PROFESSOR: Now, onward. Transcription. So, we've got DNA, we'll do two, three, probably three by now, transcription. So we have DNA goes to DNA. DNA makes RNA, RNA makes protein. This, by the way, gets the name the central dogma of molecular biology.

Due to Francis Crick, and as an aside, Francis actually never said DNA goes to RNA goes to protein. What he said was nucleic acids go to protein. The information flows from nucleic acids to proteins. He never actually said DNA goes to RNA goes to protein, and that's an important point. And we'll come to it at some point, probably next time. So, transcription. Here's my genome.

Here's my double helix. I'm going to stop wrapping around itself, just because it's tedious. And here's a chunk of DNA that encodes a gene. Maybe it's a gene that makes our enzyme for arginine biosynthesis. Remember, we had our arginine genes and all that. But what happens is it has a starting point, it has a stopping point. Five prime to three prime.

What happens is there is a signal in the DNA that the cell knows how to read called a promoter. And under certain circumstances, this promoter invites an enzyme to sit down, and the enzyme starts copying. Which direction does this enzyme go? Five prime to three prime. They all go five prime to three prime. But it makes RNA. Okay?

And then it gets to certain point, and it stops copying. This process of copying is called transcription, because it's just a direct transcribing. So what's the difference between DNA and RNA? Two differences. One, this is two prime deoxyribose. This is ribose. It's not two prime deoxy. It's truly ribose. The other difference, where DNA has T, RNA, has U, uracil.

The difference, what's the difference between T and U? The difference is a methyl group. It's a methyl group in an unimportant position for the base paring. It doesn't matter. It has an extra methyl group. You can look it up in your book.

So for all practical purposes, you, in thinking about polymerization and five prime to three prime, and everything, could imagine the DNA and RNA are the same basic structure, because it's got one little methyl group that distinguishes T and U. And it's got a hydroxyl on the two prime position in the carbon, in the sugar, which actually isn't anything we use. We never use the two prime.

So none of what I've told you is affected by t versus u, or deoxyribose versus ribose. Now, it turns out it does make a difference in the overall structure. It's harder to base pair with the ribose there as opposed to the deoxyribose because they stack differently, et cetera. It makes a difference to the cell. RNA is less stable, all sorts of things.

But for your practical purposes, apart from having to know that it's T versus U, and deoxyribose versus ribose, you won't see in this course actually see any real strong reasons why it matters, but it does matter to the cell. All right. So this enzyme comes along, and it copies a segment of the DNA, starting at a promoter. It knows which strand it's on. Remember, this is stranded.

It's not like it's going back this way. It has a directionality to it. And in reaches what's called a transcriptional stop signal. Transcriptional stop, which is a certain sequence in the DNA, and it comes to an end. And it makes an RNA transcript, which then floats away. Which we'll talk next time, gets translated into a protein. And how do you think this works?

It takes nucleotides, RNA nucleotides here, with their triphosphates, and sticks them on, just like we saw with DNA. And it makes a polymer of RNA. And the enzyme is called RNA polymerase, right? This is all pretty logical stuff. RNA polymerase comes along and does that. So we get RNA polymerase.

Now, when I am a cell, and this is my genome, I have a gene that goes this way. Here's its promoter, here's its transcriptional stop. I could also have a gene that goes this way. Here's its promoter, here's its transcriptional stop. Directionality could go in either direction. RNA polymerase comes along, and with the help of friends, knows where to start.

Those friends could be other proteins that are sitting down there that RNA polymerase likes to associate with. And which strand is being transcribed? The bottom strand, or the top strand? Matters. You get a different single stranded RNA. So RNA, when it floats off, is single stranded.

This is going to make a single stranded RNA that, five prime to three prime RNA that is complimentary to, matching to, the bottom. This guy, however, will make an RNA that is complimentary to the top. Much of the business of running your cell is figuring out which genes you should be transcribing into RNA. It turns out your liver is making different transcripts.

It's transcribing different segments of your genome than say, a muscle cell. Than say, a brain cell. All of that machinery of figuring out how one genome gets read out in different ways by RNA polymerase is the problem of gene regulation.

And we will talk about that in a little while. What we're going to talk about next time is how that RNA transcript gets translated into a protein. And you guys probably, again, all know this. But nonetheless, we'll talk a little bit about it. And then we'll talk about some variations on that theme. Until next time.