From one instructor to another, PhysioEx 10.0 laboratory simulations in physiology. Now what is PhysioEx? It is an extensive library of 63 activities that simulate experimental opportunities for your students. They come complete with standard assessment questions and novel investigative questions. The length of each activity varies, and the instructor can decide how much to assign or utilize. There is also the opportunity to generate, review, and submit a complete lab report. Importantly for us, the instructors, our students can repeat these labs as often as they like, which then encourages them to test run new ways of thinking and further developing their laboratory knowledge base. These features make PhysioEx adaptable to many levels of student preparedness in a wide variety of science and pre-professional classes. And let us not forget the advantages to us, the instructors, facing demands from the students who want to maximize their learning in shorter periods of time. We face demands from the administration to do more teaching with less resources. PhysioEx allows our students to repeat these experiments as often as they want to, without harming live animals and that are difficult to perform in a wet lab environment because of time, supply costs, or safety concerns.

But enough with the words, how about a quick example of what I'm saying. Okay, here we have the experiments that allow the students to explore the effects of thyroid hormone on metabolism. We can start by taking a normal rat, putting it into the chamber, sealing the chamber off from the environment, weighing the rat, and setting our timer to 1 minute of virtual time, it's about 10 seconds of real time. During that 1 minute of virtual time, the rat is consuming oxygen which reduces the air pressure in the chamber, that's revealed to us by the monometer. The CO2 that's being produced is being absorbed by the pellets in the bottom of the chamber. We can now measure how much oxygen was consumed in that 1 minute by injecting milliliters of oxygen into the monometer. To do that, we close the monometer off to the chamber but open it to the syringe. We are going to inject, I'm going to say about 7 milliliters of oxygen. I'm looking at the monometer and on the right branch it's about 7 and on the left branch it looks to be about 14 so I'm going to estimate about 7 milliliters of oxygen were consumed. I'll know if this is correct because the monometer is going to display the word “level” when I have injected how many milliliters of oxygen were consumed. And it is correct, 7 milliliters. I may now palpate the thyroid. There's no remarkable finding and I can record the data.

Now the deeper, meaningful learning gains can be achieved as the students go through data-driven hypothesis testing. For example, not only do they have this normal rat available to them, but they also have a thyroidectomized rat and a hypophysectomized rat. And on top of that, they have three different reagents that they can inject into these rats. Thus, there's multiple premutations here that are possible that will allow them to really explore and understand the hypothalamus pituitary axis, the regulation of thyroid hormone, and the subsequent effect on metabolism. So, as an example of that, let's inject thyroid stimulating hormone into our normal rat. We'll put the rat into the chamber again, seal it off from the environment, weigh the rat, give ourselves 1 minute on the virtual clock. Again, during this one minute, the rat is um consuming oxygen, reducing the air pressure in the chamber, the monometer shows us that. The CO2 being produced is absorbed by the pellets in the bottom of the chamber. After the 1 minute we can

again measure how many milliliters of oxygen were consumed and I'm looking, that looks to be about 8 so let's give it a test. Looks to be about 6 to 14 so I'm going to say about 8 milliliters of oxygen to be injected to balance out the monometer arms. And so, it's connected, there you go. And again, if I'm correct it will say the word “level”. And so, it approaches, you'll notice there's a minus button here as well if I injected too much. Oh, I did. So, it's about 7.9 milliliters of oxygen were consumed in that 1 minute. Again, palpate the thyroid and now we do find a mass and record the data. From here you could inject one of the other reagents, uh when you hit when you put the animal back into the cage and hit clean, you can now inject another reagent. And again, you have additional rats that you can inject um and test your hypothesis of what's going to happen to thyroid hormone levels and thus the metabolism rate.