BIOL 315 Course Profile

The course description for Biology 315 (**Quantitative Biology I**) can be found here.

Generally offered in: Fall and winter semesters

Prerequisite(s): Biology 241 and 243

Antirequisite(s): None

Answered by Dr. Jeremy Fox

In your own words, can you give a brief summary about what this course is about?

This course teaches biology students how to think about, analyze, and present data--quantitative information.

What is the main skill you want students to take away from this course?

I want students to be able to think quantitatively. Yes, technical skills are important. But even more important is the ability to think sensibly about the numbers you encounter in everyday life. **Even if you don't go on to a career that requires you to use statistics**--and many students don't, which is fine--you're going to be confronted with numbers all the time as a citizen. You'll be confronted with opinions and advice and government policies that are based on, or claim to be based on, quantitative information. And you'll be interacting with organizations that are collecting data about you and others, and using that data for their own purposes. **To be an informed, thoughtful citizen, it really helps to be able to think quantitatively.**

What aspect of the course do you think students struggle the most with?

Keeping track of the various different statistical techniques one uses to analyze different kinds of data. That's why one of the lab exercises is a small group project called a portfolio. **Your portfolio summarizes the key features of each statistical technique**: what it's used for, how it's done, and what it means. Students find it very helpful to put together a portfolio, and many keep their portfolios as a reference to use in more advanced courses.

Besides attending lectures and doing the assigned readings, what can a student do to be successful in this course?

Keep up with the course material rather than falling behind and then trying to catch-up the day before the exam. That means attending lecture and paying attention (it doesn't do you any good to show up to lecture and then spend the time texting or watching videos...). Take your own notes, ideally by hand rather than by typing so that you can draw illustrations as well as take down key words and phrases. **Studies show that you retain material much better if you take your own notes, especially if you do so by hand.** The course is structured to encourage you to attend lecture, reward you for doing so, and make the

lectures engaging, though **the details of the lecture structure vary among the instructors who teach BIOL 315.** In my lectures, I use the TopHat system to break up the lectures with clicker questions. That makes the lectures more interesting, and it instantly checks whether students are grasping what I'm teaching.

Is there any lab or tutorial component to this course?

Yes, a weekly lab.

What should students expect from the laboratory component?

The labs are computer labs, in which students learn to apply the concepts taught in lecture. That means **learning to use the R programming language.** We use R for several reasons:

1. It is by far the most widely used programming language in the world for data analysis. It's widely used in the private sector, not just in universities. So R skills aren't just something that will come in handy in your other biology courses, or if you go on to graduate school, **they'll also be useful for many jobs**. And because R is widely used, there's lots of advice on how to use it available online.
2. R is free, and it works with any operating system. You can and should download it onto your own computer.
3. R is powerful. Because it's popular, open source software, lots of people are working all the time to expand it's capabilities. R will do lots of things that just can't be done in, say, Excel. **So there's a steep learning curve with R, but it's worth it.** We know that many of the students in BIOL 315 have never written a computer program before; the labs are designed to get you up to speed.

What do you think is the most effective way that students can prepare for an examination in the course?

Don't just re-read your notes and the textbook--**do a lot of practice problems.** On exams, only a minority of the questions ask you to just regurgitate material you've memorized. Most of the questions will ask you to demonstrate your understanding of the material by applying what you know to new situations. For instance, a question might show you some graphs and statistical information about some bit of biology, and ask you to interpret that information.

The textbook has many practice problems, and I devote several lecture sessions just to having students do practice problems. It's dangerous to just rely on re-reading your notes and the textbook, because that doesn't reveal gaps in your understanding of the material. When you re-read your notes and the textbook, it all sounds familiar. That vague feeling of "oh yeah, I remember this stuff, this all looks familiar" is easy to mistake for mastery of the material. **You have to try to answer exam-style questions to discover what you *really* understand vs. what you only *think* you understand.**

Do you have any other advice for incoming students taking this class?

We know that many students who take this course take it because they're required to do so rather than because they're super-keen to learn statistics. That's fine. After all, if you were *really* into mathematics

and statistics, presumably you'd be a math and statistics major rather than a biology major! And we know many students come into the course a bit anxious about their ability to handle the material.

But the only thing you have to fear is fear itself. You can do this! Like the many, many students who've gone through this course before you, if you put in the effort, you'll do fine. And you'll probably be surprised to discover that statistics is more fun and interesting than you thought it would be.

My other piece of advice is: **ask me questions!** Make an appointment to come see me if you're struggling, or else email me questions. It's my job to help you master this material, and I love my job! **Not many BIOL 315 students ask questions of the prof. I'm not sure why that is**, **but I wish more of them would**. Maybe it's because Calgary is such a big university, it's easy to allow yourself to get lost in the shuffle? My own undergraduate experience was at a tiny college in the US (Williams College, just 2200 undergrads and no grad students). Williams students had no hesitation about asking questions of their profs, whether in class or via email or in office hours or whatever. I wish more Calgary students were like that.

Do you have any funny memories or anything that has stuck out to you from your time teaching this course?

This is going to sound extremely nerdy, because it is extremely nerdy. I really like teaching the Central Limit Theorem. **The Central Limit Theorem is one of the most mind-blowing results in all of mathematics.** Encountering the Central Limit Theorem for the first time should be just as jaw-dropping as your first encounter with some amazing organism--a blue whale or a Tyrannosaurus skeleton or whatever. I try to convey that same sense of awe and wonder when I teach the Central Limit Theorem, and hopefully I succeed!