

# Lab 1: Strings and Loops

IBCS SL and HL

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## 1 DNA Background

In this lab you will practice handling Strings in Java. To do so, you will read in a DNA sequence that is meant to create a pump for a cell membrane. DNA provides a blueprint to create proteins which in turn create all the necessary parts for us to stay alive. This process involves a few steps :

1. DNA starts with one strand and that strand's complement, forming a two strand double helix.
2. When ready, the DNA will split apart and messenger RNA, or mRNA, will create a copy.
3. The mRNA will then travel into a ribosome, The ribosome will read in the mRNA and create amino acids by reading a section at a time.
4. A chain of amino acids will then form the proteins necessary.
5. Watch [this video](#) and [this one](#).

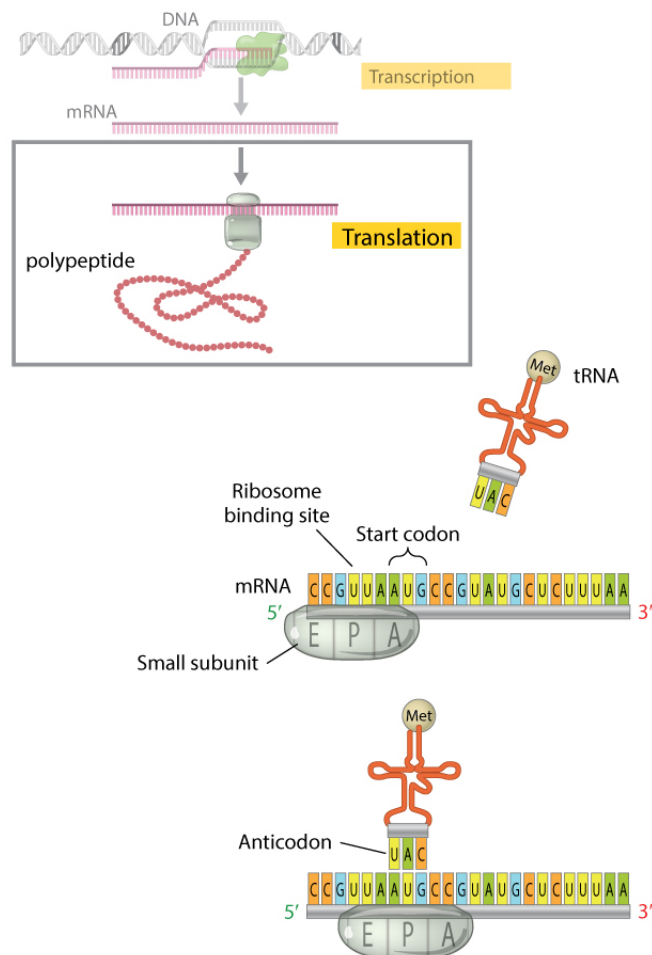


Figure 1: Protein Creation

## 2 Assignment

1. Create a DNAStrand class.
  - (a) Create a method, **readDNA**, that reads in the dna sequence file by looping through each line. Store the sequence in an ArrayList.
  - (b) Create another method, **createCompliment**, which uses the read-in sequence and takes in no parameters, iterates through it, and creates its compliment by checking each letter. Store the compliment in an ArrayList. Remember that the compliment to "a" is "t" and "c" is "g". **The output should keep all strings as LOWERCASE.** HINT: Use the .replace method for strings.
  - (c) Create **getCompliment** and **getDnaSequence** methods that return the corresponding ArrayList. So **getCompliment** should return the ArrayList created in createCompliment.
  - (d) Create a **mutateDna** method that will loop through the DNA sequence and change it in any way that you want. You can get creative on how this changes the DNA.
  - (e) Create a **printPeptide** method that loops through an ArrayList of amino acids and prints the sequence inside of it.
2. Create Mrna class.
  - (a) Create a **createCopy** method that reads in a DNA arraylist and stores the translated copy in an ArrayList. Remember that mRNA doesn't use "T", but instead the translation of "a" is "u". **The output should keep all strings as LOWERCASE.**
  - (b) Create a **getMessengerDnaCopy** that returns the arraylist with the copy of the DNA.
3. Create a Ribosome class.
  - (a) Create a **createProtein** static method that returns an ArrayList of amino acids. This should take in an ArrayList as a parameter.

		Second nucleotide					
		U	C	A	G		
First nucleotide	U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr UAA STOP UAG STOP	UGU Cys UGC Cys UGA STOP UGG Trp	U C A G	Third nucleotide
	C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G	
	A	AUU Ile AUC Ile AUA Ile AUG Met	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G	
	G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G	

Figure 2: Proteing List For Ribosome

## 3 HL Extension

1. Create a Medicine class.
  - (a) Create a **cancerCure** method that checks if a sequence is the same as the original sequence from the txt file and then returns a fixed ArrayList with the correct sequence.

## 4 Rubrics

### 4.1 SL

Element Implementation	Score
createCompliment and getCompliment	15
readDNA and getDnaSequence	15
createCopy and getMessengerDnaCopy	15
createProtein	30
mutateDna	25
printPeptide	10
Style	30
<b>Total</b>	<b>140</b>

### 4.2 HL

Element Implementation (HL)	Score
createCompliment and getCompliment	15
readDNA and getDnaSequence	15
createCopy and getMessengerDnaCopy	15
createProtein	30
mutateDna	25
printPeptide	10
Style	30
cancerCure (HL Only)	30
<b>Total</b>	<b>170</b>