

**Biology 1305 – Modern Concepts in Bioscience – ICB Textbook**  
Week of September 20<sup>th</sup>, 2020  
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Hello everyone!! I hope you are all enjoying the Biology ICB class. Remember we continue to have group Tutoring for this class each week. If you cannot make it to Group Tutoring, also know that these resources are available to you in the tutoring center website. However, if you want to attend group tutoring, make sure you reserve a spot via the website as well.

**Our Group Tutoring sessions will be every Tuesday from 6:00 – 7:00 PM. You can reserve a spot at <https://baylor.edu/tutoring>. I hope to see you there!**

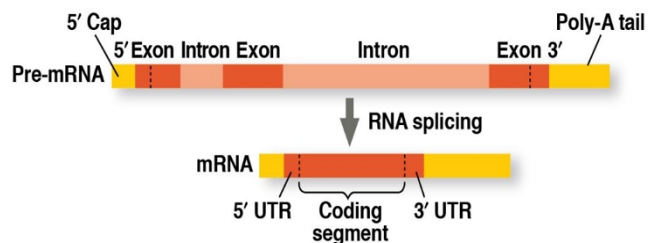
Last week, we went over the how DNA communicates information to the cell, how gene transcription is regulated, how you can measure the strength and speed of gene induction, and how cells make proteins. That resource can be found here:

[https://www.baylor.edu/support\\_programs/index.php?id=967950](https://www.baylor.edu/support_programs/index.php?id=967950)

This week, we will explore a little more into **how cells pick and choose information, the probability rules in the context of genetics, and the concept of “random” in genetics.**

Let's begin with the first topic: **How do cells pick and choose information?** We now know what the CENTRAL DOGMA of biology is, and while we may think that transcription and translation is everything we need to know about how information used in cells, we need to look a little further. **Let's recall that information is transmitted within and between biological systems, but the more complex organisms get, their transcription and translation processes also become more complex. Let's look at Eukaryotes and the concept of mRNA splicing and post-translational processing.**

During transcription, genes encoded in DNA and the resulting RNA molecule after transcription have a lot of information that isn't really necessary for proper translation. **This is what we call SPLICING (shown in the diagram to the right), which is the process of cutting off RNA segments (introns (think about intruders)) that are not needed for translation, and leaving functional segments (exons), which will be translated.**



Source: Pearson Education, Inc.

**Check out this 3 minute video to see how RNA processing works:**  
<https://www.youtube.com/watch?v=Yzuzvjv2IWQ>

Now, let's look at **POST-TRANSLATIONAL PROCESSING**. This basically means that biochemical modifications are necessary after a protein has been translated for it to function properly. The protein-hormone **INSULIN** (the one that controls glucose levels in the blood) is a great example of this processing, happening in the rough **Endoplasmic Reticulum (rER)**.

This video is a great summary of the insulin modifications for it to be functional:  
<https://www.youtube.com/watch?v=5Px94fV-Po0>

In summary, we can say that splicing and post-translational processing are two major ways in which cells pick and choose information that will be functional. This means that genes are longer than mRNA, and mRNAs are longer than proteins. Proteins can be trimmed and chemically modified by a wide range of enzymes that ensure each protein has its proper function.

## PROBABILITY RULES IN GENETICS

Let's look now at the two major probability rules in genetics and some examples. Probability rules in genetics allow you to predict genotypes of offspring based on the genotypes of the parents.

**The Multiplication Rule:** Key word is AND. This rule specifies that inheritance events are INDEPENDENT.

EXAMPLE: Consider a cross of two pea plants, one with genotype YY and the other with genotype yy. To produce a F1 generation. Then, consider a self-pollination of F1 to produce the F2 generation.

Let's look at Punnett Squares to have a visual representation of these crosses and their probabilities.

To get an F1 generation we cross YY and yy:

	Y	Y	
y	Yy	Yy	YY = 0/4 Yy = 4/4 (1) yy = 0/4
y	Yy	Yy	

To get an F2 generation we cross Yy and Yy:

	Y	y	
Y	YY	Yy	YY = 1/4 Yy = 2/4 (1/2) yy = 1/4
y	Yy	yy	

- What is the probability that a particular F2 pea is YY?

Here we need to know that for this to be possible, the pea must inherit Y from the pollen and also Y from the egg, yet these two events are INDEPENDENT. Because they are independent, the multiplication rule says that the probability of inheriting Y from the pollen (1/2) is multiplied by the probability of getting Y from the egg (1/2). Therefore:

$$\frac{1}{2} * \frac{1}{2} = \frac{1}{4}$$

So, the answer is: The probability of a F2 generation to be YY is 1/4 .

\*\*\*\*There is one case in which the multiplication rule can be applied when events are not independent, but here you need to know the probability of one of the events. This is considered **CONDITIONAL PROBABILITY**, because one event does depend on the occurrence of another.

**The Addition Rule:** Key word is OR. This rule specifies that events being considered are **MUTUALLY EXCLUSIVE**, meaning they cannot occur simultaneously.

EXAMPLE: Let's use the same statement above; we have a cross of two pea plants, one with genotype YY and the other with genotype yy. To produce a F1 generation. Then, consider a self-pollination of F1 to produce the F2 generation.

- What is the probability that a particular F2 pea is homozygous?

Here the pea must inherit Y from both pollen and egg, or inherit y from both pollen and egg, but these events cannot occur simultaneously; therefore, they are mutually exclusive.

The addition rule then says that the probability of a pea being YY (1/4) is added to the probability of a pea being yy (1/4), Therefore:

$$\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$$

The answer is: The probability of a F2 generation to be homozygous is 1/2.

Still need further help with the multiplication and addition rules? **I highly recommend looking at the following videos – both are from the amazing tutors at Baylor!!!**

<https://www.youtube.com/watch?v=xvoVTvayJOI>  
<https://www.youtube.com/watch?v=ODjNc3YgtNY>

Khan Academy also has a great resource page with more examples for probability rules: Check out this here: <https://www.khanacademy.org/science/high-school-biology/hs-classical-genetics/hs-introduction-to-heredity/a/probabilities-in-genetics>

**That's it this week. Please reach out if you have any questions and don't forget to visit the Tutoring Center website for further information.**