## **SAY IT WITH DNA**: PROTEIN SYNTHESIS WORKSHEET: Practice Pays

Having studied the process by which DNA directs the synthesis of proteins, you should be ready to decode some DNA "secret" messages. To do this, you must follow the procedure of protein synthesis as this is taking place right now in your cells; no short cuts! Practice these steps by following and finishing the **partially solved message** below.

STEP 1: "Build" the mRNA molecule, matching the RNA nucleotides to the DNA nucleotides properly, letter by letter.
(For purposes of simplicity, it will be assumed that this mRNA is bacterial; there are no introns to cut out!)

STEP 2: Figure out the tRNA triplets (codons) which would fit the mRNA triplets (letter by letter).

STEP 3: Look up each tRNA codon in the **tRNA Dictionary** (below), and find the corresponding symbol and amino acid abbreviation for that codon. Record that one-letter symbol (and its amino acid) below each codon. "Spc" = "space". If you have done this correctly, the symbols should spell out a meaningful message in English.

Remember, C always pairs with G, G always pairs with C, A pairs with T (in DNA) or U (in RNA), Tpairs with A, and U (in RNA) pairs with A (in DNA). Clues: C & G are curved letters; A & T are angular; U is used in RNA in place of T.

When you finish the sample message below, decode the special message assigned to you (from the sheet with many messages). Be sure to show the details of your solution on the **Practice Sheet** provided, and hand it in. In your DNA exam, you will be expected to do this from memory (provided with the tRNA Dictionary).

### PARTIALLY SOLVED MESSAGE

**GIVEN: DNA** code message --> GAA TAG AAA CTT ACT TAG AGC ATT CCT GCC CTT CGA TGC ATC

**SOLUTION** (steps 1-4)

1. **mRNA** (built to match the DNA message, letter for letter----------> CUU AUC UUU GAA UGA AUC UCG ... ... ... ... ... ... ...

2. **tRNA** (determined by matching letters (bases) with those in mRNA)----------> GAA UAG AAA CUU ACU UAG ... ... ... ... ... ... ... ...

3. **Amino acids** carried by each tRNA (according to dictionary, below)----------> L I P G | I
e s h l l s
u o e u o

4. **Symbols** of amino acids:----> L I F E I . . . . . .

### DICTIONARY OF tRNA CODONS & THEIR AMINO ACIDS (SYMBOLS & ABBREVIATIONS)

| tRNA | sym | AA |
|---|---|---|
| AAA | F | Phe |
| AAC | L | Leu |
| AAG | F | Phe |
| AAU | L | Leu |
| ACA | C | Cys |
| ACC | W | Trp |
| ACG | C | Cys |
| ACU | - | spc |
| AGA | S | Ser |
| AGC | S | Ser |
| AGG | S | Ser |
| AGU | S | Ser |
| AUA | Y | Tyr |
| AUC | - | spc |
| AUG | Y | Tyr |
| AUU | - | spc |

| tRNA | sym | AA |
|---|---|---|
| CAA | V | Val |
| CAC | V | Val |
| CAG | V | Val |
| CAU | V | Val |
| CCA | G | Gly |
| CCC | G | Gly |
| CCG | G | Gly |
| CCU | G | Gly |
| CGA | A | Ala |
| CGC | A | Ala |
| CGG | A | Ala |
| CGU | A | Ala |
| CUA | D | Asp |
| CUC | E | Glu |
| CUG | D | Asp |
| CUU | E | Glu |

| tRNA | sym | AA |
|---|---|---|
| GAA | L | Leu |
| GAC | L | Leu |
| GAG | L | Leu |
| GAU | L | Leu |
| GCA | R | Arg |
| GCC | R | Arg |
| GCG | R | Arg |
| GCU | R | Arg |
| GGA | P | Pro |
| GGC | P | Pro |
| GGG | P | Pro |
| GGU | P | Pro |
| GUA | H | His |
| GUC | Q | Glu |
| GUG | H | His |
| GUU | Q | Glu |

| tRNA | sym | AA |
|---|---|---|
| UAA | I | Iso |
| UAC | M | Met |
| UAG | I | Iso |
| UAU | I | Iso |
| UCA | S | Ser |
| UCC | R | Arg |
| UCG | S | Ser |
| UCU | R | Arg |
| UGA | T | Thr |
| UGC | T | Thr |
| UGG | T | Thr |
| UGU | T | Thr |
| UUA | N | Asn |
| UUC | K | Lys |
| UUG | N | Asn |
| UUU | K | Lys |