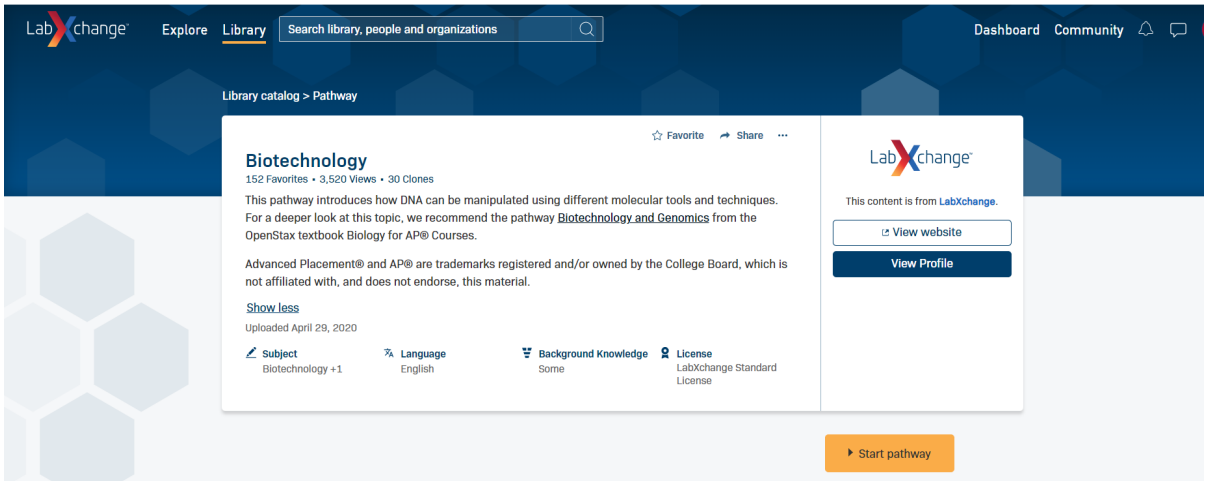
Unit 2: Intermediate Biotechnology

1: Exploring Biotechnology



Learning objectives

1. You will explain the use of genetic engineering techniques like gel electrophoresis and DNA sequencing in analyzing DNA.

2. You will explain the use of genetic engineering techniques like PCR and gene cloning in manipulating DNA.

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2: Tools & Techniques in Biotechnology: Gel Electrophoresis

Learning objectives

1. You will explain how gel electrophoresis separates biological molecules based on size and charge.
2. You will identify and explain the role of each piece of equipment required to conduct gel electrophoresis.
3. You will demonstrate how to separate dye molecules using gel electrophoresis.
4. You will interpret a gel to determine the relative sizes of molecules separated by gel electrophoresis.

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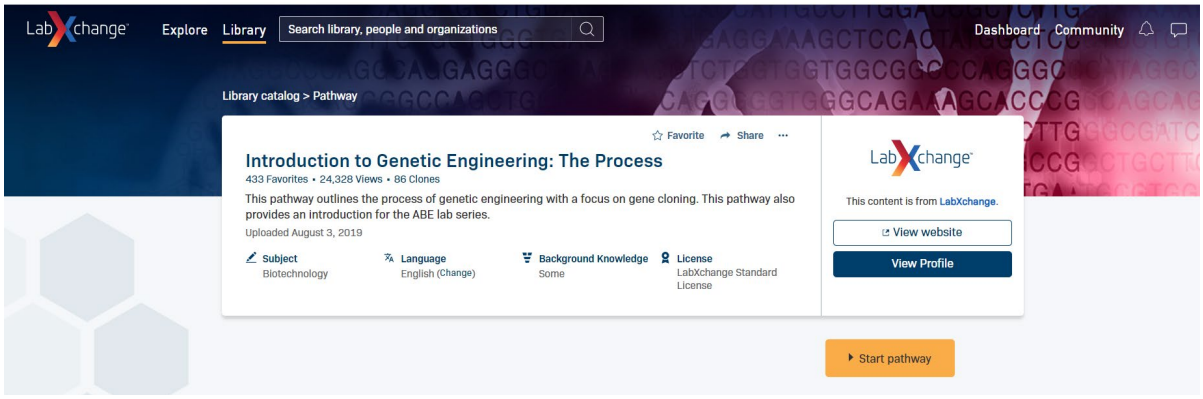
3: Introduction to Genetic Engineering



Learning objectives

1. You will identify the common features of human and bacterial cells that make genetic engineering possible.
2. You will outline the steps of gene cloning and identify the importance of each step to the process.
3. You will describe an example of how gene cloning is used to treat a specific disease, such as diabetes.
4. You will apply an understanding of the gene cloning process to evaluate its use as a therapy for a particular disease.

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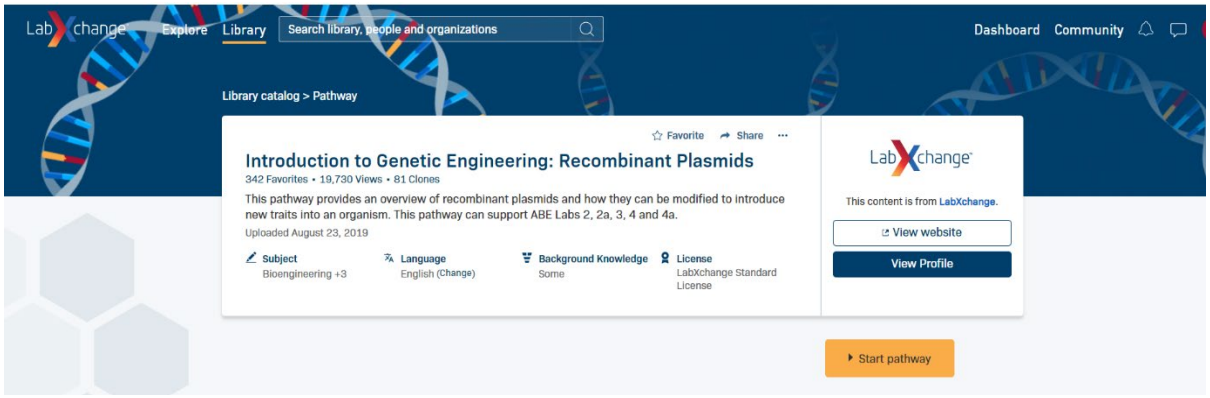
4: Recombinant Plasmids

Introduction to Genetic Engineering:



Learning objectives

1. You will describe what a plasmid is and its role in bacterial cells.
2. You will label the key features of a recombinant plasmid.
3. You will explain the function of each part of a plasmid vector.
4. You will explain the role of restriction enzymes in creating a recombinant plasmid.
5. You will design a recombinant plasmid to express a protein of interest.

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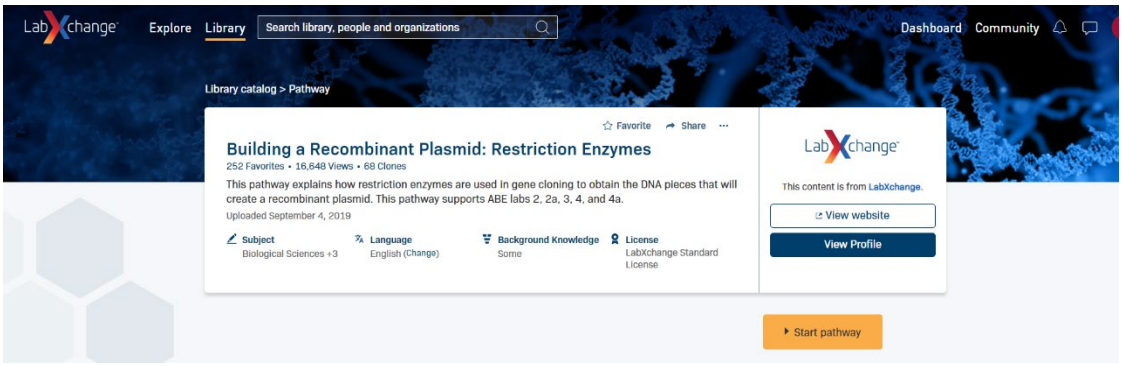
Building a Recombinant Plasmid: Restriction Enzymes



Learning objectives

1. You will explain how restriction enzymes cut DNA.
2. You will explain why restriction enzymes are a valuable tool in genetic engineering.
3. You will describe how conditions such as temperature and pH affect the activity of restriction enzymes.
4. You will choose the best restriction enzyme for a given application.

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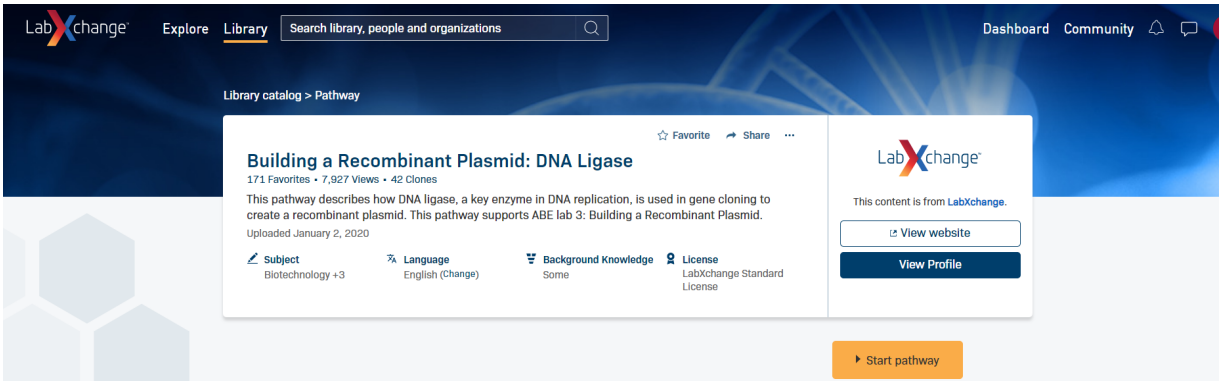
Building a Recombinant Plasmid: DNA Ligase



Learning objectives

1. You will explain how DNA ligase joins two DNA strands together.
2. You will justify why DNA ligase is an important tool in genetic engineering.
3. You will predict the recombinant plasmids that will form when two DNA fragments with complementary sticky ends are connected by DNA ligase.

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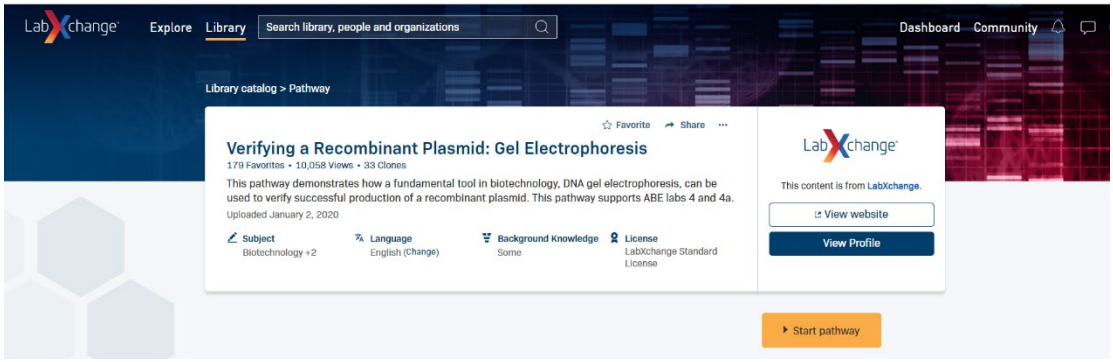
Verifying a Recombinant Plasmid: Gel Electrophoresis



Learning objectives

1. You will describe the interactions that give DNA its unique helical structure.
2. You will explain how gel electrophoresis can be used to sort DNA molecules by size.
3. You will use gel electrophoresis to evaluate whether the desired recombinant plasmid has been created from a ligation experiment.

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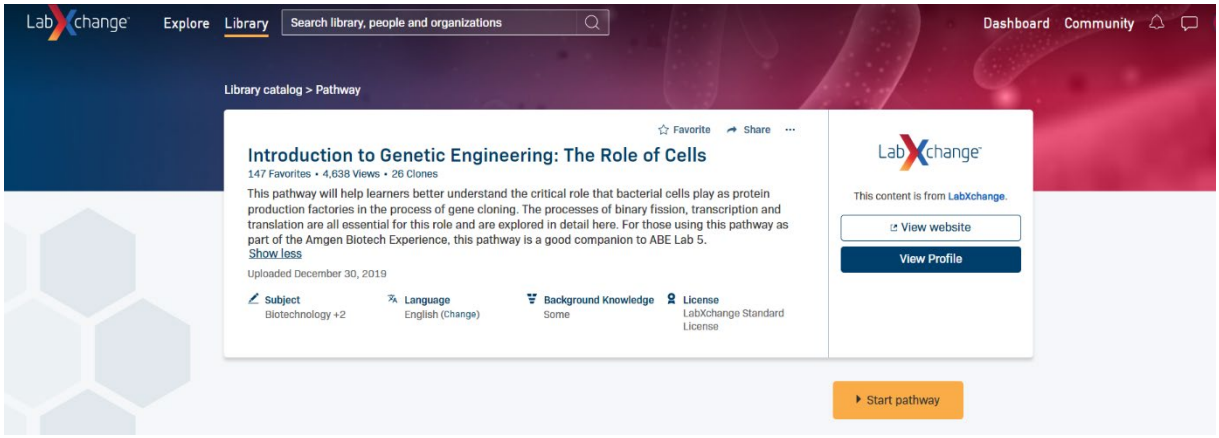
5: Introduction to Genetic Engineering: The Role of Cells



Learning objectives

1. You will describe how proteins are used inside cells.
2. You will explain how protein structure relates to function.
3. You will describe how recombinant proteins are being used in science.

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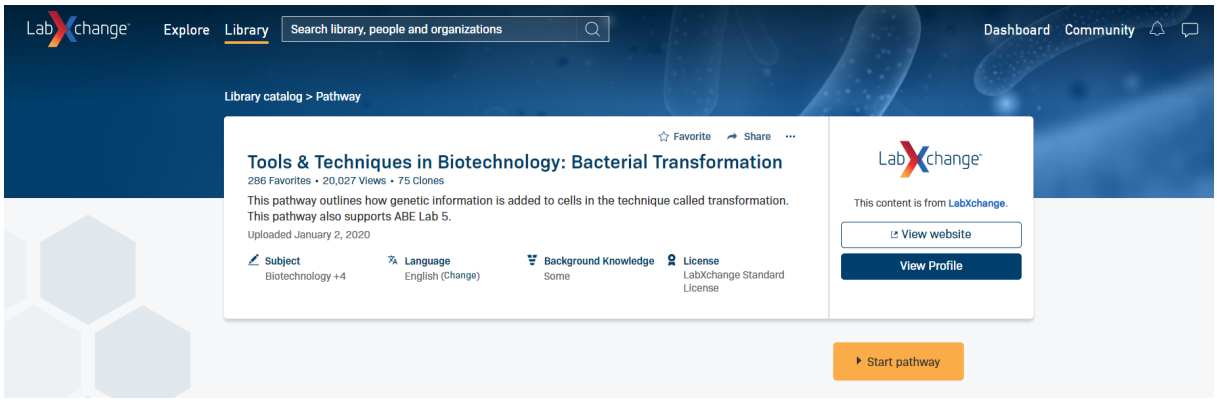
6: Tools & Techniques in Biotechnology: Bacterial Transformation



Learning objectives

1. You will describe different ways that bacteria can acquire new DNA.
2. You will explain how the heat shock process allows DNA to enter bacterial cells.
3. You will judge whether a transformation experiment was successful by evaluating the growth of bacteria on selective media.

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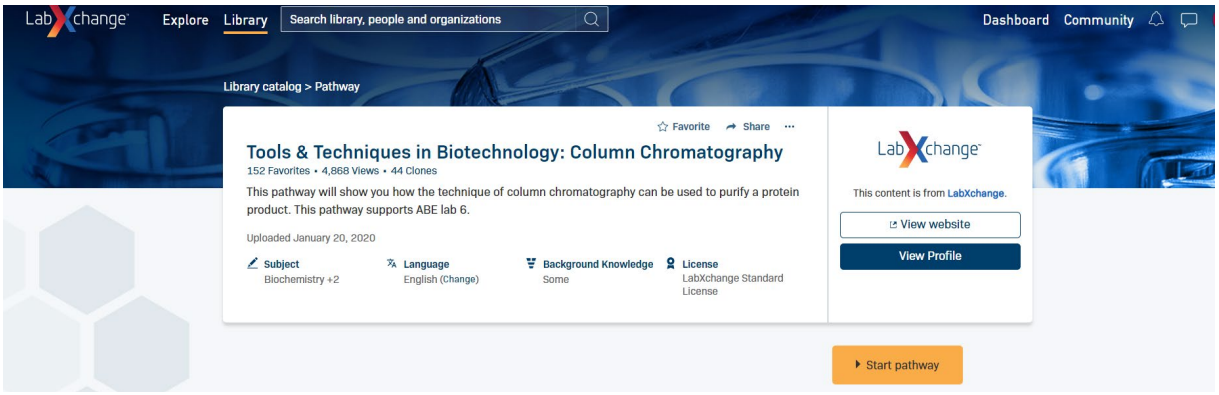
6: Tools & Techniques in Biotechnology: Column Chromatography



Learning objectives

1. You will summarize why proteins need to be purified from cells in order to be used.
2. You will describe the role of lysis and centrifugation in the process of protein purification.
3. You will explain how column chromatography works to separate proteins from a mixture

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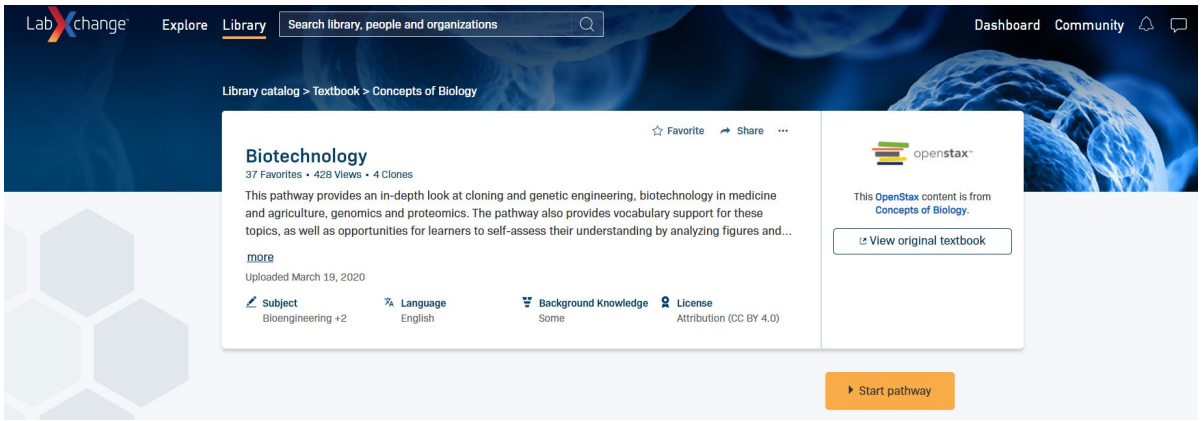
Additional Resources

Biotechnology – In depth, Text-based



Learning objectives

1. You will explain the basic techniques used to manipulate genetic material.
2. You will explain molecular and reproductive cloning.
3. You will describe uses of biotechnology in medicine.
4. You will describe uses of biotechnology in agriculture.
5. You will define genomics and proteomics.
6. You will define whole genome sequencing.
7. You will explain different applications of genomics and proteomics

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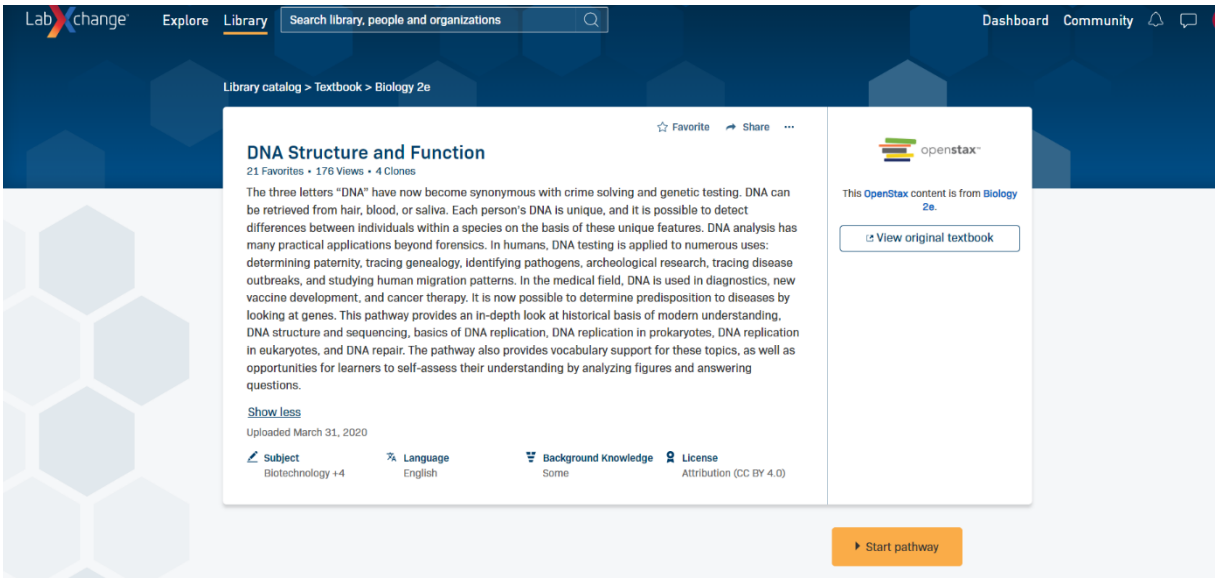
DNA Structure and Function – In depth, Text-based



Learning objectives

1. You will explain the transformation of DNA.
2. You will explain how Griffith's experiments in 1928 relate to our modern understanding of DNA and how it works.
3. You will discuss key historic experiments that helped identify DNA as the genetic material.
4. You will define Chargaff's rules of nitrogenous base pairing.
5. You will illustrate the molecular structure of DNA.
6. You will describe the Sanger method of DNA sequencing.
7. You will recall an application of DNA sequencing.
8. You will contrast the similarities and differences between eukaryotic and prokaryotic DNA.
9. You will explain how the structure of DNA provides for the process of replication.
10. You will discuss how the Meselson and Stahl experiments supported the semi-conservative nature of replication.
11. You will explain how DNA is replicated in prokaryotes, and describe the roles of the leading and lagging strands and Okazaki fragments in the process.

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12. You will explain the role of DNA polymerase and other enzymes and proteins in supporting replication.

13. You will contrast the similarities and differences between DNA replication in eukaryotes and prokaryotes.

14. You will recall the role of telomerase in DNA replication.

15. You will list different types of mutations in DNA and explain the significance of mutations.

16. You will identify examples of mechanisms that repair mutations in DNA.