you need to leave the lab before you've finished, it's a good idea to leave off at the end of one of these main sections so you can jump right back in when you return. Take a look through the objectives. We've got a lot of material to get through, so let's get started.

[35] We'll start by reviewing the topics from the Orientation, starting with qualitative and

reviewing the handy equivalents, I’ll have you try a few practice questions on the next page of the program.

[41] What is the proper metric measurement of this flower? Continue when you have the correct answer.

[42] How about the size of this little berry in millimeters? Continue when you have the correct answer.

[43] Now that you’ve demonstrated your measurement skills, we’d also like you to be able to convert one unit into another. Try the four practice metric conversions shown in your lab book and return to the program when you have finished.

[44] How are you doing on the math? I hope you found these conversions pretty simple. Compare your answers to the ones shown here and copy the equations if you had any trouble. Now you’re ready to collect some data of your own. Before we begin, however, let me explain about how data should be collected.

[45] We’re going to examine a variety of leaves from a local tree. When you collect your own sample of leaves from the big box of leaves on the demo table, make sure you pick them randomly. What I mean by this is that you need to make sure you aren’t making a conscious choice about picking leaves of a certain

at the central value of the distribution. But you need to collect a LOT of data to get this kind of distribution.

[51] In histogram example shown in your lab book, there are some mice with short tails and some with long tails, but most mouse tails are around 7.6 cm. This central tendency gives us a quick way to estimate the mean. Now estimate the average height of men from the graph shown in your lab book. After you have determined the mean and range from the histogram, return to the program when you are ready to begin Section 3.

[52] One of the fun parts of taking a biology class is that you will get to see some wild stuff you've never seen before. Unless you've used a microscope in other classes, you've probably never seen real live cells up close and personal. Well in this class, we'll be examining all kinds of cells, either in prepared slides or microscope slides that you will prepare yourself. To do this we use a very powerful tool – the compound microscope.

[53] To start using the microscope, you'll need to learn the names of all the parts, so you'll know when to turn certain knobs and when to slow down and make careful adjustments. We're going to trust you to handle the scope carefully – they are very expensive and have to last us for years and years, so please follow the directions VERY carefully.

[54] Start by locating the parts shown in the diagram of your lab book. This type of scope is called a binocular compound microscope. "Binocular" means it has two ocular lenses at the top, just like a pair of binoculars you might use to watch a sporting event. "Compound" refers to the fact that there are three powerful objective lenses which give us a choice as to how much we want to zoom in on a specimen.

[55] At this point I'll let you take your time and get acquainted with the microscope parts and how they function. Read the instructions carefully because when you reach the end of the exercise, you'll have to ask the lab instructor to come over to your booth and check your set up. After the instructor has signed the signature box, complete the last part of the exercise using the high power lens and then return to the program to begin Section 4.

[56] I hope you got through your letter i exercise without too much drama, because we'll be using the microscope all semester and it does take some practice. If you struggled to find your letter i on the slide then let me go over a few hints to help you in the future:

[57] Whenever you use the microscope, make sure you're using both eyes, opened and relaxed. There's no squinting required, even if you wear glasses or contacts. Also make sure you use the lenses in the correct order – always use scanning first to find the object, center it in the field of view,

through the scope while slowly moving the stage down. Just to make sure you're getting all this, let's try some questions:
[58] For this question, drag the labels so they point to the correct lenses on the photograph. Click the "Score this page" button when you think you have them all right. Continue when you get 100%.

[59] Ok, now try labeling the other parts of the microscope. Click the "Score this Page" button and make sure you get 100% before you continue.

[60] And one more question...

[61] Good! Now let's find out what we're really seeing when we look through the scope. I hope you noticed how the scope seemed to do the opposite of what you thought it would – in other words, when you put the slide on right-side up, the specimen appeared up-side down, and when you thought

micrometer units, here’s a hint on the calculation: there are one thousand micrometers in each

[76] The first characteristic of life that we will examine is organization. Even if we've never seen a particular organism before, we can usually guess if an object is living or was once living if we see some sort of structural pattern. A quality we see in almost every life form is called symmetry, or the balance of structures, shown here in these beautiful diatoms.

[77] Here is an extremely old fossil impression. The person who recognized its significance was a 15 year old boy in England who enjoyed looking for fossils near his home. Because he noticed the organization, he guessed it was the impression of a living thing. This creature lived more than 500 million years ago and turns out to be one of the oldest multicellular fossils ever found. The fossil is called *Charnia masoni*, after its discoverer, Roger Mason.

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critical molecule called starch. Starch is the compact form of hundreds of sugar molecules. Examine the root cross section shown on the screen to orient yourself to the various cells.

[85] Now examine the same *Ranunculus* slide and find some typical cortex cells with some nice fat starch grains inside. Carefully zoom in on high power and complete Section 7. Draw just one or two cortex cells and label the starch grains inside the cells. Continue with the program when you are done with the drawing, but leave the *Ranunculus* slide on the scope if you are continuing on to the next section of the lab.

[86] In addition to starch, the stored form of sugar, another critical molecule for plants is water. Water can only be absorbed by the roots, so all plants need specialized cells to conduct water throughout the rest of the plant. You can't just go sloshing water around though, water is a molecule that must be regulated, and this brings us to our next characteristic of life – homeostasis.

[87] Review the definition of homeostasis – it is the maintenance of a constant internal environment, despite changes in the organism's external environment. Let's think about our little *Ranunculus* on a hot day. Throughout the day, the plant is taking in as much water as it can through the roots, but water is also being lost through the leaves by evaporation. A plant has to balance this water loss and gain to maintain its shape. In other words, it has to maintain a constant internal environment no matter how hot or cold it gets during the day.

[88] When you looked at the whole root cross section of *Ranunculus*, you undoubtedly noticed the bright red cells in the center of the root. These specialized cells are called xylem cells and they are critical for the homeostasis of almost all plants on earth.

[89] Examine your *Ranunculus* slide again and complete your drawing of five

[92] Did you find any creatures? Please observe them for a few minutes and watch how they react to stimuli. Do they bump off of objects in their path or move through them? Do they react to other creatures? Can you observe them feeding? Record a few of your observations in the space provided and return to the program when you are ready to begin Section 10.

[93] The next characteristic of life is reproduction, the production of new individuals of the species. One method of reproduction you may not have thought about is called asexual reproduction, which does not involve sex cells. Here's a little animal called a *Hydra* which is producing a new individual by a process called "budding". Weird, huh? Please record the definition of asexual reproduction in the table of your lab book before continuing.

[94] The more common method of reproduction that is more familiar to you is, of course, sexual reproduction. This method requires the production of some very specialized cells called gametes. You probably know gametes from their more common name, eggs and sperm. Please record the definition of sexual reproduction on the table before continuing.

[95] Here are some gametes in action. Only one of the sperm will actually fertilize the egg, causing exactly the right number of chromosomes to come together in the resulting cell called a zygote. The chromosomes contain all the genetic information needed to produce an adult organism. Have you ever thought of yourself as a single cell? Well, you were once, and because of some very fancy chemistry, you're now a college student sitting in a booth listening to my voice.

[96] We'll spend several labs discussing how this fancy chemistry works, but I think you already know it involves DNA, an exquisite little molecule that is something all life on earth has in common. But as I said, we'll get to that molecule later in the semester. But for now, let's finish Lab 1 with the last section of the lab, Section 11.

[97] Okay, home stretch for the lab work – you'll be outta here soon! But we've left one the most important biological concepts for the end, so I need you to pay close attention. Please record the definition of adaptation – a characteristic of a species that allows survival.

[98] That little definition probably doesn't sound like too big a deal, but it is the cornerstone of how biologists think about everything they study. Let's start with some examples that will illustrate this concept. We'll look at some desert organisms that demonstrate some extreme adaptations. I'll give you a summary table to copy at the end of this audio section, but for now, let me explain the three types before you start writing.

[99] Here's a classic desert animal – the camel. It is certainly the largest animal you would find in any desert, and it lives in one of the harshest deserts on earth, the Sahara Desert of Africa. Being such a large animal is not easy. There are very few trees for shade and somet 0 Tm /TT 0 the size of a camel certainly can't dig a burrow to 0 Tm /TTde in, so how can such a large animal survive the heat?

[100] The first major type of adaptation is called physical, and these are the adaptations that you can see on the animal. Now think about the sand the camel is walking on. It's hot. Way hot. The sand temperature is close to 130º F. If you've ever tried walking across a hot parking lot barefoot at the