Lab 8, Biol-1, C. Briggs, revised Fall 2017

DNA Isolation

Adapted from Schmidt, et al. 2006. Life All Around Us.

Objectives

- Extract DNA from your own cheek cells.

Materials

- Disposable plastic graduated tube
- NaCl (salt) solution
- Paper cup
- Woolite
- Large glass test tube
- Parafilm
- Ethanol
- Small plastic test tube
- Disposable dropper or glass rod

Instructions

1. Measure about 10mL of NaCl solution into a disposable plastic graduated tube.
2. Swish this liquid vigorously inside your mouth for three minutes.
3. Spit the water into a paper cup. Pour this solution into a large glass test tube containing 5mL of 25% Woolite.
4. Seal your glass tube with Parafilm.
5. Hold the test tube horizontally, and gently rock it for three minutes.
6. Open the tube, and pour 5mL of cold ethanol down the side of the test tube so that it forms a layer on top of the soapy solution.
7. Let the tube sit for about one minute. While waiting, you may fill a small plastic test tube half full with ethanol.
8. Use a small disposable dropper or glass rod to transfer your DNA to the small plastic test tube.
9. Clean up: Soak your glass test tube in bleach for several minutes before washing.

DNA Fingerprinting

Adapted from Schmidt, et al. 2006. Life All Around Us.

Objectives

- Learn how DNA fingerprinting is performed.
- Learn to interpret DNA fingerprinting results.

Instructions

1. At some point during lab, learn how DNA fingerprinting is performed.
2. Observe the gel and draw what you see.

DNA Replication and Protein Synthesis

Adapted from Schmidt, et al. 2006. Life All Around Us.

Objectives

- Learn how DNA replication works.
- Learn how transcription and translation work.

Instructions: For version on paper

DNA Replication:

1. Using the single strand of the unzipped DNA found in Table 1, fill in the complementary strand.

Transcription:

2. Construct the complementary strand of mRNA using the DNA given as the template in Table 2. This would normally occur in the nucleus of the cell.

Translation:

3. Draw brackets around the codons along the length of your mRNA in Table 2.
4. Use the mRNA codon chart found below to associate the codons with particular amino acids.
5. Remember that tRNA molecules have anticodons, and carry amino acids to the ribosome. Identify the anticodon for each mRNA codon.
6. A bond forms between tyrosine (Tyr) and phenylalanine (Phe). This contributes to the protein's tertiary structure. The protein will be able to do its job only if the Tyr and Phe amino acids are separated by another three amino acids. Sketch the amino acid chain, showing the effect of this bond.

Mutations:

7. Mutation #1: Base substitution: Suppose the 14th base of the DNA is **changed** to "G" (as shown in Table 3). Construct a new, mutated mRNA and protein in Table 3. Sketch the amino acid chain below the one you sketched earlier.
8. Mutation #2: Base addition: Suppose we **add** a "G" just before the 19th base of the DNA (as shown in Table 4). Construct a new, mutated mRNA and protein in Table 4. Sketch the amino acid chain below the other two.

Table 1:

Unzipped DNA strand	Complementary DNA strand
T	
A	
C	
G	
A	
T	
A	
T	
A	
A	
G	
A	
A	
C	
C	
C	
T	
G	
A	
A	
A	
T	
A	
G	
A	
C	
T	

Table 2:

DNA strand	mRNA strand	tRNA anti-codons	amino acids
T			
A			
C			
G			
A			
T			
A			
T			
A			
A			
G			
A			
A			
C			
C			
C			
T			
G			
A			
A			
A			
T			
A			
G			
A			
C			
T			

Table 3: Base substitution

DNA strand	mRNA strand	tRNA anti-codons	amino acids
T			
A			
C			
G			
A			
T			
A			
T			
A			
A			
G			
A			
A			
G			
C			
C			
T			
G			
A			
A			
A			
T			
A			
G			
A			
C			
T			

Table 4: Base addition

DNA strand	mRNA strand	tRNA anti-codons	amino acids
T			
A			
C			
G			
A			
T			
A			
T			
A			
A			
G			
A			
A			
C			
C			
C			
T			
G			
G			
A			
A			
A			
T			
A			
G			
A			
C			
T			

Table of tRNA anti-codons:

AAA	Phenylalanine	CAA	Valine	GAA	Leucine	UAA	Isoleucine
AAG	Phenylalanine	CAG	Valine	GAG	Leucine	UAG	Isoleucine
AAU	Leucine	CAU	Valine	GAU	Leucine	UAU	Isoleucine
AAC	Leucine	CAC	Valine	GAC	Leucine	UAC	Methionine or Start
ACA	Cysteine	CCA	Glycine	GCA	Arginine	UCA	Serine
ACG	Cysteine	CCG	Glycine	GCG	Arginine	UCG	Serine
ACU	Stop	CCU	Glycine	GCU	Arginine	UCU	Arginine
ACC	Tryptophan	CCC	Glycine	GCC	Arginine	UCC	Arginine
AGA	Serine	CGA	Alanine	GGA	Proline	UGA	Threonine
AGG	Serine	CGG	Alanine	GGG	Proline	UGG	Threonine
AGU	Serine	CGU	Alanine	GGU	Proline	UGU	Threonine
AGC	Serine	CGC	Alanine	GGC	Proline	UGC	Threonine
AUA	Tyrosine	CUA	Aspartic acid	GUA	Histidine	UUA	Asparagine
AUG	Tyrosine	CUG	Aspartic acid	GUG	Histidine	UUG	Asparagine
AUU	Stop	CUU	Glutamic acid	GUU	Glutamine	UUU	Lysine
AUC	Stop	CUC	Glutamic acid	GUC	Glutamine	UUC	Lysine

Instructions: For version using models

9. Use the models to simulate DNA replication.
10. Use the models to transcribe an mRNA strand.
11. Use the mRNA strand to build a sequence of amino acids and form a protein. Draw your protein.
12. Use the mutated DNA strand to build a mutated protein. Draw the mutated protein.

Mutations

Adapted from Schmidt, et al. 2006. Life All Around Us.

Objectives

- Observe the general effects of mutation.

Instructions

1. Examine the germinated seedlings and note what you see.

Lab 8 Assignment

Regarding Lab 8:

1. Turn in this completed lab, and attach your responses to the items below.
2. What was the appearance of the DNA you collected?
3. What makes your DNA different from everyone else's?
4. If the restriction enzyme used in the DNA fingerprinting was *Hae*III, which cuts at the sequence "GGCC," draw a diagram of what you think the suspect's DNA looked like. (Discuss example in lab, beforehand.)
5. Inspect the sketches you made of the proteins you synthesized, and consider the changes that the mutations caused. Which type of mutation, a substitution or an addition, had more substantial consequences? Why?
6. Could a mutation be considered neutral? Explain your answer.
7. What seemed to be the effects of increasing doses of radiation on the seedlings?

Preparing for Lab 9:

8. What relevance does the study of genetics have for your life? Be as specific as you can.

"My soul is a hidden orchestra; I know not what instruments, what fiddlestrings and harps, drums and tamboura I sound and clash inside myself. All I hear is the symphony."

—Fernando Pessoa, The Book of Disquiet